ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

HAZRAT SHAHJALAL INTERNATIONAL AIRPORT (HSIA) EXPANSION PROJECT (PHASE 1)

Civil Aviation Authority, Bangladesh (CAAB)
Ministry of Civil Aviation and Tourism

May 2017

Prepared by:
Development Design Consultants Limited

This page is intentionally kept blank

ABBREVIATIONS

ADB	--	Asian Development Bank
BBS	–	Bangladesh Bureau of Statistics
BCC	–	Behavior Change Communication
BOD	–	Biochemical Oxygen Demand
BUET	--	Bangladesh University of Engineering and Technology, Dhaka
CAAB	–	Civil Aviation Authority Bangladesh
CAP	-	Corrective Action Plan
COD	–	Chemical Oxygen Demand
DDCL	--	Development Design Consultants Limited, Dhaka
DEE	-	Dhaka Elevated Expressway
DLS	–	Department of Livestock Services
DMDP	-	Dhaka Metropolitan Development Plan
DO	–	Dissolved Oxygen
DoE	–	Department of Environment
DSC	-	Design and Supervision Consultants
DWASA	–	Dhaka Water Supply and Sewerage Authority
EA	–	Executing Agency
ECA	--	Environmental Conservation Act, 1995
ECC	–	Environmental Clearance Certificate
ECR	--	Environmental Conservation Rules, 1997
EIA	–	Environmental Impact Assessment
EMP	–	Environmental Management Plan
EMS	-	Environmental Management System
FAA	--	Federal Aviation Administration
FGD	-	Focus Group Discussion
GOB	–	Government of Bangladesh
HDPE	–	High Density Poly-Ethylene
HSIA	--	Hazrat Shahjalal International Airport, Dhaka
IATA	--	International Air Transport Association
ICAO	-	International Civil Aviation Organization
IDM	-	Information Disclosure Meeting
IEE	–	Initial Environmental Examination
JICA	-	Japan International Cooperation Agency
KII	--	Key Informants Interview
LCC	--	Location Clearance Certificate
Lden	-	Day-Evening-Night Average Sound Level
LGD	–	Local Government Division
MOEF	-	Ministry of Environment and Forest
MPPA	-	Million Passengers Per Annum
NAVAIDS	-	Navigational Aid Equipments
O&M	–	Operation and Maintenance
OHS	--	Occupational Health and Safety
OM	–	Operations Manual
PIU	-	Project Implementation Unit
PPE	--	Personal Protective Equipment (like helmet, boots)
RAJUK	-	Rajdhani Unnayan Kartripakhkha (Capital Development Authority)
RAP	–	Resettlement Action Plan
RF	–	Resettlement Framework

SIEE	–	Summary Initial Environmental Examinations
SO	–	Safety Officer
ToR	–	Terms of Reference
UNCED	--	United Nations Conference on Environment and Development
UNFCCC	--	United Nations Framework Convention on Climate Change

WEIGHTS AND MEASURES

ha	–	hectare
km	–	kilometer
m	–	Meter
Mm	–	millimeter
km/h	–	kilometer per hour

TABLE OF CONTENTS

Reference

This page is intentionally kept blank

1. EXECUTIVE SUMMARY

Introduction

The Aviation activities have been started in Bangladesh on last week of December in 1971. The Government of Bangladesh has been implementing all the aviation activities through Civil Aviation Authority of Bangladesh (CAAB), an autonomous organization run by the Chairman. Over the years, the infrastructures and facilities have been developed to meet the growing air traffic demand of the country. At present, aviation activities are being carried out from 3 international and 5 domestic airports located at significantly important places of the country. About 17 airlines are now operating in and out in the country. Till now, about 47 states signed bilateral agreements with Bangladesh.

Air traffic flow in Bangladesh is rapidly increasing day by day. Existing infrastructure facilities of the airports in Bangladesh are not sufficient to meet the future air traffic demand of the country. As the capital airport, it is the air gateway of the country and is insufficient to handle the growing air traffic demand. At present, Hazrat Shahjalal International Airport (HSIA), Dhaka is the busiest airport of the country, through which about 80% of the total air traffic flow takes place. This airport was designed as a domestic airport in early 60s. Currently, the airport has an annual passenger handling capacity of only 8 million. As an air gateway of the country, this is insufficient to handle the growing air traffic demand of the country. The space of the Passenger Terminal Building is not enough to implement the modern five level security concepts.

As the capacity of Hazrat Shahjalal International Airport (HSIA) is nearing its limit, Civil Aviation Authority of Bangladesh (CAAB) initiated necessary activities to expand the HSIA. In this regard, CAAB appointed a consultant in 2014 to prepare a master plan, feasibility study and design of the expansion works. Scope of the consultant also included preparing Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA) reports, and assisting CAAB in obtaining Environmental Clearance Certificate (ECC) from Department of Environment (DOE). As part of that scope, a draft IEE report was first prepared in August 2015 and later revised version was submitted to DOE in August 2016. Subsequently, DOE approved the IEE and issued a Site Clearance in September 2016. The CAAB appointed consultant then proceeded to prepare the EIA report and submitted a draft EIA to DOE in December 2016.

Meanwhile, CAAB approached to Japan International Cooperation Agency (JICA) for possible finance to implement the project. A JICA study team first worked between April 2016 and November 2016 to review the expansion plan; and CAAB and JICA finalized a Project scope for possible JICA finance under the title “Hazrat Shahjalal International Airport (HSIA) Expansion Project”. Then JICA engaged another Study Team for finalization of project preparation from December 2016 till March 2017. This team (the JICA Preparatory Survey Team) observed that the contents of the draft EIA submitted to DOE in December 2016 did not fully meet DOE and JICA environmental guidelines.

Thus, to support CAAB in preparing an acceptable EIA report, the JICA Preparatory Survey Team decided to carry out some supplementary activities by subletting DDC Ltd.

The scope of supplementary works is as follows:

- Alternative Analysis
- Analysis of Social Environment
- Aircraft Noise Measurement
- Tree Inventory
- Analysis of water Logging in surrounding areas
- Focus Group Discussion (FGD)
- Key Informants Interview (KII)
- Individual Consultation
- Discussion with former Lease Holders
- Information Disclosure Meeting (IDM)

The output of this supplementary works is being used for finalization of Project's EIA report (this report) submitted to JICA and DOE for their concurrence and approval. The relevant portions of the outcome of this supplementary study have been inserted in appropriate sections of this EIA report. The details of these studies have been Annexed like Aircraft Noise Measurement (**Annex 19**), Tree Inventory and Classification (**Annex 20**), Analysis of Water Logging in Surrounding Area (**Annex 21**), Focus Group Discussion (**Annex 22**), Key Informants Interview (**Annex 23**), Individual Consultation (**Annex 24**), Discussion with former Lease Holders (**Annex 25**), Information Disclosure Meeting (**Annex 26**), relationship with Dhaka Elevated Expressway (**Annex 27)** and Aircraft Noise Prediction (**Annex 28**).

This final EIA Report is also incorporates all comments from JICA and DOE and submitted to DOE in May 2017.

The main objectives of the Project are to construct 3rd terminal building, and other ancillary buildings and facilities to enhance the airport capacity to meet the growing air traffic demand and enable the airport to handle the operation of larger aircrafts as mentioned earlier.

There is some specific legislation set out by the Department of Environment to implement any development project in the country. The main legislations for environmental protection in Bangladesh are the Environmental Conservation Act (ECA) 1995 and the Environmental Conservation Rules (ECR) 1997. Environmental Conservation Act (ECA) 1995 requires the proponents of every development project in the country to obtain Location/ Site Clearance Certificate (LCC) and Environmental Clearance Certificate (ECC) from the Department of Environment (DOE), Government of Bangladesh (GOB). Thereafter, Environmental Conservation Rule (ECR), 1997 [Rule 7] of Bangladesh classifies industrial units and projects into four categories depending on environmental impact and location for the purpose of issuance of Environmental Clearance Certificate.

The ECR'97 requires the proponents of development project in the country to submit an Initial Environmental Examination (IEE) and/ or an Environmental Impact Assessment (EIA), based on level of environmental impact and categorization, to Department of Environment (DOE). The proposed project works fall under the Red category project as per ECA, 1995 and the followed up rules ECR, 1997 [Red Category in item no 60], and needs Location Clearance Certificate and Environmental Clearance Certificate from Department of Environment. As per requirement of DOE, the IEE study along with appropriate EMP was prepared with the objective of obtaining Location Clearance Certificate and Environmental Clearance Certificate from DOE. The IEE was approved and Site Clearance was issued by DOE on 8 September 2016. The site clearance from the DOE has been issued on condition that the project authority shall submit a comprehensive Environmental Impact Assessment (EIA) considering the overall activity of the

Hazrat Shahjalal International Airport Expansion Project in the accordance with the TOR and time schedule indicated in the Initial Environmental Examination (IEE) Report.

The present EIA report has been prepared to fulfill the requirement mentioned in the site clearance certificate and in the light of the requirement of Department of Environment (DOE), Government of Bangladesh (GOB) and the international donor organizations with specific attention to fulfilling the requirements of JICA Guidelines.

The overall objective is to conduct Environmental Impact Assessment (EIA) report for the proposed project with the purpose of obtaining Environmental Clearance Certificate from the DOE. It will ensure that the Project is developed in an environmentally sound and sustainable manner so that all possible negative effects are mitigated as best as practical and positive impacts are enhanced. More specifically, the EIA aims to identify the likely potential impacts to be generated by the Project and to provide a set of actions need to be implemented in order to meet national and international environmental safeguard standards. The specific objectives of the study are as follows:

- Justification of the Project;
- Analysis of alternative sites;
- Identification of national and international legal environmental requirements;
- Establishment of environmental and socio-economic baseline condition of the study area;
- Prediction and evaluation of potential environmental and socio-economic impacts;
- Assessment of occupational risk and hazard;
- Identification of mitigation and abatement measures; and
- Development of Environmental Management Plan (EMP)

As per ECR 1997, this proposed project is included the “Red Category in item 60” and described as “*Engineering works: capital above 10 (ten) hundred thousand Taka”*. Rule 7 states that the proponent of such projects must obtain a Location Clearance Certificate (LCC) and an Environmental Clearance Certificate (ECC) from the Department of Environment (DOE), Government of Bangladesh (GOB).

For this report, at first the EA study has conducted in-depth consultation meetings with stakeholders including socioeconomic survey at several locations that have been proposed to have project interventions. Individual consultation conducted with 40 (forty) people of different occupation including women. A team of experienced professional and support staff has conducted surveys and consultation meetings after being briefed about the project. The orientation session was facilitated by the survey team leader. Techniques of data collection, sampling methods, methods of filling up questionnaire, potential locations of the survey, etc. were discussed in the orientation session using map of the study area. The respondents were selected by random sampling method from each of the locations and also by purposive sampling method in some locations. The consultation meeting participants were from project stakeholders on site.

Development Design Consultants Limited (DDCL), an internationally reputed consultancy firm has formed a multidisciplinary team of EIA experts having experience of conducting Environmental Impact Assessment of large scale industrial and infrastructural development projects. JICA Project Preparation Team did some supplementary works and advised CAAB for finalizing EIA report

This infrastructural development project is needed at Hazrat Shahjalal International Airport because of lack of existing facilities. However, air traffic flow in Bangladesh is rapidly increasing day by day. Existing infrastructure facilities of the airports in Bangladesh are not sufficient to meet the future air traffic demand of the country. Currently, the airport has an annual passenger handling capacity of only 8 million. The space of the Passenger Terminal Building is not enough to implement the modern five level security concepts. Besides, the Airport is not capable to handle new generation (Code F) Aircrafts like B747-8F, B777-300 ER etc.

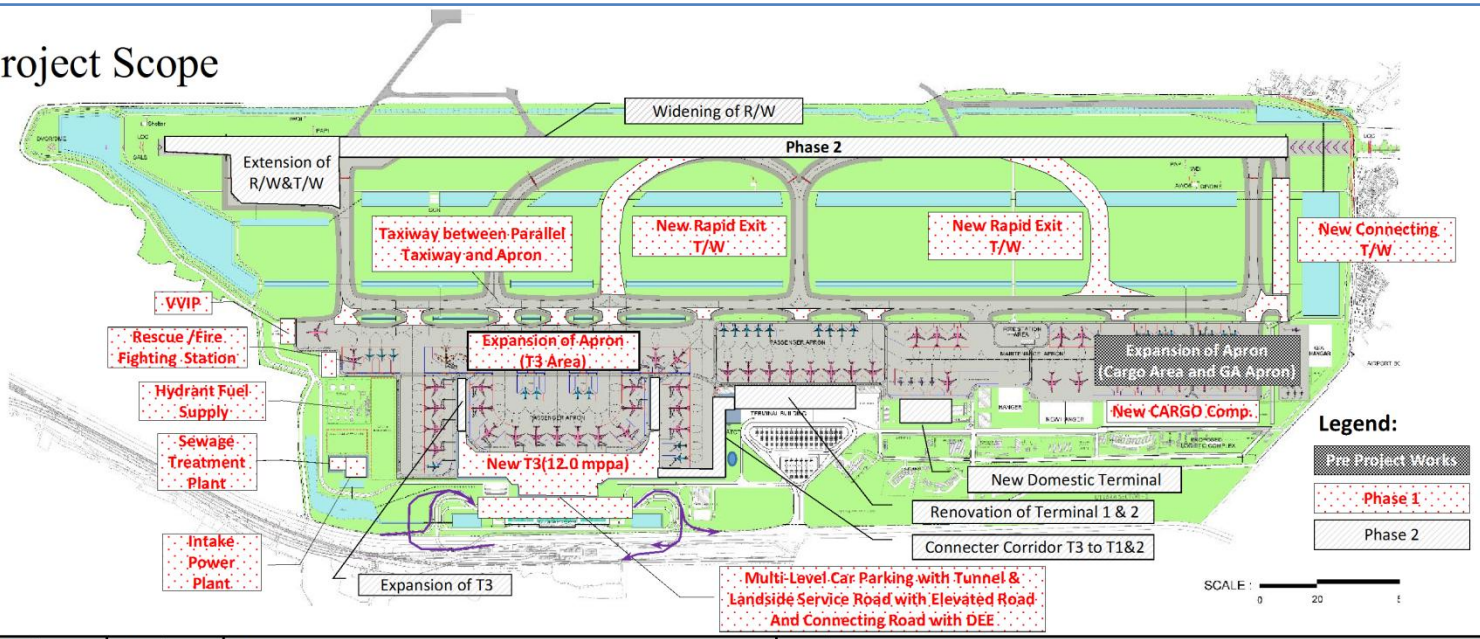
This infrastructural development project will be implemented on the land located within the boundary line of Hazrat Shahjalal International Airport acquired by the Civil Aviation Authority Bangladesh with financial support from Government of Bangladesh as well as from potential donor agency of JICA. It is located north of Dhaka city, in a densely populated area, at a distance of approximately 15 km from the city center. National highway road (N3) from Dhaka to Mymensingh passes in the north-east side of the proposed site for implementation of the proposed project works.

Description of the Project

The scope of works of the project has been divided into two phases – Phase 1 and 2. First, the Phase 1 will be completed with JICA funding and then the works of Phase 2 will be started to ensure smooth running of the activities in the airport without any interruption of services.

The scope of JICA funded project (for which this EIA report is prepared) with layout is given in the following figure.

Project Scope



Package	Works	Division	Facilities
Phase 1	Building	New Passenger Terminal Building (Terminal 3)	3 story building with area of approx 220 thousand m^2 Including supply of related equipment /Capacity of 12.0 mppa
		Multi-Level Car Parking with Tunnel	The area of approx 62,000 m^2
		New Cargo Complex	The area of approx 41,000 m^2
		VVIP Complex	The area of approx 6,000 m^2
		Rescue and Fire Fighting Facilities and Equipment	
	Civil	Parking Apron (Terminal 3 Area)	Terminal 3 Area: approx 500,000m^2
		Taxiways	9 connecting taxiways connecting to the T3 apron: approx 42,000m^2
		Landside Service Road with Elevated Road and Connecting road with Dhaka Elevated Express way	
		Improvement of Drainage System	
		Taxiways (two rapid exit and one connecting taxiway for the runway 14 threshold)	Approx 65,000 m^2
	Utility	Water Supply System	
		Sewage Treatment Plant	The area of approx 3,000 m^2
		Intake Power Plant with Distribution System	The area of approx 7,000 m^2
		Hydrant Fuel Supply System	
		Communication System	
		Security and Terminal Equipment	

Building works in Phase 1 will include New Passenger Terminal Building 3, which will be a 3 story building with area of approximately 220 thousand m^2 including supply of related equipment. The capacity of this terminal will be 12 million passengers per annum (mppa). It will also include Multi-Level Car Parking with tunnel & landside service road and connecting road with DEE (area approximately 62,000 m^2), New Cargo Complex (area approximately 41,000 m^2), VVIP Complex (area approximately 6,000 m^2) as well as the Rescue and Fire Fighting Facilities and Equipment.

Civil works in Phase 1 includes Parking Apron in front of Terminal 3 area having an area of 500,000 m^2, Taxiways (9 numbers connecting to the T3 apron: approx. 42,000 m^2), Landside Service Road with Elevated Road and Connecting road with Dhaka Elevated Express way, Improvement of Drainage System, and Taxiways (two rapid exit and one connecting taxiway for the runway 14 threshold having an area an area of approximately 65,000 m^2.

Utility works in Phase 1 include water supply system, sewage treatment plant (approximately 3,000 m^2), Intake Power Plant with Distribution System (approximately 7,000 m^2), Hydrant fuel supply system, and security and terminal equipment.

Alternative Analysis

Since it is expected that the passenger demand of HSIA will exceed the capacity of the existing facilities, the countermeasures of this issue had considered. The result of alternative study is shown in below Table. The Plan 0 is 'Do Nothing' option, while 3 other plans are considered. The Plan-0 will obstruct the economic development required for graduating from Least Development Countries. The Plan-1 is able to meet the expected demand after 2030, but the benefit per cost is low; and the negative effect to environment and social is large. Plan-2 is able to meet the expected demand until 2030, while the benefit per cost is high and the negative impact to socio environmental aspect is small. Therefore, the Plan-2 is selected for this project. As for the Plan-3, the cost is high, the negative impact to socio environmental aspect is significant and most importantly, will take long time implement; that is why this plan is not considered for the time being.

Different Aspects	Plan-0	Plan-1	Plan-2	Plan-3
Outline of planning	Non installing new facility	Introducing 2nd runway and new terminal building (To meet the increase of passenger after 2030)	Introducing new terminal building (To meet the increase of passenger until 2030)	Constructing new airport on other site
Land use	No change of land use	Land acquisition around airport will be needed, so the land use will change	No change of land use	Land use will change significantly on the candidate site of new airport

Different Aspects	Plan-0	Plan-1	Plan-2	Plan-3
Technology & Economy	This plan don't meet the increase of passenger, so the number of landing and takeoff will not be increased in future. Therefore, economic development will be obstructed.	The benefit of the 2nd runway is small because of locating close to existing runway. The number of landing & takeoff is not expected large rising up. The specific consideration and technology will be needed for construction of new runway near the existing one.	The plan-2 is able to meet the increase of passenger until 2030 by less investment than the Plan-1. This plan doesn't need specific construction technology.	The construction of new airport is needed huge investment. There will be possibility of technological issue of flooding in rainy season because of drainage conditions.
Environmental & Social consideration	The current socio-environmental condition will be maintained.	The land acquisition and involuntary resettlement will be needed around existing airport. The negative environmental impact is large because of construction work out of the airport area. The negative impact from increasing the number of landing and takeoff will occur.	The land acquisition and involuntary resettlement will not be occur. The negative environmental impact is small because of construction works in the airport area. The negative impact from increasing the number of landing and takeoff will occur.	Huge land acquisition and involuntary resettlement will occur. The negative environmental impact will be significant during construction and after construction.
Comparative Conclusion	Socio-Environmental impact is the lowest. But this plan cannot meet to increasing of passenger in future and will obstruct economic development for rising up from LDC.	The negative Socio-Environmental impact is large. The benefit per cost is low.	Socio-Environmental impact is the lowest except the Plan-0. This plan can meet the increasing of passenger for a while. This plan is selected in this project because of advantage on economic aspect and lower negative impacts.	This plan has largest Socio-Environmental negative impact. And it need the largest cost. But this plan will be needed for future demand after 2030.

Environmental Scoping

The objective of environmental scoping is to identify significant environmental impacts for the HSIA Expansion Project. In this process of the environmental scoping, collection of existing data from all possible sources was carried out. Then, an environmental reconnaissance was conducted with a check list in hand to identify and delineate the significant effect of the project and eliminate the others from further considerations. A generic mitigation measures were considered for the identified environmental impact items. It is noteworthy that the check list including 30 general environmental impact items were prepared referring the JICA Guidelines. Major positive impacts were found in local economy and employment; and landscape improvement.

Anticipated Environmental Impacts

The present report assesses the impacts of the proposed activities on various environmental attributes of the project site. A particular methodology has been followed to identify the potential

impacts. The issues for consideration have been raised by the following means: (i) input from interested and affected parties, if any; (ii) desktop research of information relevant to the proposed project; (iii) site visit and professional assessment by environment specialist engaged by the implementing agency; and (iv) evaluation of proposed design scope and potential impacts based on the environment specialist's past experience. Categorization of the project and formulation of mitigation measures have been guided by Checklist for Development as per JICA Environmental Guidelines.

Environmental impacts during pre-construction phase includes relocation and land use change and during construction phase these are noise, air pollution, soil and water pollution, vegetation and fauna, solid waste generation, occupational health and safety, etc. There are no impacts related to operation of the project. After the construction phase there will not be any effects/ significant effects on the environment outside the Hazrat Shahjalal International Airport. The only direct effect on the environment outside the airport will be in connection with the repair of the drainage system (the establishment of two new pump stations and sluices). The effects on out-side environment will result in increase in water pumped from the airport area to the outside when compared with the existing condition. The environmental impacts from this increased load of water to the outside is assessed not to have any effects on the water level outside, and not to result in any environmental impacts. There will be significant noise impact during operation phase from the aircraft; and there will also be minor global carbon emission impact, which is responsible for climate change and global warming.

Assessment of Impacts

Based on the impacts assessment**,** the issues such as Infrastructure, Transportation and communication, Health & education facilities, and History, culture & tourism have the **most/ major positive significant** impact. In addition, Industry and agriculture have the **moderately positive** impact. Moreover, Demography has **minor positive** impact. From this airport improvement project the above issues would be beneficial for the studied area. Since these parameters have positive impacts, no mitigation measures are required and recommended.

However, air quality and noise have the **most/ major negative** impact. Besides, Soil, water, and occupational health & safety have the **moderate negative** impact because of the project activities. Furthermore, Climate, Solid waste, and Wetland habitats have the **minor negative** impact from this improvement project. These issues might be problematic, concerned with environmental issues, for the studied area if necessary mitigation measures would not taken into consideration.

The remaining studied environmental parameters such as Topography, Land use, Vegetation, Fauna, Protected areas, Landscape, and areas of cultural value have **no impacts** from the activities of the upgrading project.

Mitigation Measures

Appropriate mitigation measures during construction phase for impacts like noise, air pollution, pollution of soil and water, socio-cultural and occupational health and safety have been suggested. Suitable measures for operational phase have also been formulated.

Environmental Management Plan

Environmental Management Plan (EMP) is a site specific plan developed to ensure that the project is implemented in an environmentally sustainable manner where all contractors and

subcontractors, including consultants understand the potential environmental risks arising from the proposed project and take appropriate actions to properly manage that risk. EMP also ensures that the project implementation is carried out in accordance with the design and the mitigation measures as recommended in the Initial Environmental Examination (IEE), Environment Impact Assessment (EIA) study to reduce the adverse impacts during the project's life cycle. The plan outlines existing and potential problems that may adversely impact the environment and recommends corrective measures where required. Also, the plan outlines roles and responsibility of the key personnel and contractors who are charged with the responsibility to manage the proposed project site and its surroundings.

Protection of Ecological Environment

During the operational phase of the proposed project, plantation shall be done for three specific reasons:

- Plantation in and around the airport to reduce noise impact
- Plantation to absorb air pollutant
- Re-plantation, pertaining to the cutting of trees
- Plantation of Creeper grasses over the paved slope of the canals

During the operational phase, air emissions will be from the vehicular traffic and operation. An adequate greenbelt development at and around the project site has been suggested to reduce the impact on the flora and fauna as the plant species will act as air and noise pollutants sink. Green belt will be developed in and around the airport area and along the road side.

Based on the location, suitable type of trees and plants will be recommended as a part of the greenbelt development plan to mitigate the impact and to restore the damaged habitat of the region.

Guideline for Plantation & Landscaping: Selection of plant species is to be done on the basis of their adaptability to the existing geographical conditions and the vegetation composition of the topography of the region.

As the area is an open area and open scrub, suitable native species of flora to be planted, those are found in that geographical region.

Selection of plant species will be done carefully, as such they are of fast growing verity, perennial and evergreen with thick canopy cover, large leaf area index (LAI) and a high pollution attenuation factor (PAF) for effective dry deposition of particles and fibers. On the same time, the species selection must take into consideration those trees, which do not attract the birds in order to avoid the chances of bird hitting with aircraft.

Green Belt Development Plan: in order to assure proper greenbelt development, following management plan will be adopted:

- Healthy and established sapling having 1m height should be selected for planting in greenbelt to avoid mortality of plants.

- Pit measurements of 0.6 m x 0.6 m x 0.6 m are to be dug up at desired point in triangular pattern.

- The tall shrubs and dwarf trees with 3 m spacing between plants and rows is sufficient while medium and tall trees in middle and rear rows are to be planted at a distance of 6-7 m and 8-10 m apart respectively depending upon the space available.

- Close plantation is recommended for accommodating more number of trees per unit area resulting in more leaf surface.

- The pit should be filled with mixture of cow dung manure and soil in ratio of 1:4. 10 grams BHC of 10% concentration should be properly mixed with the soil and manure to kill the termites and insect.

- Close plantation with three tiers system keeping dwarf trees with round canopy exposed to the source of emission followed by medium and tall trees with cylindrical canopy is ideal design for the polluted area, because all plants are exposed to the pollutants. This plantation shall be done inside the airport boundary lines and inside the airport residential area boundary lines nearby Dhaka Mymensingh highway. The minimum thickness of this proposed green belt is 100 meter as per recommendation of IATA. Plan detailing the location of Green Belt will be prepared and it will be followed during implementation.

- Close plantation also result in tall trees with deeper roots and ultimately yield more bio-mass per unit area and more efficient absorption of pollutants. Plantation of trees in staging arrangement in multiple rows across the direction of the wind is recommended for better trapping and absorption of the pollutants.

- Provide Heterogenic trees in green belts development.

Implementation of Environmental Management Action Plan

The environment management cell developed for the upcoming project will ensure the implementation of the mitigation measures suggested for the proposed project. The details of the implementation mechanism for the mitigation measures have been discussed in **Table 8-2** of the main text.

Conclusions and Recommendations

Based on the environmental assessment, all possible environment aspects have been adequately assessed and necessary control measures have been formulated to meet with statutory requirements, in the preparation of the IEE, EIA, EMP.

The overall conclusion is that if the mitigation, compensation and enhancement measures are implemented in full, there should be no significant negative environ-mental impacts as a result of location, design, construction or operation of this airport expansion project. There should in fact be some benefits from recommended mitigation and enhancement measures and major improvements in quality of life and individual, education, job and public health once the scheme is in operation. Thus, the proposed project is a welcome development and may be accorded environmental clearance.

The benefits of the project can be summarized as follows:

- This project aims at the infrastructural development of the area.
- The project will provide impetus to the growth of the area.

- Employ in the workforce people who live in the vicinity of the construction site to provide them with a short-term economic gain and
- Plant large-growing trees at the periphery of the site by the contractor to mask it from view and give it a more natural and pleasing appearance.

The proposed project is aimed at the infrastructural development of the area. The project will provide impetus to the growth of the area. Thus implementing this project will not have any significant negative impacts. Thus, the proposed project is a sustainable development and may be accorded environmental clearance.

Two straight recommendations which are as follows need to be followed by the concerning authority to ensure sound environmental and socio-economic condition**:**

- All mitigation, compensation and enhancement measures proposed in this EIA report needed to be followed.
- The Environmental Management and Monitoring Plan proposed in this report also need to be followed.

2. INTRODUCTION

2.1 Background of the Project

The Aviation activities have been started in Bangladesh on last week of December in 1971. The Government of Bangladesh has been implementing all the aviation activities through Civil Aviation Authority of Bangladesh (CAAB), an autonomous organization run by the Chairman. Over the years, the infrastructures and facilities have been developed to meet the growing air traffic demand of the country. At present, aviation activities are being carried out from 3 international and 5 domestic airports located at significantly important places of the country. About 17 airlines are now operating in and out in the country. Till now, about 47 states signed bilateral agreements with Bangladesh.

Air traffic flow in Bangladesh is rapidly increasing day by day. Existing infrastructure facilities of the airports in Bangladesh are not sufficient to meet the future air traffic demand of the country. As the capital airport, it is the air gateway of the country and is insufficient to handle the growing air traffic demand. At present, Hazrat Shahjalal International Airport (HSIA), Dhaka is the busiest airport of the country, through which about 80% of the total air traffic flow takes place. This airport was designed as a domestic airport in early 60s. Currently, the airport has an annual passenger handling capacity of only 8 million. As an air gateway of the country, this is insufficient to handle the growing air traffic demand of the country. The space of the Passenger Terminal Building is not enough to implement the modern five level security concepts.

As the capacity of Hazrat Shahjalal International Airport (HSIA) is nearing its limit, Civil Aviation Authority of Bangladesh (CAAB) initiated necessary activities to expand the HSIA. In this regard, CAAB appointed a consultant in 2014 to prepare a master plan, feasibility study and design of the expansion works. Scope of the consultant also included preparing Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA) reports, and assisting CAAB in obtaining Environmental Clearance Certificate (ECC) from Department of Environment (DOE). Under that scope, a draft IEE report was first prepared in August 2015 and later revised version was submitted to DOE in August 2016. Subsequently, DOE approved the IEE and issued a Site Clearance in September 2016. The CAAB appointed consultant then proceeded to prepare the EIA report and submitted a draft EIA to DOE in December 2016.

Meanwhile, CAAB approached to Japan International Cooperation Agency (JICA) for possible finance to implement the project. A JICA study team first worked between April 2016 and November 2016 to review the expansion plan; and CAAB and JICA finalized a Project scope for possible JICA finance under the title “Hazrat Shahjalal International Airport (HSIA) Expansion Project”. Then JICA engaged another Study Team for finalization of project preparation from December 2016 till March 2017. This team (the JICA Preparatory Survey Team) observed that the contents of the draft EIA submitted to DOE in December 2016 did not fully meet DOE and JICA environmental guidelines.

Thus, to support CAAB in preparing an acceptable EIA report, the JICA Preparatory Survey Team decided to carry out some supplementary activities by subletting DDC Ltd.

The scope of supplementary works is as follows:

1. Alternative Analysis
2. Analysis of Social Environment
3. Aircraft Noise Measurement

4. Tree Inventory
5. Analysis of water Logging in surrounding areas
6. Focus Group Discussion (FGD)
7. Key Informants Interview (KII)
8. Individual Consultation
9. Discussion with former Lease Holders
10. Information Disclosure Meeting (IDM)

The output of this supplementary works is being used for finalization of Project's EIA report (this report) submitted to JICA and DOE for their concurrence and approval. The relevant portions of the outcome of this supplementary study have been inserted in appropriate sections of this EIA report. The details of these studies have been Annexed like Aircraft Noise Measurement (**Annex 19**), Tree Inventory and Classification (**Annex 20**), Analysis of Water Logging in Surrounding Area (**Annex 21**), Focus Group Discussion (**Annex 22**), Key Informants Interview (**Annex 23**), Individual Consultation (**Annex 24**), Discussion with former Lease Holders (**Annex 25**), Information Disclosure Meeting (**Annex 26**), relation with Dhaka Elevated Expressway (**Annex 27)** and Aircraft Noise Prediction (**Annex 28**).

This final EIA Report is also incorporates all comments from JICA and DOE and submitted to DOE in May 2017.

The main objectives of the Project are to construct 3rd terminal building, and other ancillary buildings and facilities to enhance the airport capacity to meet the growing air traffic demand and enable the airport to handle the operation of larger aircrafts as mentioned earlier.

2.2 Purpose of the Report

There is some specific legislation set out by the Department of Environment to implement any development project in the country. The main legislations for environmental protection in Bangladesh are the Environmental Conservation Act (ECA) 1995 and the Environmental Conservation Rules (ECR) 1997. Environmental Conservation Act (ECA) 1995 requires the proponents of every development project in the country to obtain Location/Site Clearance Certificate (LCC) and Environmental Clearance Certificate (ECC) from the Department of Environment (DOE), Government of Bangladesh (GOB). Thereafter, Environmental Conservation Rule (ECR), 1997 [Rule 7] of Bangladesh classifies industrial units and projects into four categories depending on environmental impact and location for the purpose of issuance of Environmental Clearance Certificate. The ECR'97 requires the proponents of development project in the country to submit an Initial Environmental Examination (IEE) and/or an Environmental Impact Assessment (EIA), based on level of environmental impact and categorization, to Department of Environment (DOE). The proposed project works fall under the Red category project as per ECA, 1995 and the followed up rules ECR, 1997 [Red Category in item no 60], and needs Location Clearance Certificate and Environmental Clearance Certificate from Department of Environment. As per requirement of DOE, the IEE study along with appropriate EMP was prepared with the objective of obtaining Location Clearance Certificate and Environmental Clearance Certificate from DOE. The IEE was approved and Site Clearance was issued by DOE on 8 September 2016. The scanned copy of Site Clearance is attached in **Annex 11.** The site clearance from the DOE has been issued on condition that the project authority shall submit a comprehensive Environmental Impact Assessment (EIA) considering the overall activity of the Hazrat Shahjalal International Airport Expansion Project in the accordance with the TOR and time schedule indicated in the Initial Environmental Examination (IEE) Report.

The present EIA report has been prepared to fulfill the requirement mentioned in the site clearance certificate and in the light of the requirement of Department of Environment (DOE), Government of Bangladesh (GOB) and the international donor organizations with specific attention to fulfilling the requirements of JICA Guidelines.

2.3 Objectives of the EIA Study

The overall objective is to conduct Environmental Impact Assessment (EIA) report for the proposed project with the purpose of obtaining Environmental Clearance Certificate from the DOE. The overall purpose of the EIA is to ensure that the Project is developed in an environmentally sound and sustainable manner ensuring that all possible negative effects are mitigated as best as practical and positive impacts are enhanced. More specifically, the EIA aims to identify the likely potential impacts to be generated by the Project and to provide a set of actions need to be implemented in order to meet national and international environmental safeguard standards. The specific objectives of the study are as follows:

- Justification of the Project
- Analysis of alternative sites
- Identification of national and international legal environmental requirements
- Establishment of environmental and socio-economic baseline condition of the study area
- Prediction and evaluation of potential environmental and socio-economic impacts
- Assessment of occupational risk and hazard
- Identification of mitigation and abatement measures
- Development of Environmental Management Plan (EMP)

2.4 Extent of the Study

Bangladeshi law and International policy require that the environmental impacts of development projects are identified and assessed as part of the planning and design process, and that action is taken to reduce those impacts to acceptable levels. This is done through the environmental assessment process, which has become an integral part of lending operations and project development and implementation worldwide.

a. National Policy

The main provisions for environmental protection and pollution control in Bangladesh are provided in the Environmental Conservation Act (ECA) of 1995 and the Environmental Conservation Rules (ECR) of 1997. These legislations also provide the principal mechanism for assessing and mitigating the environmental impacts of projects, both existing and proposed. The detailed description of these both legislations is provided afterward in the Section II of this report.

As per ECR 1997, this proposed project is included the “Red Category in item 60” and described as “*Engineering works: capital above 10 (ten) hundred thousand Taka”*. Rule 7 states that the proponent of such projects must obtain a Location Clearance Certificate (LCC) and an Environmental Clearance Certificate (ECC) from the Department of Environment (DOE), Government of Bangladesh (GOB). As a Red category projects, the following documents are needed to submit to the relevant DOE Divisional Officer:

Completed Application for Environmental Clearance Certificate, and the appropriate fee, shown in Schedule 13 of the Rules;

I. Report on the feasibility of the project;
II. Report on the IEE/ EIA for the project, and its Process Flow Diagram, Layout Plan;
III. Report on the Environmental Management Plan;
IV. No objection certificate from the local authority;
V. Emergency plan relating to adverse environmental impact and plan for mitigation of the effect of pollution; and
VI. Outline of the relocation and rehabilitation plan (where applicable).

As part of the Environmental Clearance Certificate application, a detailed Initial Environmental Examination (IEE)/ Environmental Impact Assessment (EIA) with Environmental Management Plans (EMP) satisfactory to the Department of Environment must be prepared.

This project is considered to have some potential environmental impacts, therefore must have to prepare Initial Environmental Examination (IEE) Report along with Environmental Management Plan (EMP),which have to be accepted by DOE as part of the LCC &ECC Issuance. Under the ECR'97, DOE has 60 days to respond after reviewing documents from the receipt of the ECC application for a Red category project. Submission of any further materials would be carried out, as per requirement of DOE toward obtaining the Location Clearance Certificate (LCC) and Environmental Clearance Certificate (ECC).Steps to be followed for obtaining the Environmental Clearance Certificate for this airport project are shown in Flow Diagram **Figure 2-1.**

In addition to Environmental Conservation Act 1995 and Environmental Conservation Rules 1997, there are a number of other policies, plans, and strategies which need to be considered in the project. The detailed description of all these relevant legislations is provided afterward in the Section II of this report.

b. International Policy

The most of the development projects have been implemented in Bangladesh by the financial help and technical guidance of some international donor agencies. These international agencies have their own environmental and social safeguard policies. Bangladesh Government has also agreed and signed some international treaty, conventions, protocols and agreements for environmental assessment, protection, and pollution Control. International Design Codes, Standards and Guidelines have also been implemented to conduct any development project here in Bangladesh.

Flow Diagram for Government of Bangladesh Environmental Assessment Process shown below (as this airport project fall into Red Category, only red color marked steps need to be followed):

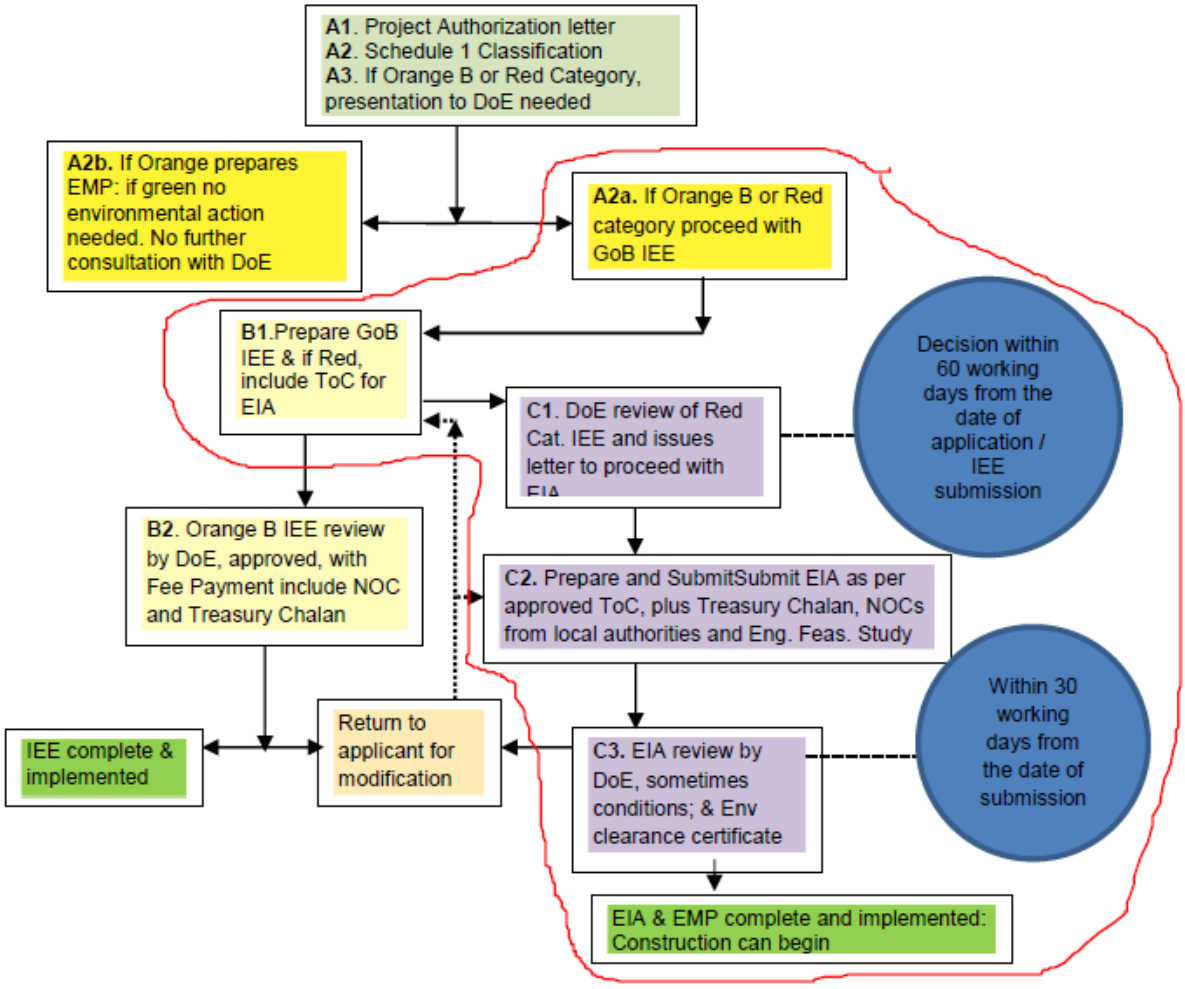


Figure 2-1 Flow Diagram for Government of Bangladesh Environmental Assessment Process

ADB has had environment assessment requirements for more than 20 years and own safeguard policy framework which is currently taken to consist of three operational policies, namely the Environment Policy (2002), the Policy on Indigenous Peoples (1998), and the Policy on Involuntary Resettlement (1995), together with their respective operations manual sections and guidelines.

World Bank has developed their environmental and social safeguard policy for the development works they have been conducting globally. The significant environmental safeguard policies include OP/BP 4.01 Environmental Assessment, OP/BP 4.04 Natural Habitats, OP/BP 4.09 Pest Management, OP/BP 4.11 Physical Cultural Resources, OP/BP 4.36 Forests and the social safeguard policies includes Indigenous People (OP 4.10), Involuntary Resettlement (OP 4.12). In 1989 the World Bank adopted Operational Directive (OD) 4.00, “Annex A: Environmental Assessment”. Environmental Assessment (EA) became standard procedure for Bank financed investment project. In 1991 the directive was as OD 4.01, which has subsequently been changed to operational policy OP 4.01 in January 1999 and the operational policy statement has

been updated in March, 2007. EA is designed to be a flexible process that part of project preparation allows environmental issues to be addressed in a timely and cost-effective way during project preparation and implementation.

Japan International Cooperation Agency (JICA) has formulated specific social and environmental guidelines entitled as "JICA Guidelines for Environmental and Social Considerations 2010" (available at JICA website). JICA has classified all the projects into four categories in the order of environmental impacts in terms of their complicity, extent, and intensity: Category A, B, C, and FI. Category-A are the projects, which may cause significant adverse environmental and social impacts, and Category-B are the projects, of which potential adverse impacts on the environment and society are less than those of Category A project. Category-C is the project likely to have minimal or little adverse impact on the environment and society. Projects having several sub-projects with potential environmental impacts are classified under Category-FI.

Bangladesh is a party to a large number of international conventions, treaties, and protocols (ICTPs) related to the Project and is committed to ensure that these protocols are complied with during all development works. The applicable ICTPs are Rio declaration (environment and development) 1992, Convention on Biological Diversity (Rio de Janeiro) 1992, UNESCO World Heritage Convention 2011, International Plant Protection Convention (IPPC) 1951, Plant Protection Agreement for the South East Asia and Pacific Region 1956, Convention on Biological Diversity (CBD) 1992, UN Framework Convention on Climate Change (UNFCCC) 1992, Ramsar Convention (Convention on Wetlands of International Importance especially as Waterfowl Habitat) 1971, Convention on Persistent Organic Pollutants (Stockholm) 2001.

International Design Code, Manual, Standard, and Guideline that are relevant to the proposed project include International Civil Aviation Organization Standards (ICAO), International Air Transport Association (IATA), and U.S. Federal Aviation Administration (FAA). The relevant ICAO standard documents are Annex 3: Meteorological Service for International Air Navigations-15th Edition-2004, Annex 16: Environmental Protection Volume I for Aircraft Noise-4th Edition-2005, and Doc. 9184 Airport Planning Manual Part 2: Land Use and Environmental Control-2nd Edition-2002. In addition, the AC 150/5020-1-Noise Control and Compatibility Planning for Airports, 1983 is a suitable document from FAA Standards. However, if necessary, Korean Standards and Special Standards could be used to establish sustainable environmental protection and control measures.

The detailed description of all these relevant international legislations is provided afterward in the **Chapter 3** of this report.

2.5 Scope of the Study

In general the study discusses the environmental impacts and mitigation measures relating to the location, design, construction, and operation of all physical works proposed under this project. This EIA report will clarify the environmental situation and fulfill the requirements set out by DOE for obtaining Location Clearance Certificate (LCC) and Environmental Clearance Certificate (ECC) from them. The overall scope of the study includes identification of the statutory requirements, prediction of potential environmental and socio-economic impacts due to implementation of the project, suggestion of appropriate mitigation measures and formulation of Environmental Management Plan (EMP).The detailed scope of this study:

- Conduct field visit, reconnaissance survey, and consultation with local stakeholders;
- Analysis of Occupational Risk and Hazard;
- Collect primary data on water, land, air, and ecosystems condition through focus group discussion (FGD), questionnaire survey (QS) and other method for the establishment of baseline conditions of the Project;
- Analysis of Environmental policy and legal requirement;
- Identify important environmental and social components likely to be impacted by the proposed Project;
- Assess environmental and social impacts of the proposed project;
- Conduct comprehensive public consultations;
- Identify of suitable mitigation measures;
- Prepare of Environmental Management Plan (EMP); and
- Preparation of the EIA report for obtaining Environmental Clearance from the DOE.

2.6 Methodology

In order to conduct the required impact assessment for the component of this project, it is necessary to collect relevant data from appropriate primary and secondary sources to fully establish existing baseline conditions for the relevant environmental (biophysical and socio-economic) aspects. Secondary data were collected from different concerned government departments, books, reports and published materials to establish baseline profile for physical, ecological and socioeconomic environmental conditions. Primary data were collected through baseline environmental survey and public consultation. On the basis of collected data, scoping of important environmental components were done following the method in JICA guidelines, (**Chapter 5**) anticipated impacts were assessed (**Chapter 6**), mitigation measures were identified (**Chapter 7**), Environmental Management Action Plan (**Table 8-2)** including the Monitoring Plan (**Table 8-5**) has been prepared, (**Chapter 8**) and Monitoring Formats have been given in **Annex 2**. The location of primary sampling points for data collection has been shown in **Annex 12**.

a. Physical Environment

Information was collected on the existing physical environment, particularly as related to, topography and soil, geology, hydrology and drainage, water quality, air quality and noise.

i. Geology, Topography and Soils

Data related to geology, topography and soil were collected to establish the baseline of the project area and further to find out the impacts of the project during the pre-construction, construction and operational phases.

ii. Hydrology and Drainage

Data related to hydrology and drainage was collected to identify the elements of the hydrological cycle that are likely to have impacts on the project and the possible impacts that the project could have on the hydrological regime. Field assessments included a determination and verification of all the existing inflows into the drain, assessment of drainage issues, interviews with local community members, and discussions with stakeholders.

b. Baseline Environmental Quality Parameters Analysis

Moreover, environmental quality analyses of soil, bed material, surface water, ground water, ambient air and noise with selected parameters were conducted in the Department of Civil

Engineering, Bangladesh University of Engineering Technology (BUET) and Department of Soil, Water and Environment under Dhaka University.

i. Air Quality Monitoring

Ambient air quality measurements are essential to provide a description of the existing conditions, to provide a baseline against which changes can be measured and to assist in the determination of potential impacts of the proposed construction on air quality conditions. To monitor ambient air quality, carbon monoxide (CO), Sulphur Di-Oxide (SO_2), Oxides of Nitrogen (NOx) and Particulate Matter (PM_{10} and $PM_{2.5}$) have been included for ambient air quality monitoring. LATA Envirotech APM 250 with Combined PM_{10}/$PM_{2.5}$ Sampler was used for the measurement of particulate matters and for gaseous pollutants LATA Envirotech LES 411 was used for monitoring.

ii. Noise Monitoring and Assessment

The noise monitoring was performed by the Department of Civil Engineering, environmental engineering laboratory of BUET, for laboratory analysis. Existing sound level has been monitored in time weighted average Leq in dBA both at day and night time at four locations encompassing each of the sample sites were recorded using a calibrated HTC Sound Level Meter set to A-weighting, slow response and statistical analysis settings. From every location Day and Night Noise has been captured. Vibration was recorded from two locations using HTC VB-8205 vibration meter.

However, noise monitoring by BUET was not adequate, as that was done only for 15 minutes and not covered for night time. So, JICA Study Team conducted new ambient noise test (morning 9 AM to 11 PM night, continuously), and calculated maximum Leq10 for day and night time separately as well as Leq60. The details of this study have been given in **Annex 17: Noise Level Measurement Test Results in Location 3 and 4.**

iii. Soil Sampling

In order to better establish baseline site conditions, a number of soil samples were collected from the proposed site and sent to Department of Civil Engineering, environmental engineering laboratory of BUET, for laboratory analysis. Observations were also made about the physical characteristics of the soil at the project area such as color, texture and plasticity.

iv. Water quality

Surface Water quality

For the water samples, a number of physico-chemical parameters were tested on-site including pH, EC, TDS, TSS, DO, Fe, NH_3-N, PO_4, SO_4, and As. However, for other parameters all the samples were supplied to the Department of Civil Engineering, Environmental Engineering laboratory of BUET, for laboratory analysis. Visual observations were also recorded including color and the presence/ absence of detectable odors. Both surface water and groundwater samples were collected from the project area. Surface water sample also analysis for oil and grease were supplied to Department of soil, water and environment, Dhaka University.

Ground/Drinking Water Quality

Sampling of ground water has been performed by DDCL environment team and analysis of ground/drinking water has been carried in the laboratory of Department of Civil Engineering,

Environmental Engineering laboratory of BUET for laboratory analysis. Eleven (11) parameters were analyzed.

v. Soil and Bed Material Quality

Samplings of soil and bed material were collected by the DDCL environment team and analysis of samples was done at the laboratory of the Department of Soil, Water and Environment of University of Dhaka. For soil quality analysis Fe, Pb, Cd, Zn, and Organic matter were analyses. For bed material five parameters (Zn, Cu, Pb, Cd and As) were analyzed.

c. Environmental Risks

The issues of climate change as well as occurrences of flood, cyclone and seismicity have been considered as environmental risks.

d. Ecological status

Secondary data sources were reviewed in order to compile a potential presence/ absence list of significant fauna and flora species. Thereafter two members among the field survey team were deployed to undertake the required sampling and assessment.

i. Direct Observation

Direct observation on the occurrence and abundance of flora and fauna was made while travelling along road edges.

ii. Interviews with Local Residents

Many of the mammalian and reptilian species are cryptic and unlikely to be encountered using standard field sampling methods. As such, experience suggests that interviews with local people are a very useful method for collecting information on local biodiversity.

iii. Tree inventory and classification

As a part of baseline environmental survey, tree inventoried in the premises of proposed area of Terminal building-3 and the diversity of trees were identified and recorded. An inventory of trees with local name, girth, dbh, bole height, height, amount of fuel and numbers has been prepared (**Annex 20**).

e. Public Consultation

For this report, at first the EA study has conducted in-depth consultation meetings with stakeholders including socioeconomic survey at several locations that have been proposed to have project interventions. Individual consultation conducted with 40(forty) people of different occupation including women. A team of experienced professional and support staff has conducted surveys and consultation meetings after being briefed about the project. The orientation session was facilitated by the survey team leader. Techniques of data collection, sampling methods, methods of filling up questionnaire, potential locations of the survey, etc. were discussed in the orientation session using map of the study area. The respondents were selected by random sampling method from each of the locations and also by purposive sampling method in some locations. The consultation meeting participants were from project stakeholders on site.

Moreover, detailed individual consultations and focus group discussions, key informant interviews, consultation with former lease holders, and information disclosure meeting were

conducted. This information has been included in the Chapter on Information Disclosure, Consultation and Participation; and the relevant **Annexes 22, 23, 24, 25 and 26.**

f. Socio-economic Environment

For social Environment describes the existing conditions of socio-economic components (e.g. population, and housing, traffic and transport, economy and employment, cultural, archaeological and historical resources, etc.) in the both ends of run way. The primary objectives are to provide a baseline data that helps to identify important social components (ISCs) and to assess the potential impacts on the ISCs which may be caused by the project activities during pre-construction, construction and operation and maintenance (O&M) stages.

The Consultants utilized a combination of desk research, field investigations, and individual consultation for collection of data. Data was collected on Population-Demographic Profile, Traffic and transport, Public Utilities: Water supply, sanitation and solid waste disposal and Cultural, archaeological and historical sites.

g. Geographical Information Systems

Geographical Information Systems (GIS) was used as a specialized analysis and presentation tool. Before commencing field investigations, spatial analysis of satellite imagery and present administrative areas and other boundaries/constraints was considered for both the environmental and social assessments. It also supports more detailed on-ground survey, particularly spatial features that may be directly or indirectly influenced by Project activities.

On the basis of the identified environmental impacts and recommended mitigation measures linked with the project activities, Environmental Mitigation plan has been prepared which will be followed at the pre-construction, construction and operation stages. While preparing the EMP, highly significant impacts, where applicable, are taken into consideration to recommend possible mitigation measures. Environment monitoring plan has also been prepared.

2.7 EIA Team

DDCL, an internationally reputed consultancy firm has formed a multidisciplinary team of EIA experts having experience of conducting Environmental Impact Assessment of large scale industrial and infrastructural development projects. **Table 2-1** presents the professionals' names worked to conduct this study with their positions.

Table 2-1 EIA Study Team

Sl. No.	Name	Position
1	Md. Golam Mustafa,PEng.	Team Leader (Senior Environment Specialist)
2	ZainulAbedin, PhD	Deputy Team Leader (Senior Environment Specialist)
3	Tajul Islam, PhD	Advisor – Social
4	Tofael Ahmed	Environmental Expert
5	MadhuShudan Das	GIS Expert
6	Abdul Malek	Surveyor - 1
7	Bappy Rahman	Surveyor - 2

*JICA Project Preparation Team did some supplementary works and advised CAAB for finalizing EIA report, and Mr. Shinji Tanaka and Dr. Nurul Islam are members of that team.

3. LEGISLATIVE, REGULATION AND POLICY CONSIDERATION

3.1 National Legislations

For the protection, conservation, and management of the biophysical and social environment from damaging development pressures, the Government of Bangladesh has developed a complete legal framework, including laws, regulations, decrees, and standards addressing environmental and social safeguards. These legal frameworks are presently under review and draft materials are being circulated, but cannot be applied until they are promulgated. Among the existing documents, those most relevant to this Project are summarized in this section.

a. Environment Conservation Act 1995 (Amended 2000, 2002, and 2010)

The Environment Conservation Act, (ECA) 1995 is currently the main legislation relating to environmental protection in Bangladesh. The Act is applied by the Department of Environment (DOE), within the Ministry of Environment and Forest. The Act forms the basis of the country's environmental safeguard system. It authorizes the Director General (DG) of DOE to undertake any activity deemed necessary to control, prevent, and mitigate pollution and to conserve and enhance the quality of environment. It lays out the basic rules on damage to the ecosystem, discharge of wastes, and the agency's power to enter and collect samples as part of any investigation. The Act also defined the powers of DOE to prepare Rules in support of the Act. It is promulgated for environment conservation, environmental standards development and environment pollution control and abatement. It has replaced the earlier environment pollution control ordinance of 1992 and has been promulgated in Environmental Conservation Rules, 1997 (ECR'97).

The main objectives of this Act are:

- Conservation and improvement of the environment; and
- Control and mitigation of pollution of the environment.

The main focuses of the Act can be summarized as:

- Declaration of ecologically critical areas and restriction on the operations and processes, which can or cannot be carried out/ initiated in the ecologically critical areas (ECA);
- Regulations in respect of vehicles emitting smoke harmful for the environment;
- Environmental clearance;
- Regulation of industries and other development activities' discharge permits;
- Promulgation of standards for quality of air, water, noise and soil for different areas for different purposes;
- Promulgation of a standard limit for discharging and emitting waste; and
- Formulation and declaration of environmental guidelines

Before any new project can go ahead, as stipulated under the ECA, the project promoter must obtain Environmental Clearance from the Director General (DG), Department of Environment (DOE), Government of Bangladesh (GOB). An appeal procedure does exist for those promoters who fail to obtain clearance. Failure to comply with any part of this Act may result in punishment to a maximum of 5 years imprisonment or a maximum fine of Tk.100,000 or both. The DOE executes the Act under the leadership of the DG.

b. Environmental Conservation Act (Amendment 2000)

The Bangladesh Environment Conservation Act Amendment 2000 focuses on:

- Ascertaining responsibility for compensation in cases of damage to ecosystems,
- Increased provision of punitive measures both for fines and imprisonment and
- The authority to take cognizance of offences.

c. Environmental Conservation Act (Amendment 2002)

This amendment elaborates the following parts of the Act:

- Restrictions on polluting automobiles;
- Restrictions on the sale, and production of environmentally harmful items like polythene bags;
- Assistance from law enforcement agencies for environmental actions;
- Break up of punitive measures; and
- Authority to try environmental cases.

d. Environmental Conservation Act (Amendment 2010)

This amendment of the act introduces new rules & restrictions on:

- No individual or institution (Government or Semi Government/ Non-Government/ Self Governing) can cut any hill and hillock. In case of national interest; it can be done after getting clearance from respective department
- Ensure proper management of their hazardous wastes to prevent environmental pollution and health risk
- No earmarked water body can be filled up/changed; in case of national interest, it can be done after getting clearance from the respective department; and
- Emitter of any activities/incident will be bound to control emission of environmental pollutants that exceeds the existing emission standards.

e. Environment Conservation Rules (ECR) 1997 (amended 2002, 2003)

The Environment Conservation Rules are the first set of rules promulgated under the Environment Conservation Act, 1995. There have been three amendments to this set of rules - February and August 2002 and April 2003. These rules provide categorization of industries and projects, and identify types of environmental assessment required against respective categories of industries or projects. These Rules provide:

- National Environmental Quality Standards (NEQS) for ambient air, surface water, groundwater, drinking water, industrial effluents, emissions, noise, and vehicular exhaust etc.;

- Listing out industries, development projects, and other activities to group into four environmental assessment categories on the basis of actual (for existing industries/development projects/activities) and anticipated (for proposed industries/development projects/activities) pollutant loading;

- Procedure for planning and completion of IEE and EIA, including the preparation of Environmental Management Plans, document format and content,

- The requirement for and procedures to obtain environmental clearance; and,

- Procedure for damage-claiming by persons affected or likely to be affected due to activities causing pollution or activities causing hindrance to normal civic life.

The Environment Conservation Rules, 1997 were issued by the GOB to exercise the power conferred under the Environment Conservation Act (Section 20), 1995. Under these Rules, the following aspects, among others, are covered:

- Declaration of ecologically critical areas;
- Classification of industries and projects into 4 categories;
- Procedures for issuing the Environmental Clearance Certificate (ECC); and
- Determination of environmental standards.

Rule 3 defines the factors to be considered in declaring an *'ecologically critical area'* as per Section 5 of the ECA (1995). It empowers the Government to declare the area as the Ecologically Critical Areas (ECA), if it is satisfied that the ecosystem of the area has reached or is threatened to reach a critical state or condition due to environmental degradation. The Government is also empowered to specify which operations or processes may be carried out or may not be initiated in the ecologically critical area. Under this mandate, the Ministry of Environment and Forest (MOEF) has declared Sundarban, Cox's Bazar-Tekhnaf Sea Shore, Saint Martin Island, Sonadia Island, Hakaluki Haor, Tanguar Haor, Marzat Baor and Gulshan-Baridhara Lake as ecologically critical areas and prohibited certain activities in those areas.

According to Rule 7 of the ECR 1997, depending on the industry, activity, development project location, type of work, size, and severity of pollution loads and impacts, DOE classified 186 activities into four environmental assessment categories. These categories are:

I. Green;
II. Orange A;
III. Orange B; and
IV. Red.

"Green category" does not require any environmental assessment; *"Orange A& B category"* requires Initial Environmental Examination (IEE) and *"Red category"* requires full environmental assessment or EIA. The categorization of a project determines the procedure for issuance of an Environmental Clearance Certificate (ECC). All proposed industrial units and projects that are considered to be low polluting are categorized under "Green" and shall be granted Environmental Clearance. For proposed industrial units and projects falling in the "Orange-A", "Orange-B" and "Red" Categories, firstly a site clearance certificate (SCC) and thereafter an environmental clearance certificate (ECC) will be required. A detailed description of those four categories of industry/project is in Schedule-1 of ECR 1997. Apart from general requirement, for every Red category proposed industrial unit or project, the application must be accompanied with Feasibility Report, Initial Environmental Examination (IEE), Environmental Impact Assessment (EIA) based on approved Terms of References (TOR) by DOE, and Environmental Management Plan (EMP), etc.

The ECR'97 also contains the procedures for obtaining Environmental Clearance Certificates from the Department of Environment for different types of proposed units or projects. Any person or organization wishing to establish an industrial unit or project must obtain ECC from the Director General. The application for such certificate must be in the prescribed Form (Form-3, Page-191) together with the prescribed fees laid down in Schedule 13, through the deposit of a Treasury *Chalan* in favor of the Director General. Rule 8 prescribes the duration of validity of such certificate (3 years for Green category and 1 year for other categories) and compulsory requirement renewal of certificate at least 30 days before expiry of its validity.

f. Civil Aviation Ordinance 1960 and Civil Aviation Rules 1984 (Amended 2009)

The Civil Aviation Ordinance, 1960 had been developed to demonstrate better provisions for the control of manufacture, possessions, use, operation, sale, import, and export of aircraft, and the control development of aerodromes in the country. It repealed the Aircraft Act, 1934 (XXII of 1934). Currently Civil Aviation Rules, 1984 and Air Navigation Orders are the legal regulatory frameworks for civil aviation activities in Bangladesh. All civil aviation activities in Bangladesh are regulated by the Civil Aviation Rules, 1984 which was made and promulgated by the Government in exercise of the powers conferred by sections 4, 5, 7 and 8 of the Civil Aviation Ordinance, 1960 (XXXII of 1960), section 10 of the Aircraft (Removal of Danger to Safety) Ordinance, 1965 (Xll of 1965), section 4 of the Telegraph Act, 1885 (Xlll of 1885) and in suppression of the Aircraft Rules, 1937 and the Airport Obstruction Clearance Rules, 1981. Later on, Civil Aviation Rules, 1984 has been amended to cope with the latest amendment of ICAO Annexes. This set of rules elaborately dealt with personnel licensing, rules of the air, aviation meteorology, operation of aircraft, airworthiness requirements, aircraft noise, safeguard against acts of unlawful interference, air transport services, and construction height of the surrounding infrastructure etc. Specifically, much of today's operational responsibilities and functions of CAAB are defined and formulated in these Rules. Chairman is the supreme personnel of Civil Aviation Authority to execute all activities of the organization under the rules.

The significant rules relevant to the current project concerning to environment is as follows:

- No building or structure shall be constructed or erected or tree shall be planted in those areas, except only if the Chairman allows, which may affect aircraft operation or jeopardize the safety of aircraft operations (Rule 11 of part Preliminary). This law demarcated two zones adjacent to airport runway and provided the specified height of infrastructures in the specified zones.

- Noise and vibration caused by aircraft (including a military aircraft) cannot exceed the limit set out by the Chairman at government and licensed aerodrome and/or aerodromes at which the manufacture, repair or maintenance of aircraft is carried out) (Rule 20 of part Preliminary).

- Aircraft shall be flown over maintaining minimum safe heights without undue hazard to persons or property on the surface, except in the event of an emergency arising (Rule 64 of part II).

- All the locally and internationally registered aircrafts need to have a noise certificate, having noise level standards as demonstrated by International Civil Aviation Organization (ICAO), issued or validated by the chairman of CAAB (Rule 276, 277 of part XVI)

- No person shall dispose of garbage, waste papers, refuse or any other object in the airport or aerodrome except in the receptacles provided for the purpose or in the specific area designated by the Airport Manager concerned for the Sanitation purpose (Rule 317 of part XIX).

- Any sorts of smoking caused by naked flame using oiled rags, cotton waste, waste oil, cleaning rags or articles, and combustible liquid is highly restriction, except being approved by the Chairman or the Airport Manager (Rule 323 of part XIX).

- Disposal of combustible waste and other matters-The combustible waste and other matters (referred in rules 317 and 323) shall not be permitted to accumulate and shall be disposed of daily in such place as may be approved by the Chairman or the Airport Manager for the purpose of proper waste management (Rule 326 of part XIX).

The current national civil aviation rules and regulations need to be reviewed due to lack of environmental provisions. It is the demand of present era to provide environmental provisions for sustainable environmental management and to avoid any violation of rules of law set out by the department of environment Bangladesh.

g. Noise Pollution Control Rules, 2006

Noise Pollution Control Rules has been issued by the Ministry of Environment and Forest in September 2006. This rule sets different zones and specifies limit of sound intensity for control of noise pollution. Different zones are Silent, Residential, Commercial, Industrial and Mixed. The Noise Levels Guidelines and Standards have been given in **Table 4-10** of this EIA report. However, as per this Rule aircraft operation has been exempted from the scope of Noise regulation.

3.2 Secondary Relevant National Legislations

The other national legal instruments, addressing both social and environmental, that have relevance to the proposed project have been presented below.

a. National Environmental Policy 1992

The Bangladesh National Environmental Policy, approved in May 1992, sets out the basic framework for environmental action together with a set of broad sectoral action guidelines to ensure environmental sustainability during development. The key elements of the Policy are:

- Maintaining ecological balance and ensuring sustainable development of the country through protection and conservation of the environment;
- Protecting the country from natural disasters;
- Identifying and regulating all activities that pollute, degrade, and destroy the environment;
- Ensuring environment-friendly development in all sectors;
- Promoting sustainable and environmentally sound management of the natural resources; and
- Maintaining active association, collaboration, as far as possible, with all international initiatives related to environment.

The policy mentions that Environmental Impact Assessment (EIA) should be conducted before projects are undertaken. The Policy seeks to ensure that no development activities are allowed to pollute the environment or degrade the natural resources. Some relevant specific issues of the Policy are that:

- All water bodies and resources be kept free from pollution;
- Wetlands be conserved for the protection of migratory birds;
- Activities which diminish the wetlands/natural habitats of fish should be prevented and rehabilitative measures encouraged;
- Existing projects on water resources development, flood control and irrigation be examined to determine their adverse impact on fisheries.
- Transport systems including airways, roads, and inland waterways cannot degrade nature.

b. National Environmental Management Action Plan (NEMAP) 1995-2005

The National Environmental Management Action Plan (NEMAP) is a wide-ranging and multi-faceted plan which builds on and extends the statements set out in the National Environmental Policy (NEP), 1992. NEMAP was developed during the period 1995 to 2005 to address specific issues and management requirements, and set out the framework within which various decisions, plans, legislative measures, rules, and regulations toward safeguarding the environment and natural resources including those of biological diversities are to be implemented that have been recommended in the National Conservation Strategy (NCS). It has been developed based on the following broad objectives which remains highly relevant today:

- Identification of key environmental issues affecting Bangladesh;
- Identification of actions necessary to halt or reduce the rate of environmental degradation;
- Sustainable resource use and improve management of the natural environment;
- Conservation of habitats and biodiversity;
- Promotion of sustainable development; and,
- Improvement of the quality of life of the people.

To this end, it has grouped all the relevant necessary actions under four heads: *institutional, sectoral, location-specific and long-term* issues*.* The *institutional* aspects reflect the need of inter-sectoral cooperation to tackle environmental problems those need new and appropriate institutional mechanisms at national and local levels. The *sectoral* aspects reflect the way the Ministries and agencies are organized and make it easier to identify the agency to carry out the recommended actions. The *location-specific* aspect focuses on particularly acute environmental problems at local levels that need to be addressed on a priority basis. The *long-term* issues include environmental degradation of such degree that it might become more serious and threatening than they seem to be if their cognizance is not immediately taken.

c. National Water Policy 1999

The National Water Policy was adopted in 1999 with the intention of guiding both public and private actions to ensure optimal development and management of water in order to benefit both individuals and the society at large. According to the policy, all agencies and departments entrusted with water resource management responsibilities (regulation, planning, construction, operation and maintenance) will have to enhance environmental amenities and ensure that environmental resources are protected and restored while executing their activities.

Particularly this Policy has been promulgated to ensure efficient and equitable management of water resources, proper harnessing and development of surface and ground water, availability of water to all concerned and institutional capacity building for water resource management. It has also addressed issues like river basin management, water rights and allocation, public and private investment, water supply and sanitation and water needs for agriculture, industry, fisheries, wildlife, navigation, recreation, environment, preservation of wetlands, etc. It also recognizes that poor water quality results in watershed degradation and deforestation, reduction of biodiversity, wetland loss and coastal zone habitat loss.

In addition, the Policy states the consequences of excessive water salinity in the southwest region of Bangladesh. In fact it ensures adequate upland flow in water channels to preserve the coastal estuary ecosystem threatened by the intrusion of salinity from the sea. Unplanned construction of embankments or structures hindering the normal drainage or hydrology of the area or on riverbanks has been recommended to stop in this policy. Moreover, pollution of both surface and groundwater around various industrial centers of the country by untreated effluent discharge into water bodies is a critical water management issue.

The strategy of the policy to conserve environment and resource can be summarized as:

- Promoting modern eco-friendly technology and infrastructure for a safe and sustainable future;
- Biodiversity conservation and sustainable land & water management;
- Restricting the conversion of agricultural land for non-agricultural purposes.

The objectives are broadly:

- To address issues related to the harnessing and development of all forms of surface water and ground water and management of these resources in an efficient and equitable manner;
- To ensure the availability of water to all elements of the society including the poor and the underprivileged, and to take into account the particular needs of women and children;
- To accelerate the development of sustainable public and private water delivery systems with appropriate legal and financial measures and incentives, including delineation of water rights and water pricing;
- To bring institutional changes that will help decentralize the management of water resources and enhance the role of women in water management;
- To develop a legal and regulatory environment that will help the process of decentralization, sound environmental management, and improve the investment climate for the private sector in water development and management; and
- To develop a state of knowledge and capability that will enable the country to design future water resources management plans by itself with economic efficiency, gender equity, social justice and environmental awareness to facilitate achievement of the water management objectives through broad public participation

The Policy suggests that the following matters should be considered:

- Zoning regulations will be established for location of new industries in consideration of fresh and safe water availability and effluent discharge possibilities;
- Effluent disposal will be monitored by relevant Government agencies to prevent water pollution;

- Standards of effluent disposal into common watercourses will be set by Water Resources Planning Organization (WARPO) in consultation with DOE;
- Industrial polluters will be required under law to pay for the cleanup of water- body polluted by them.

d. Water Act 2013

Salient Features of the Water Act have been mentioned below:

- Water Act 2013 is based on the National Water Policy, and designed for integrated development, management, extraction, distribution, usage, protection and conservation of water resources in Bangladesh.
- The new law has provided the right framework for better management of water resources in the country.
- The formation of the high-powered National Water Resources Council (henceforth termed as the Council) with the prime minister as the head implies the importance the government is paying to the management of this precious resource. An Executive Committee under the Ministry of Water Resources will implement the decisions taken by the Council.
- http://www.bangladeshchronicle.net/index.php/2013/07/review-of-the-water-act-2013/
- Control on water resources development and management has been described including approval of national water resources plan and issuance of clearance certificate on water resource development.
- Control on water use and protection and conservation of water resources including declaration of water stress area and management, preferential use of water in the water stress area and exemption, fixing the lowest safe yield of aquifer and restriction on abstracting groundwater, ensuring normal flow of water course, protection of flood control embankment, water zone demarcation and management, restriction on water storing, declaration of flood control zone and management, restriction on abstraction of total water from any water source, water pollution control.
- Offence, punishment and trial for violence of this act have been included in the act.

e. National Land Utilization Policy 1991

According to the National Land Use Policy 2001, the following objectives have to be maintained for sustainable land management:

- Prevention of the current tendency of gradual and consistent decrease of cultivable land for the production of food to meet the demand of expanding population;
- Ensuring usage of land in harmony with natural environment;
- Usage of land resources in the best possible way;
- Protection of natural forest areas, prevention of river erosion and destruction of hills;
- Prevention of land pollution; and
- Ensuring minimal use of land for construction and/or development works.

f. National Forest Policy 1994 (Amended 2010)

The National Forestry Policy has been revised in 1994 based on the National Forest Policy of 1977 in the light of the National Forestry Master Plan. An amendment of this policy has been conducted in 2010.

In general the major targets of the Policy are to conserve the existing forest areas; bring about 20% of the country's land area under the forestation program, and increase the reserve forestland by 10% by the year 2015 through coordinated efforts of GO-NGOs and active participation of the people.

The important specific objectives of the Policy include private initiatives to be encouraged to implement programs of tree plantation and forestation on fallow and hinter land, the banks of the ponds and homestead land, technical and other support services to be extended by the Forest Department for introducing agro-forestry on privately owned fallow and hinter land. Massive forestation on either side of land surrounding roads, railways, dams, khals, tanks, lakes, and ponds through the partnership of the local people and the NGOs may be commenced. Encouragement may be extended to grow fruit trees for producing more fruits along with the production of timber, fuelwood and non-wood forest products under the forestation program. Women may be encouraged to participate in homestead and farm forestry, and participatory forestation programs. There may be massive campaign through the government and non-government medias for raising consciousness among the people regarding forestation and conservation, and use of forest resources.

The amendments of the existing forestry sector related laws and adoption of new laws have been recognized very important factor for achieving goals and objectives of the policy. The Forest Policy also recognizes the importance of fulfilling the responsibilities and commitments under international multilateral environmental agreements.

g. Bangladesh Climate Change Strategy and Action Plan (BCCSAP) 2009

The Bangladesh Climate Change Strategy and Action Plan (BCCSAP) have been prepared by the Government of Bangladesh in 2008 and there was a revision in 2009. This is a comprehensive tool to address the upcoming challenges against climate change in Bangladesh. This is a part of the overall development strategy of the country. The climate change constraints and opportunities are being integrated into the overall plan and programs involving all sectors and processes for economic and social development. This also provides guidance to reduce vulnerability and increase resilience against climate change impacts. In this strategic plan more emphasize has been given on adaption compare to mitigation.

The Strategy will be achieved through implementation of an Action Plan, which is based on six themes: i) food security, social protection and health; ii) comprehensive disaster management; iii) infrastructure development; iv) research and knowledge management; v) mitigation and low-carbon development; and vi) capacity building and institutional development. The Action Plan will also be an integral part of the national development policies, plans and programs including the Sixth Five Year Plan. The Action Plan will be coordinated by Climate Change Unit (CCU) specially created for the purpose by the MOEF. The Unit operates under the overall guidance of the national Environment Committee headed by the Prime Minister and the National Steering Committee on Climate Change headed by the Minister, MOEF. All relevant sectoral ministries will have Climate Change Focal Points which will look after, design, and help in implementation of sectoral policies, programs and projects from climate change perspectives as and when so required within the framework of the planned development process.

h. Standing Orders on Disaster 2010

The 'Standing Orders on Disaster, 2010' is a substantial improvement over the previous edition (English 1999). New features introduced in this edition include, among others, the following: i) an outline of disaster management regulative framework, ii) an introduction of core groups for emergency response at various levels, iii) multi-agency disaster incident management system, iv) risk reduction roles and responsibilities for all committees and agencies, v) new outlines for local level plans, vi) revised storm warning signals, vii) a report on cyclone shelter design. Conceptually, this edition follows a comprehensive approach emphasizing risk reduction as well as emergency responses relating to all hazards and all sectors.

The Standing Order is designed to enhance capacity at all tiers of government administrative and social structures for coping with and recovering from disasters. Provision of emergency water, food and sanitation and shelter space for livestock during such periods should also be considered for future construction of shelters.

The Standing Orders on Disaster (SOD) specifically focuses on community vulnerability and capacity development of the community to adapt disaster (cyclone, tidal surge, tsunami, earthquake, tornado, flood, water logging, salinity, high tide, cold wave) resistant features like disaster resistant agriculture and other livelihood options. The SOD also delineates the activity of different administration at pre, during and post disaster period.

i. National Conservation Strategy 1992 (updated 2013)

The National Conservation Strategy (NCS) was prepared in recognition of Bangladesh's natural resource conservation commitments under several international treaties, conventions and its own constitution. It provides specific strategies and actions for conservation and sustainable development in 18 areas including human resources, land resources, water resources, forests, biodiversity, fisheries resources, livestock, crop agriculture, urbanization, health and sanitation, industry, energy and minerals, rural development, transport and communications, disasters and disaster management, environmental awareness and education, gender issues, and environment and international obligations. By adopting the NCS, the government hopes not only to reinforce its national and international commitments for conservation of resources and sustainable development but also to strengthen the economy for today and the future. While the NCS provides for coordinated conservation of natural resources, it does not explicitly address issues of biodiversity conservation. National Biodiversity Strategy and Action Plan aims to address these gaps whilst being fully consistent with the measures identified in the NCS.

j. National Biodiversity Strategy & Action Plan (NBSAP) 2007

As a Contracting Party to the Convention on Biological Diversity (CBD), Bangladesh is committed to initiating and implementing conservation and sustainable management of its national biological diversity according to the CBD principles for the sustenance of her present as well as future generations. The NBSAP document embodies Bangladesh's strategic approach to conserving the nation's biological diversity as well as the action plan for fulfilling our obligations as a signatory to the CBD. The NBSAP is a national framework for initiating and executing activities leading to the conservation and sustainable use of biodiversity, and establishing mechanisms to ensure equitable sharing of the benefits derived from such activities. A major focus of the plan is to ensure cross-sectoral linkages, reflecting the fact that in Bangladesh, more so than most other countries, biodiversity conservation is closely inter-woven with social and economic development. The implementation of the strategy is based on partnerships and

coalitions between specialized government organizations, NGOs, conservation partners, the private sector, academia and other exponents of the civil society.

The major objectives of the NBSAP are to:

- conserve, and restore the biodiversity of the country for well-being of the present and future generations;
- ensure that long-term food, water, health and nutritional securities of the people are met through conservation of biological diversity;
- maintain and to improve environmental stability for ecosystems;
- ensure preservation of the unique biological heritage of the nation for the benefit of the present and future generations;
- guarantee the safe passage and conservation of globally endangered migratory species, especially birds and mammals in the country; and
- stop introduction of invasive alien species, genetically modified organisms and living modified organisms.

k. National Adaptation Program of Action (NAPA)

The Government of the Bangladesh has recognized climate change as an important issue and attempts were being made to incorporate potential response measures for reducing impacts of climate change into overall development planning process. It was recognized that the adverse impacts of climate change in an already vulnerable country such as Bangladesh will put additional stress on overall development of the country.

The Ministry of Environment and Forest (MOEF), Government of the People's Republic of Bangladesh has prepared the National Adaptation Program of Action (NAPA) for Bangladesh in 2005, as a response to the decision of the Seventh Session of the Conference of the Parties (CoP) of the United Nations Framework Convention on Climate Change (UNFCCC).

The basic approach to NAPA preparation was along with the sustainable development goals and objectives of the country where it has recognized necessity of addressing climate change & environmental issue and natural resource management with the participation of stakeholders. The NAPA is the beginning of a long journey to address adverse impacts of climate change including variability and extreme events and to promote sustainable development of the country. There are 15 adaptation strategies have been suggested for Bangladesh to address adverse effects of climate change including variability and extreme events based on existing coping mechanisms and practices. The suggested future adaptation strategies are:

- Reduction of climate change hazards through coastal forestation with community participation.
- Providing drinking water to coastal communities to combat enhanced salinity due to sea level rise.
- Capacity building for integrating climate change in planning, designing of infrastructure, conflict management and land-water zoning for water management institutions.
- Climate change and adaptation information dissemination to vulnerable community for emergency preparedness measures and awareness raising on enhanced climatic disasters.
- Construction of flood shelter, and information and assistance center to cope with enhanced recurrent floods in major flood plains.

- Mainstreaming adaptation to climate change into policies and program s in different sectors (focusing on disaster management, water, agriculture, health and industry).
- Inclusion of climate change issues in curriculum at secondary and tertiary educational institution.
- Enhancing resilience of urban infrastructure and industries to impacts of climate change.
- Development of eco-specific adaptive knowledge (including indigenous knowledge) on adaptation to climate variability to enhance adaptive capacity for future climate change.
- Promotion of research on drought, flood and saline tolerant varieties of crops to facilitate adaptation in future.
- Promoting adaptation to coastal crop agriculture to combat increased salinity.
- Adaptation to agriculture systems in areas prone to enhanced flash flooding in North East and Central Region.
- Adaptation to fisheries in areas prone to enhanced flooding in North East and Central Region through adaptive and diversified fish culture practices.
- Promoting adaptation to coastal fisheries through culture of salt tolerant fish special in coastal areas of Bangladesh.
- Exploring options for insurance and other emergency preparedness measures to cope with enhanced climatic disasters.

l. National Fisheries Policy 1996

The National Fisheries Policy recognizes that fish production has declined due to environmental imbalances, adverse environmental impact and improper implementation of fish culture and management programs. However, fish is the principal source of animal protein in our food. The Policy (1998) aims to:

- Enhance the fisheries production,
- Poverty alleviation through creating self-employment and improvement of socio-economic conditions of the fishers,
- Fulfill the demand for animal protein,
- Achieve economic growth through earning foreign currency by exporting fish and fisheries products,
- Maintain ecological balance, conserve biodiversity, ensure public health, and provide recreational facilities,
- Maintain biodiversity in all natural water bodies and in marine environment,
- Conserve fish habitats from damage through the implementation of all development activities,
- Prevent damage of mangrove forest in the coastal region against fish culture,
- Protect environment from using harmful chemicals used in fish farms,
- Use environment friendly fish culture technology, and
- Conserve breeding ground of fish and fresh water giant prawn.

m. Bangladesh Wildlife (Conservation & Security) Act 2012

(Previously known as Bangladesh Wildlife [Preservation] Order, 1973; Amended as Bangladesh Wildlife [Preservation] Act 1974)

The Bangladesh Wildlife (Preservation) Order, 1973 & Wildlife (Preservation) (Amendment) Act, 1974 have been revamped to Wildlife (Conservation & Safety) Act of 2012. The Act is an improved version taking into consideration of current development issues and management tools. The Act has adopted 10 (ten) new types of protected areas for conservation and

protection of wildlife resources, created avenue for community conserved areas and also community based management of protected areas. The Act has included revised schedule of protected wildlife and has included many species that were previously not listed as protected wildlife such as Gangetic dolphins and smooth-coated otters in the rivers.

This Act proposed 1 (one) year imprisonment and Taka 50,000 fine for violation of law. The law also proposed at least 2 (two) years and highest 7 (seven) years imprisonment and minimum Taka 1 (one) Lakh and maximum Taka 10 (ten) Lakh fine for killing a tiger or elephant.

n. Bangladesh National Building Code 2006

The basic purpose of this code is to establish minimum standards for design, construction, quality of materials, use and occupancy, location and maintenance of all buildings within Bangladesh in order to safeguard, within achievable limits, life, limb, health, property and public welfare. The installation and use of certain equipment, services and appurtenances related, connected or attached to such buildings are also regulated herein to achieve the same purpose.

Part-7, Chapter-3 of the Code has clarified the issue of safety of workmen during construction and with relation to this, set out the details about the different safety tools of specified standard. In relation with the health hazards of the workers during construction, this chapter describes the nature of the different health hazards that normally occur in the site during construction and at the same time specifies the specific measures to be taken to prevent such health hazards. According to this chapter, exhaust ventilation, use of protective devices, medical checkups etc. are the measures to be taken by the particular employer to ensure a healthy workplace for the workers.

Section 1.4.1 of chapter-1, part-7 of the BNBC, states the general duties of the employer to the public as well as workers. According to this section, “All equipment and safeguards required for the construction work such as temporary stair, ladder, ramp, scaffold, hoist, run way, barricade, chute, lift etc. shall be substantially constructed and erected so as not to create any unsafe situation for the workmen using them or the workmen and general public passing under, on or near them”.

Part-7, Chapter -1 of the Bangladesh National Building Code (BNBC) clearly sets out the constructional responsibilities according to which the relevant authority of a particular construction site shall adopt some precautionary measures to ensure the safety of the workmen. According to section 1.2.1 of chapter 1 of part 7; “in a construction or demolition work, the terms of contract between the owner and the contractor and between a consultant and the owner shall be clearly defined and put in writing”. These however will not absolve the owner from any of his responsibilities under the various provisions of this Code and other applicable regulations and bye-laws. The terms of contract between the owner and the contractor will determine the responsibilities and liabilities of either party in the concerned matters, within the provisions of the relevant Acts and Codes (e.g.) the Employers' Liability Act, 1938, the Factories Act 1965, the Fatal Accident Act, 1955 and Workmen's Compensation Act 1923”. (After the introduction of the Bangladesh Labor Act, 2006, these Acts have been repealed).

To prevent workers falling from heights, the Code in section 3.7.1 to 3.7.6 of chapter 3 of part 7 sets out the detailed requirements on the formation and use of scaffolding. According to section 3.9.2 of the same chapter, “every temporary floor openings shall either have railing of at least 900 mm height or shall be constantly attended. Every floor hole shall be guarded by either a

railing with toe board or a hinged cover. Alternatively, the hole may be constantly attended or protected by a removable railing. Every stairway floor opening shall be guarded by railing at least 900 mm high on the exposed sides except at entrance to stairway. Every ladder way floor opening or platform shall be guarded by a guard railing with toe board except at entrance to opening. Every open sided floor or platform 1.2 meters or more above adjacent ground level shall be guarded by a railing on all open sides except where there is entrance to ramp, stairway or fixed ladder. The precautions shall also be taken near the open edges of the floors and the roofs".

3.3 International Legislations

Bangladesh is concerned about the existing international rules and regulations for the assessment, protection, and control of environment due to the impacts arising from the development works. In this regards Bangladesh has already become a part, and/or going to be a part, for several international conventions, treaties, and protocols (ICTPs) developed for environmental safety. Therefore, Bangladesh is committed to ensure that these international conventions, treaties, and protocols are complied with during all development work. The applicable ICTPs are summarized in this section below.

a. Rio Declaration (Environment and Development) 1992

The 1992 United Nations Conference on Environment and Development (UNCED) adopted the global action program for sustainable development called 'Rio Declaration' and 'Agenda 21'.

The United Nations Conference on Environment and Development was held at Rio de Janeiro from 3 to 14 June 1992, which reaffirmed the Declaration of the United Nations Conference on the Human Environment, adopted at Stockholm on 16 June 1972. The goal was to establish a new and equitable global partnership through the creation of new levels of cooperation among states, key sectors of societies, and people. In addition, it aimed to work towards international agreements which respect the interests of all and protect the integrity of the global environmental and developmental system.

Principle 4 of the Rio Declaration, 1992, to which Bangladesh is a signatory along with a total of 178 countries, states, "In order to achieve sustainable development, environmental protection should constitute an integral part of the development process and cannot be considered in isolation from it". According to Principle7 Bangladesh shall co-operate in a spirit of global partnership to conserve, protect and restore the health and integrity of the Earth's ecosystem. Moreover, Principle17 states that Environmental Impact Assessment (EIA) shall be undertaken for any proposed development activities that are likely to have a significant adverse impact on the environment and are subjected to a decision of a competent authority of Bangladesh.

b. Convention on Biological Diversity (Rio de Janeiro) 1992

The Convention on Biological Diversity was adopted at Rio de Janeiro on 5 June 1992and entered into force on 29 December, 1993. This convention sets out commitments for maintaining the world's ecological underpinnings during any development activities. Under the Convention, all the participating governments undertake actions to conserve biodiversity and sustainably use natural resources. In addition, governments require to develop national biodiversity strategies and action plans, and to integrate these into broader national plans for environment and development. It established an advance informed agreement procedure for ensuring that

countries are provided with the information necessary to make informed decisions before agreeing to the import of such organisms into their territory. Bangladesh has signed and ratified the Convention on 05 June 1992 and 20March 1994 respectively. As a Contracting Parties of the Convention Bangladesh has committed to the following issues:

- Environmental Impact Assessment (EIA) must be introduced to any proposed development projects that are likely to have significant adverse effects on biodiversity, with a view to avoiding or minimizing such effects, and where applicable allow for public participation in such procedures; and

- Appropriate arrangements must be introduce to ensure that environmental consequences of its programs and policies, that are likely to have significant adverse impacts on biodiversity, are duly taken into account,

- It is obligatory to Bangladesh as a contracting party to provide environmental impact assessments of projects that are likely to have significant adverse effects on biological diversity (art. 4).

c. UNESCO World Heritage Convention

The United Nations Educational, Scientific, and Cultural Organization (UNESCO) Convention Concerning the Protection of the World Cultural and Natural Heritage (the World Heritage Convention)was entered into force in 1975. Total 187 countries, including the United States, are party to the Convention. Bangladesh is also a member of the Convention. This convention identifies and helps protect international sites of such exceptional ecological, scientific, or cultural importance that their preservation is considered a global responsibility.

Under the Convention, participating countries nominate sites to be included on the World Heritage List and the List of World Heritage in Danger (Danger List).Countries that are party to the Convention agree to protect listed sites within their borders and refrain from actions that might harm such sites in other countries. Currently, the World Heritage List is composed of 936 natural and cultural sites in 153 countries, and the Danger List includes 35 sites from 28 countries. These are the 'Jewels in the Crown' of conservation.

The World Heritage Site in Bangladesh includes the Sundarbans. The proposed project should be carried out in such a manner that the multilateral cultural &environmental agreements may not be violated and may not cause adverse impact on the natural resources. In fact, there is minor chance to cause adverse impact on Cultural and Natural Heritage from the proposed project.

d. Convention Concerning the Protection of the World Cultural and Natural Heritage (Paris 1972)

Convention concerning the Protection of the World Cultural and Natural Heritage was held at Paris in 1972. This convection has been ratified by 175 states. This defines and conserves the world's heritage by drawing up a list of natural and cultural sites whose outstanding values should be preserved for all humanity. Of the 730 total sites, there are currently 144 natural, 23 mixed and 563 cultural sites that have been inscribed on the World Heritage List (distributed in 125 State parties). These are the 'Jewels in the Crown' of conservation. Bangladesh has accepted and ratified the convention on 03.08.1983 and 03.11.83 respectively. As per provision

of the convention it is obligatory for Bangladesh to prevent of damage or destruction of culturally and/or historically significant sites, monuments, etc.

e. International Plant Protection Convention (IPPC) 1951

This convention was arranged at Rome in 1951. Bangladesh has ratified this convention. Under the convention, Bangladesh has to secure actions to prevent the introduction of plants pests from Project work or construction materials and to promote appropriate measures for their control. It is governed by the Commission on Phyto-sanitary measures which adopts international standards of this measure.

f. Plant Protection Agreement for the South East Asia and Pacific Region 1956

Bangladesh has ratified this agreement as an international member. The aim of the agreement is to prevent the introduction into, and spread within the region of, destructive plant diseases and plant pests from the project work or construction materials.

g. Convention on International Trade of Endangered Species of Wild Fauna and Flora (CITES) 1973

Bangladesh has also ratified this Convention. It provides guidance for international cooperation for the protection of certain species of wild fauna and flora against over-exploitation through international trade.

h. UN Framework Convention on Climate Change 1992

United Nations Framework Convention on Climate Change (UNFCCC) was adopted in 1992 and Bangladesh has also ratified this convention. The main attempt of the convention is to address global warming occurring as a result of human-induced climate change. Its ultimate objective is to stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Countries ratifying the Kyoto Protocol to the UNFCCC (1997) have been committed to reduce their emissions of carbon dioxide and five other greenhouse gases, and/or to engage in emissions trading if maintain or increase emissions of these gases. Parties under UNFCCC should also adopt national climate change mitigation programs and adaptation strategies.

Bangladesh has been recognized asthe most significant vulnerable country to climate change in the UNFCCC 1997. Therefore, a Climate Change Cell (CCC) has been established within the DOE, GOB as a part of the Government's Comprehensive Disaster Management Program. Its objective is to enable the management of long term climate risks and uncertainties as an integral part of national development planning. Where possible the management of Ecologically Critical Area (ECAs) should be in accordance with any policy developed as a part of the work of the Climate Change Cell. The National Adaptation Program of Action (NAPA) addresses immediate climate change adaptation needs and incorporation of climate change issues in all development projects.

i. Ramsar Convention (Convention on Wetlands of International Importance especially as Waterfowl Habitat) 1971

The Convention on Wetlands of International Importance especially as Waterfowl Habitat was adopted at Ramsar in Iran on 2 February 1971 which is known as Ramsar Convention. Bangladesh has ratified the Convention on 20 April, 2002. There are 127 Parties with 1085 wetland sites designated as Wetlands of International Importance. This is an intergovernmental treaty which provides direction for the conservation and wise use of all wetlands and wetland habitats through local, regional, and national actions and international cooperation. The Convention includes marine wetlands (wetlands up to a depth of six meters at low tide), islands, lakes and rivers.

The signatory states made a commitment to reverse the loss and degradation of wetland habitats and to prevent filling of wetland and its drainage during construction. It is obligatory for Contracting Parties is that the designation of wetlands to the "List of Wetlands of International Importance", the provision of wetland considerations within their national land use planning, and the creation of Natural Reserves must be conducted. Parts of the Sundarbans Reserved Forest (Southwest of Bangladesh) are one of the Ramsar Sites.

j. Convention on Persistent Organic Pollutants (Stockholm) 2001

The Convention on Persistent Organic Pollutants was held at Stockholm, Sweden in 2001. Bangladesh has signed the treaty on 23 May 2001 and is in the process of ratifying this treaty. It is a global treaty to protect human health and the environment from Persistent Organic Pollutants (POPs). In the implementation of the Convention, Bangladesh Government should take measures to eliminate or reduce the release of POPs into the environment. Bangladesh has obligation to use limited pesticides and herbicides.

k. JICA Guidelines

According to JICA Guidelines for Environmental and Social Considerations (2010), JICA classifies projects into four categories (A, B, C, or FI) according to the extent of environmental and social impacts, taking into account an outline of project, scale, site condition, etc.Categories are as follows:

Category A: Proposed projects are classified as category A if it is likely to have significant adverse impacts on the environment and society. Projects with complicated or unprecedented that are difficult to assess, or projects with a wide range of impacts or irreversible impacts, are also classified as Category A. These impacts may affect an area broader than the sites or facilities subject to physical construction. Category A, in principle, includes projects in sensitive sectors, projects that have characteristics that are liable to cause adverse and long-lasting environmental impacts; Projects are likely to be located in or near sensitive areas. An EIA, including an EMP, is required for all projects falling under Category A.

Category B: Proposed projects are classified as category B, if their potential adverse impacts on the environment and society are less adverse than those of Category A projects. Generally, they are site-specific; few if any are irreversible; and in most cases, normal mitigation measures can be designed more readily. An initial environmental examination (IEE), including an EMP, is required.

Category C: Proposed projects are classified as category C if they are likely to have minimal or little adverse impacts on the environment and society. An EIA or IEE is not required, although environmental implications need to be reviewed.

Category FI: Proposed projects are classified as category FI if they involve the investment of JICA funds to, or through, a financial intermediary.

The Guidelines for Environmental and Social Considerations (JICA 2010) define the overarching framework for environmental management on the project. In those Guidelines, JICA sets out the international imperative for environmental management and social equity as applied to technical cooperation, loan and grant aid projects; and formulation and adoption of guidelines via committee and public consensus, in keeping with those of other multilateral and bilateral development agencies. JICA‟s policy is set out in the Guidelines: to "take steps to assure fairness," to attend "to factors such as environmental and social impacts on developing countries," and "inclusion of environmental and social costs in development costs. . . [by means of a] . . . social and institutional framework" that ensures "stakeholder participation, information transparency, accountability, and efficiency."

JICA guidelines support environmental impact assessment (EIA) that incorporates social assessment on apart with environmental assessment. JICA identifies seven principles to guide the assessment process:

- A wide range of impacts must be addressed;
- Measures for environmental and social considerations must be implemented from a planning stage to a monitoring stage;
- JICA is responsible for accountability when implementing cooperation projects;
- JICA asks stakeholders for their participation;
- JICA discloses information;
- JICA enhances organizational capacity; and
- JICA makes serious attempts at promptness.

JICA confirms an approach consistent with "the laws or standards related to the environment and local communities in the central and local governments of host countries" and "that projects do not deviate significantly from the World Bank's Safeguard Policies." JICA categorizes projects in a way that does not materially differ from the methods of other international and national agencies. Category A projects are those that, among other criteria, are found in sensitive sectors, which includes (Appendix 3) "roads, railways, and bridges."

JICA lists a number of environmental considerations to be assessed through EIA, with additional emphasis on "Social impacts, including migration of population and involuntary resettlement, local economy such as employment an livelihood, utilization of land and local resources, social institutions such as social capital and local decision-making institutions, existing social infrastructures and services, vulnerable social groups such as poor and indigenous peoples, equality of benefits and losses and equality in the development process, gender, children rights, cultural heritage, local conflicts of interest, infectious diseases such as HIV/AIDS, and working conditions including occupational safety."

Degrees of uncertainty and absences of information are taken into consideration in the JICA Guidelines. JICA recognizes the integrated role of EIA in the process of project development through preparatory survey, project formulation, classification and disclosure. Details of requirements for consideration in the EIA are provided in Appendix 1 of the Guidelines, including "multiple alternatives . . . examined in order to avoid or minimize adverse impacts," "appropriate follow-up plans and systems, such as monitoring plans and environmental management plans . . . prepared," "impacts on human health and safety, as well as on the natural environment," and "derivative, secondary, and cumulative impacts."

Further, "Projects must be adequately coordinated so that they are accepted in a manner that is socially appropriate to the country and locality in which they are planned. For projects with a

potentially large environmental impact, sufficient consultations with local stakeholders, suchas local residents, must be conducted via disclosure of information at an early stage, at whichtime alternatives for project plans may be examined. The outcome of such consultations mustbe incorporated into the contents of project plans."

And "Appropriate consideration must be given to vulnerable social groups, such as women, children, the elderly, the poor and ethnic minorities . . ."

Monitoring is a key feature of the Guidelines and JICA sets out that "after projects begin, project proponents, etc. monitor whether any unforeseeable situations occur and whether the performance and effectiveness of mitigation measures are consistent with the assessments prediction. They then take appropriate measures based on the results of such monitoring."

The content and main elements for EIA Reports are provided in Appendix 2 of the Guidelines, which are consistent with the World Bank Operational Policy - OP 4.01, AnnexB. The JICA Guidelines are comprehensive and practical; this cursory review does not cover all aspects. Further details on the JICA Guidelines can be obtained by consulting the Guidelines themselves.

I. International Civil Aviation Organization Standards Recommended Practices (ICAO)

The first convention on International Commission for Air Navigation (ICAN) was held in 1903 in Berlin and participating 8 (eight) countries did not sign any formal agreement. The second and third conventions were arranged in Berlin (1906) and London (1912), respectively. Afterward, the Provisional International Civil Aviation Organization (PICAO) was established in August 1945 and was operated till April 1947. International Civil Aviation Organization (ICAO) became permanent in 1947 and the headquarters has been located in the Quartier International of Montreal, Quebec, Canada. At present 191 contracting States are the members of ICAO which is one of the most successful International agencies of United Nations. Bangladesh has ratified the Chicago treaty on 22nd December in 1972 and has become a member state of the ICAO.

The strategic objectives of this organization include safety, security, environmental protection, and sustainable development of air transport. Now a days, ICAO has been taking grate care into the environmental issues such as Carbon emission and Noise pollution. Carbon emission from aviation sector over the world, currently, is considered as one of the most important environmental protection issues.

The council of ICAO has implemented some standards and recommended practices concerning environmental issues and aspects. Annex 16 of ICAO Standards and Recommended Practices, fifth edition published in 2008, retiled as "Environmental Protection" in which volume I contains Aircraft Noise standards and volume II contains the provisions related to Aircraft Engine Emission. The Standards and Recommended Practices for Aircraft Noise were first adapted by the Council on 2 April 1971 pursuant to the provisions of the Article of the Convention of International Civil Aviation (Chicago, 1944) and designated as Annex 16 to the Convention.

Volume I of Annex 16 contains Aircraft noise certification process, Evaluation method for noise certification, Noise measurement process for monitoring purposes, Assessment of airport noise, and balanced approach to noise management. The aircrafts such as Sub-sonic jet aeroplane, Propeller-driven aeroplane, Propeller-driven STOL (short take-off and landing) aeroplane, Helicopter, and Supersonic aeroplane are considered and handled in this standard.

The Aircraft should have noise certification from the state of registry of an aircraft on the basis of requirements of the standards specified in the Annex 16-Volume-I according to Provision 1.2 to 1.11 of Chapter 1 of Part II. This document has also recommended the ranges of aircraft noise level at different measurement points. The maximum and minimum noise level varies depending on the noise measurement points which have been summarized in Table 1. The sum of the differences, at all measurement points, between the maximum noise levels and maximum permitted noise level shall not be less than 10 EPNdB (Effective Prescribed Noise Level) as mentioned in section 4.4.1.1 in Annex 16, Volume I.

Table 3-1 Noise level variation of aircrafts at different noise measurement points

Aircrafts	Noise measurement points	maximum noise (EPNdB)	minimum noise (EPNdB)	Reference in Annex 16-Volume I
Subsonic & Propeller aeroplane	(1) At lateral full-power reference point	103	94	3.4.1.1, Page-II-3-3
	(2a) At flyover reference point (2 engines or less)	101	89	3.4.1.2 (a), Page-II-3-3
	(2b) At flyover reference point (3 engines)	104	-	3.4.1.2 (b), Page-II-3-3
	(2c) At flyover reference point (4 engines or more)	106	-	3.4.1.2 (c), Page-II-3-3
	(3) At approach reference point (2 engines or less)	105	98	3.4.1.3, Page-II-3-3
Helicopter	(1) For take-off	109	89	8.4.1.1, Page-II-8-2
	(2) For over-flight	108	88	8.4.1.2, Page- II-8-2
	(3) For approach	110	90	8.4.1.3, Page- II-8-2
Supersonic	Not yet developed but can be used Standards ofSubsonic & Propeller Aeroplane			12.2, Page-II-12-1

Note: EPN, dB (Effective Prescribed Noise Level)

Annex 16-Volume I (Page-V-1) has also demonstrated balanced approach to noise management which consists of identifying noise problem at airport and analyzing existing methods to reduce noise through the four principal elements such as (a) reduction at source, (b) land-use planning and management, (c) noise abatement operational procedures, and (d) operating restrictions with the most cost effective manner.

Besides, the provisions related to emission of aircraft engine have been noticed in Annex 16-Volume II. The ICAO has been working for reducing CO_2 emission by half between 2005 and 2050. The number of increasing aircrafts making continuous carbon emission; which giving very significant environmental effect around the airports and the world.

Carbon emission and noise pollution from aircraft also exist in Bangladesh through aviation activities. Thus, as a contracting party Bangladesh has obligation to take immediate precautionary measures as same as other parties. However, Bangladesh has introduced Civil Aviation Authority Ordinance 1985 in accordance with the context of ICAO Standards and Recommended Practices. But Carbon emission and noise pollution issues have not been yet included in this Ordinance. As a contracting States, in the event of impossibility of compliance, Bangladesh is bound to notify to the ICAO Council under Article 38 of the Convention. However, interpretation of Standards and Recommended Practices depend on the legal system of the country.

4. ENVIRONMENTAL BASELINE DATA

4.1 Project Data Sheet

a. Type, Category and Need

This is a project which has been planned to facilitate and expand the existing infrastructures in the premises of Hazrat Shahjalal International Airport at Dhaka in Bangladesh. As explained above this project has been classified by Department of Environment, Government of Bangladesh according to ECR 1997 as “Red Category” it is expected to have major negative environmental impacts. Under Rule 7 of ECR 1997 procedures such developments require an IEE to identify and mitigate the impacts, and to determine whether further study or a more detailed EIA may be required along with EMP.

This infrastructural development project is needed at Hazrat Shahjalal International Airport because of lack of existing facilities. However, air traffic flow in Bangladesh is rapidly increasing day by day. Existing infrastructure facilities of the airports in Bangladesh are not sufficient to meet the future air traffic demand of the country. Currently, the airport has a single runway and annual passenger handling capacity of only 8 million. The space of the Passenger Terminal Building is not enough to implement the modern five level security concepts. Besides, the Airport is not capable to handle new generation (Code F) Aircrafts like B747-8F, B777-300 ER etc.

b. Location, Size and Implementation Schedule

This infrastructural development project will be implemented on the land located within the boundary line of Hazrat Shahjalal International Airport acquired by the Civil Aviation Authority Bangladesh with financial support from Government of Bangladesh as well as from potential donor agency of JICA. Photographs of the proposed site are attached as **Annex 6**. Location Map of the project is shown in **Figure 4-1 and Figure 4-2**. It is located north of Dhaka city, in densely populated area, in a distance of approximately 15 km from the city center. National highway road (N3) from Dhaka to Mymensingh passes in the north-east side of the proposed site for implementation of the proposed project works.

Figure 4-1 Location Map of the Project (Red Bold Color)

Figure 4-2 Location of the Project (Red Bold Color)

The area of the Hazrat Shahjalal International Airport within the airport boundary is approximately **5 km^2 (500 ha)**. It has a single runway with two potential directions of approach. The ICAO defines runways by category, Cat I, II III, or "non-precision approach". In practice this is determined by the navaids at the airport and on the aircraft. Although some aspects of Hazrat Shahjalal's runway are in Cat II, most is in Cat I. For an international gateway airport, Cat II would be expected on at least one approach. This airport is linked by a 3 lane dual carriageway to the outskirts of the city. Terminal access has improved over recent years, most recently through privately operated multi-storey parking. Two new 5 star hotels with good access to Hazrat Shahjalal are in operation. A concession has recently been awarded for construction of 2 hotels, a country club and golf course on unused airport land [2]. Existing and proposed facilities of the HSIA have been shown in **Figure 4-3 and Figure 4-4.**

Figure 4-3 Existing (Gray Color) & Proposed (Green Color) Master Plan of HSIA

Figure 4-4 Photographical View of Existing Facilities of HSIA

Determining the facility requirements is the essential step in the airport master planning process. "Air Facility Requirements" is to determine the needs of the airport based on air traffic demand forecast. Based on the design traffic estimated, the requirements of the airport facilities will be calculated for the year 2015/ 2040. These requirements estimate will comply with relevant standards, recommended practices of International Civil Aviation Organization (ICAO) together with other standards or regulations. The assessment of facility requirements includes the following major elements:

- Airfield System Capacity, including Design Aircraft;
- Airside Facility Requirements;
- Landside Facility Requirements;
- Airline Terminal Requirements;
- Runway Facilities.
- Airport Access; and
- Support Facilities

The master plan of the Hazrat Shahjalal International Airport has been shown in **Figure 4-5,** although it has to be modified after the revision of scope as per latest plan. The 3-Dimensional VVIP Terminal has been given in **Figure 4-6,** Terminal-3 in **Figure 4-7,** Domestic Terminal in **Figure 4-8,** Cargo section in **Figure 4-9** and Drainage Plan in **Figure 4-10**. The design period of was from the beginning of July 2014 to the end of June 2015.

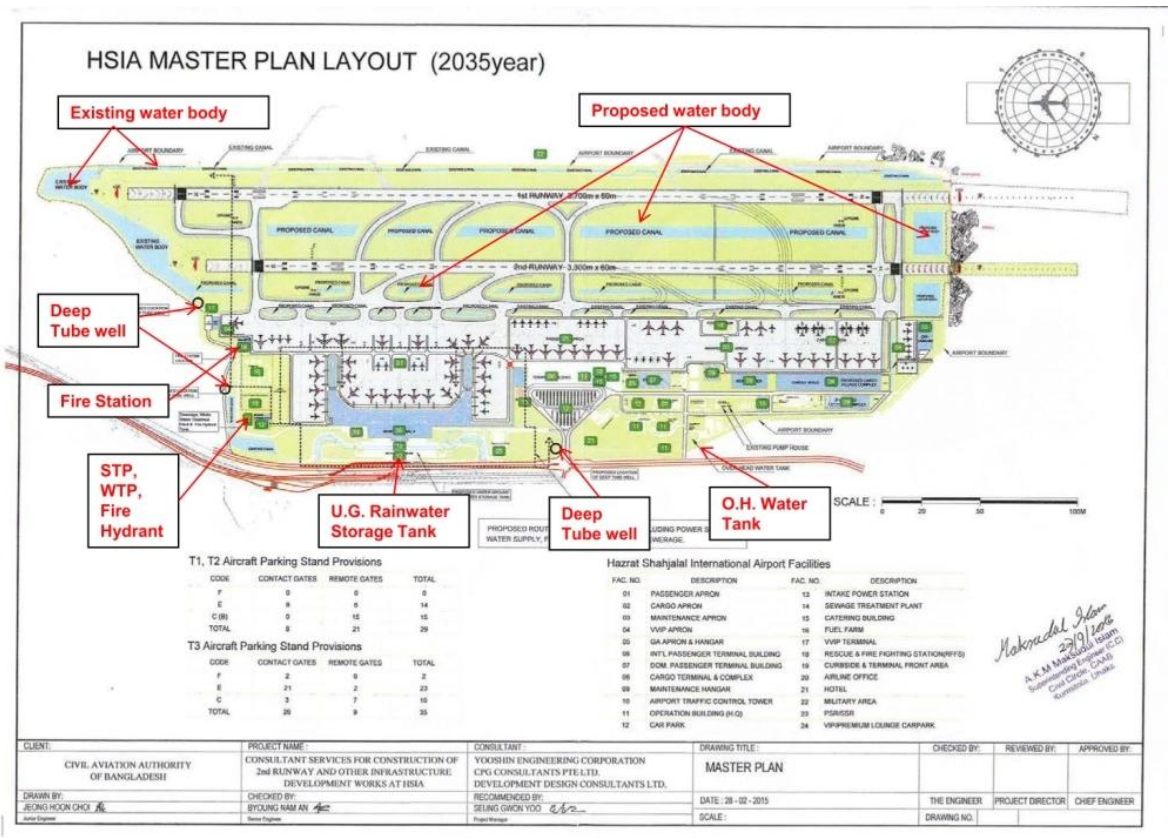


Figure 4-5 Master Plan of HSIA

Figure 4-6 Three-dimensional View of VVIP Terminal

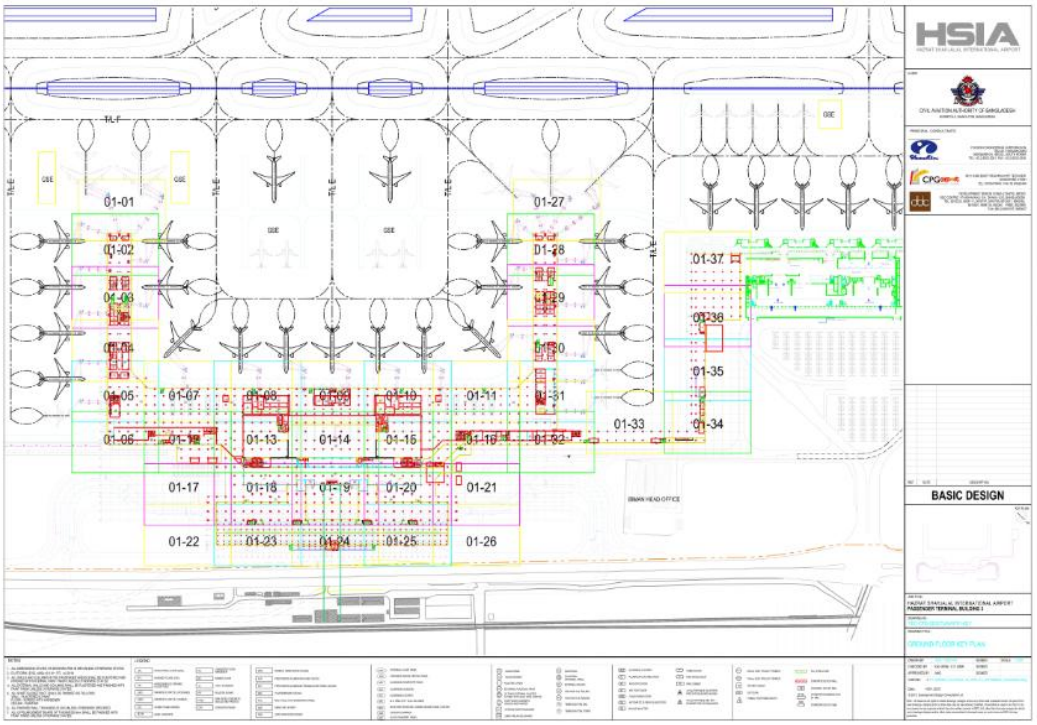


Figure 4-7 Terminal-3 Ground Floor Plan

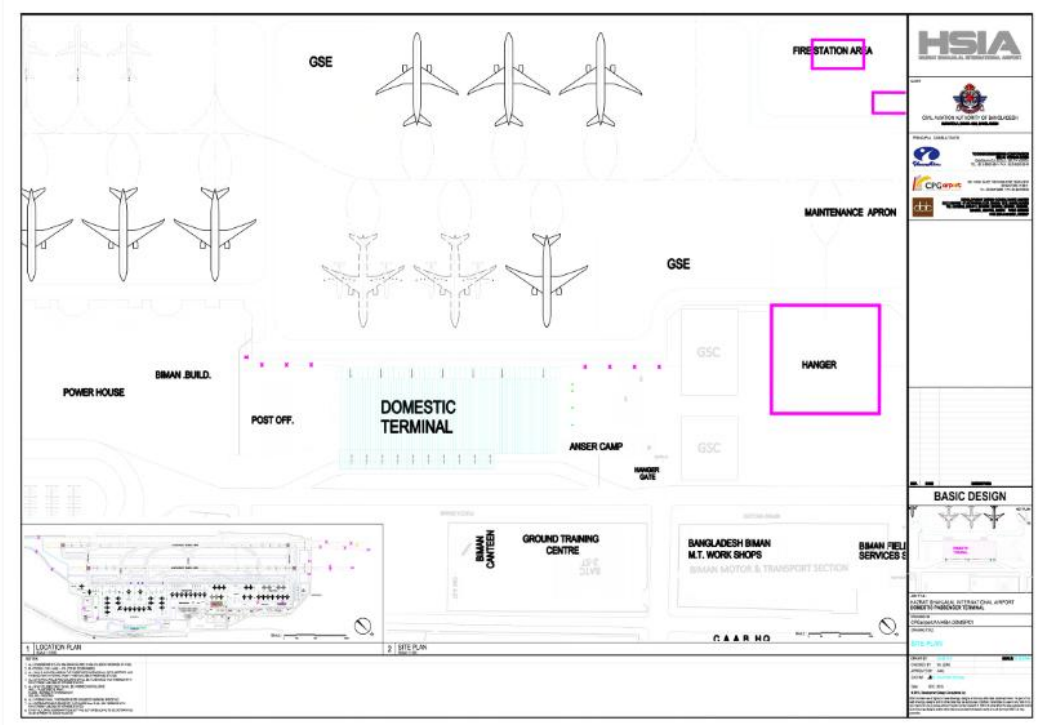


Figure 4-8 Domestic Terminal

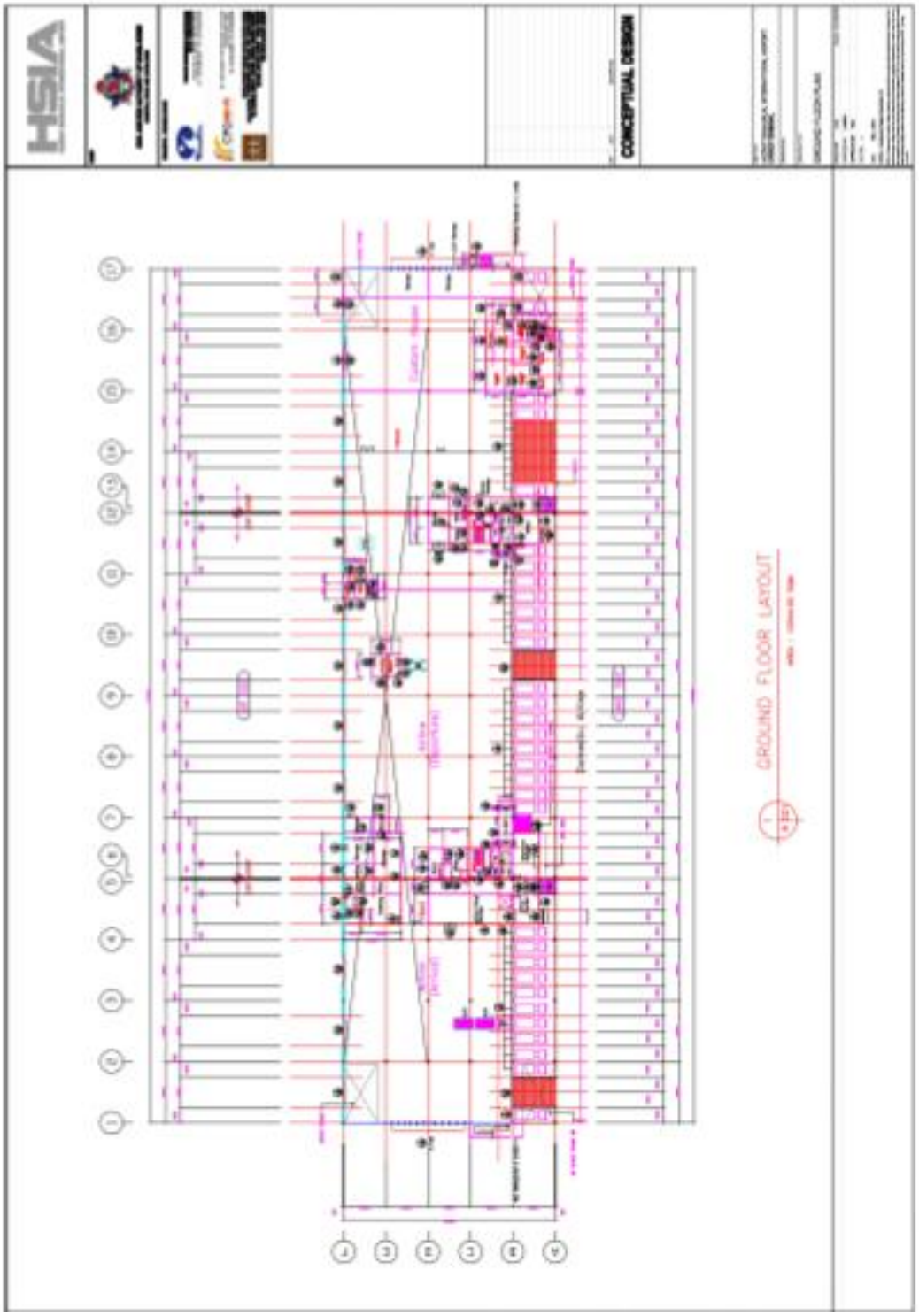


Figure 4-9 Cargo Terminal

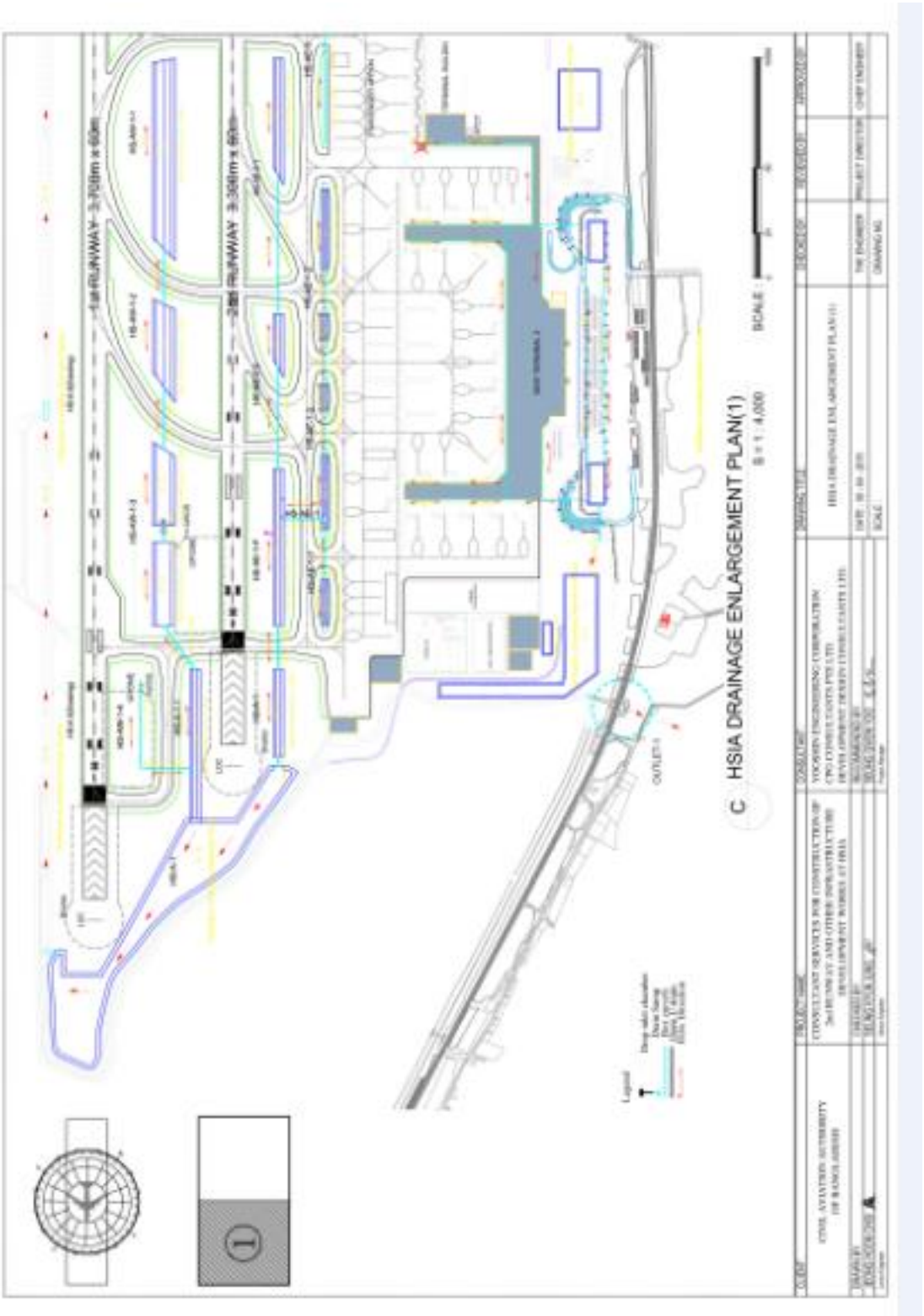


Figure 4-10 Drainage Plan for HSIA

c. Scope of Works and Services under the JICA Project

The scope of works of the project has been divided into two phases – Phase 1 and 2. First the Phase 1 will be completed with JICA funding and then the works of Phase 2 will be started to ensure smooth running of the activities in the airport without any interruption of services.

The Scope of JICA Project and its layout is shown in Figure 4-11.

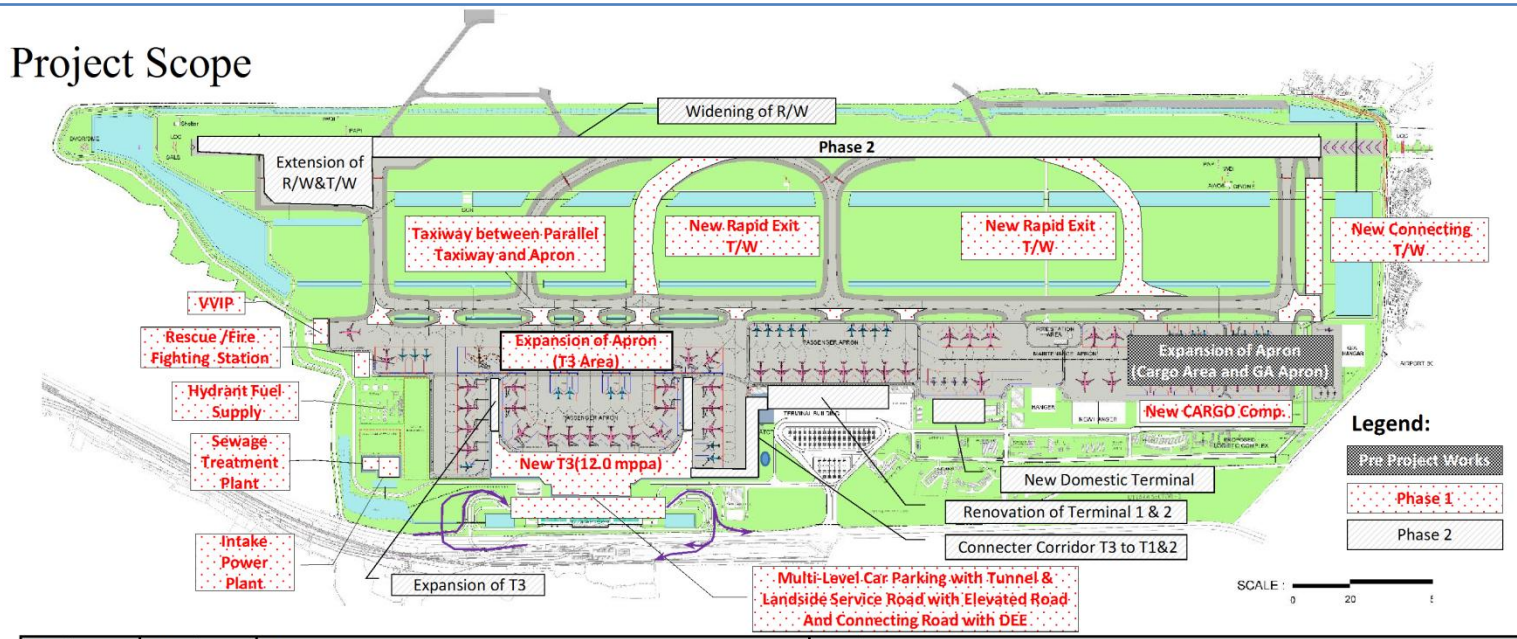
Building works in Phase 1 will include New Passenger Terminal Building 3, which will be a 3 story building with area of approximately 220 thousand m^2 including supply of related equipment. The capacity of this terminal will be 12 million passengers per annum (mppa). It will also include Multi-Level Car Parking with tunnel& landside service road and connecting road with DEE (area approximately 62,000 m^2), New Cargo Complex (area approximately 41,000 m^2), VVIP Complex (area approximately 6,000 m^2) as well as the Rescue and Fire Fighting Facilities and Equipment.

Civil works in Phase 1 includes Parking Apron in front of Terminal 3 area having an area of 500,000 m^2, Taxiways (9 numbers connecting to the T3 apron: approx. 42,000m^2), Landside Service Road with Elevated Road and Connecting road with Dhaka Elevated Express way, Improvement of Drainage System, and Taxiways (two rapid exit and one connecting taxiway for the runway 14 threshold having an area an area of approximately 65,000 m^2.

Utility works in Phase 1 include water supply system, sewage treatment plant (approximately 3,000 m^2), Intake Power Plant with Distribution System (approximately 7,000 m^2), Hydrant fuel supply system, and security and terminal equipment.

On the other hand, the Phase 2 works will include:

- Widening of runway;
- Extension of runway and taxiway;
- Expansion of Terminal 3;
- Connector corridor from T3 to T1 and T2;
- Renovation of Terminal 1 and 2
- Construction of new Domestic Terminal



Package	Works	Division	Facilities
Phase 1	Building	New Passenger Terminal Building (Terminal 3)	3 story building with area of approx 220 thousand m^2 Including supply of related equipment /Capacity of 12.0 mppa
		Multi-Level Car Parking with Tunnel	The area of approx 62,000 m^2
		New Cargo Complex	The area of approx 41,000 m^2
		VVIP Complex	The area of approx 6,000 m^2
		Rescue and Fire Fighting Facilities and Equipment	
	Civil	Parking Apron (Terminal 3 Area)	Terminal 3 Area: approx 500,000m^2
		Taxiways	9 connecting taxiways connecting to the T3 apron: approx 42,000m^2
		Landside Service Road with Elevated Road and Connecting road with Dhaka Elevated Express way	
		Improvement of Drainage System	
		Taxiways (two rapid exit and one connecting taxiway for the runway 14 threshold)	Approx 65,000 m^2
	Utility	Water Supply System	
		Sewage Treatment Plant	The area of approx 3,000 m^2
		Intake Power Plant with Distribution System	The area of approx 7,000 m^2
		Hydrant Fuel Supply System	
		Communication System	
		Security and Terminal Equipment	

Figure 4-11 Scope of JICA Project

d. Analysis of Alternatives

i. Overview

JICA Environmental Guidelines of 2010 stipulates that the environmental investigation needs to consider feasible alternatives for the proposed development. The developer should be encouraged to consider alternatives that would meet the objective of the original proposal and which could have an acceptable impact on the environment. The role of alternatives in the EIA process is therefore to find the most effective way of meeting the need and purpose of the proposal, either through enhancing the environmental benefits of the proposed activity, and or through reducing or avoiding potentially significant negative impacts.

ii. Alternative Options

The term alternatives in this context refer to the reasonable and potentially viable alternatives for the proposed project activities. One of the alternatives that can be kept in view is of no action alternative also. From the environment point of view is considered with different alternatives analysis keeping in view the environmental and socio-economic issues. The design team analyzed different construction methods in different ways for finalizing through alternative analysis to be selected the suitable one. For the proposed project the following alternatives have been considered:

Plan0 - Do nothing - From a purely physical and environmental point of view, the "do nothing" approach is preferable to any project implementation since it would avoid creation of any of the adverse impacts associated with a new development. The "without project" alternative is not acceptable since this will strongly reduce the potential for socioeconomic development of the country. Despite having great potential, the industrial and tourist growth is retarded mainly due to absence of safe and reliable communication facility.

The airport is handling about 7 million passengers at present which is expected to progressively increase every year and may reach to 15 million in the year 2030. That will be accompanied by arrival of newer international aircrafts. More and more airport service amenities will be needed. This presents the potential of unprecedented national economic growth. Thus, 'no project plan' is not acceptable because it prohibits future growth potential.

Plan1 – Both the 2nd runway and new terminal building- Constructing the 2nd runway and widening of the existing one will increase the capacity of the airport in landing and take-off only without increasing the capacity of passenger handling. So new terminal building is also necessary. It is analyzed and investigated that not enough land for 2nd run way is available outside of the airport. In Master Plan, it was proposed to build a runway within the airport area, but it will increase capacity by only 50% with large investment. However, improvement of taxiway with less cost can increase capacity of existing runway. So, this option was dropped as a result of alternate analysis. Most import needs will be fulfilled first – this will give better return of investment.

Plan2 – 3rd terminal building only – Construction of 3rd terminal building will solve the problem of handling passengers. With the additional taxiways, the capacity of the current runway can be increase, thus all kinds of demand can be solved till 2030. So this is a complete solution of the problem. Terminal-3 will be implemented in the space of civil aviation area where all facilities like sewage line, water treatment plan will be from civil aviation. If it would be out of Civil Aviation area lands acquisition would have required.

Plan3 – Completely new airport in a different location – Construction of completely new airport in a different location could be an option. But it would take very long time (about 15-20 years) as well as huge resources. The social and environmental impacts also would be significant. So, considering the urgency of the situation, this alternative cannot be accepted.

Analysis: No project means there is no improvement; the capacity will fail within 2019. If Plan 0 is adopted, cargo as well as passenger capacity will fail. As this is the main airport of the country, it would create major negative impact.

- Existing run way current capacity approximately 170,000 movements per year and requirement in 2020 is 103,830. It is possible to meet the demand until 2030 with one run way by maximizing of capacity for one run way.
- Peak hour aircraft movements was 18 in 2015 and it will increase to 24 in 2020, therefore existing facilities have no problem.
  (*Ref: JICA Data collection survey of expansion of HSIA, 2016)*.

The Plan-0 will obstruct the economic development for graduating from Least Development Countries. The Plan-1 is able to meet the expected demand after 2030, but the benefit per cost is low. And the negative effect to environment and social is large. Plan-2 is able to meet the expected demand until 2030, the benefit per cost is high and the negative impact to socio environmental aspect is small. Therefore, the Plan-2 is selected for this project. For the Plan-3, the cost is high and the negative impact to socio environmental aspect is significant; and most importantly, time to develop is rather long, thus this plan cannot be considered for the time being. The detailed analysis of the above options is described in the **Table 4-1**.

Table 4-1 Comparison of Environmental and Social Aspects of each Alternative Option

Different Aspects	Plan-0	Plan-1	Plan-2	Plan-3
Outline of planning	Non installing new facility	Introducing 2nd runway and new terminal building (To meet the increase of passenger after 2030)	Introducing new terminal building (To meet the increase of passenger until 2030)	Constructing new airport on other site
Land use	No change of land use	Land acquisition around airport will be needed, so the land use will change	No change of land use	Land use will change significantly on the candidate site of new airport
Technology & Economy	This plan don't meet the increase of passenger, so the number of landing and takeoff will not be increased in future. Therefore, economic development will be obstructed.	The benefit of the 2nd runway is small because of locating close to existing runway. The number of landing & takeoff is not expected large rising up. The specific consideration and technology will be needed for construction of new runway near the existing one.	The plan-2 is able to meet the increase of passenger until 2030 by less investment than the Plan-1. This plan doesn't need specific construction technology.	The construction of new airport is needed huge investment. There will be possibility of technological issue of flooding in rainy season because of drainage conditions.
Environmental & Social consideration	The current socio-environmental condition will be maintained.	The land acquisition and involuntary resettlement will be needed around existing	The land acquisition and involuntary resettlement will not occur.	The huge land acquisition and involuntary resettlement will be

Different Aspects	Plan-0	Plan-1	Plan-2	Plan-3
		airport. The negative environmental impact is large because of construction work out of the airport area. The negative impact from increasing the number of landing and takeoff will be occur.	The negative environmental impact is small because of construction works in the airport area. The negative impact from increasing the number of landing and takeoff will occur.	occur. The negative environmental impact will be significant during construction and after construction.
Comparative Conclusion	Socio-Environmental impact is the lowest. But this plan cannot meet to increasing of passenger in future and will obstruct economic development for rising up from LDC.	The negative Socio-Environmental impact is large. The benefit per cost is low.	Socio-Environmental impact is the lowest except the Plan-0. This plan can meet the increasing of passenger for a while. This plan is selected in this project because of advantage on economic aspect and lower negative impacts.	This plan has largest Socio-Environmental negative impact. And it need the largest cost. But this plan will be needed for future demand after 2030.

iii. Final Remarks

Considering the urgent need of the present situation, "without project" alternative cannot be accepted. The passenger handling capacity of the airport is now about 8 million; the airport is at present handling about 7 millions. So it has already reached its maximum capacity. Moreover, the modern five level security concepts cannot be implemented. New terminal building with latest modern facilities will provide scope for implementation of this very much urgently needed requirement.

Completely new airport in a different location with adequate capacity and modern facilities is not possible within short time frame. Thus Plan 2 is considered as best option.

4.2 Physical and Chemical Components

a. Land Use

i. Regional and Local Planning

National and municipal land use plans have been prepared in Bangladesh. Dhaka Metropolitan Development Plan (DMDP) was prepared in 1995 with support from UNDP by a Project Management and Co-ordination Cell under Rajdhani Unnayan Kartripakkha (RAJUK) (Capital Development Authority) under Ministry of Public Works and Housing. The plan covers the area within the Dhaka Metropolitan development area, an area of over 1500 km^2. RAJUK published revised plan in 2015 also; but there has been no change in land use within this area, where the HSIA is located.

The Dhaka Elevated Expressway (DEE) is being constructed just in front of the Terminal – 3. The connecting ramps from the airport to the DEE will facilitate movement of passengers in the best possible way. The detailed information in this regard has been given in **Annex – 28** of this EIA report.

Height restrictions are enforced in an airport overlay zone. The usual practice is that the municipality consults with CAAB in connection with projects in the airport surroundings, particularly in cases of high constructions. The area north of the airport that is over-flown in 70 % of all approaches has been intensively developed with residential and business areas during recent years. Obviously it would have been desirable if that was prevented through area planning to prevent excess nuisance levels from the airport, and to provide for future airport extension.

ii. Planning Principles

Land use planning in Bangladesh is taking place at central government level and at municipal level. A Planning Commission under the Ministry of Planning is responsible for developing national land use plans. These plans are updated subject to a rolling updating plan on a 3 year, a 5 year, and a 10 year basis. Project developments are considered in the planning according to their importance or urgency, i.e. projects of highest importance or urgency are considered in the short-term 3 year planning level.

Prior to the aforementioned Dhaka Metropolitan Development Plan (DMDP) from 1995, urban planning and management was fragmented and uncoordinated, subject to the responsibility of various agencies, with different status and responsibilities, and some of the faster growing fringe areas under minimal local government control. As a result of the DMDP a lead planning and coordination authority was established based on RAJUK that is responsible for Dhaka urban planning. The urban plan is updated subject to a principle similar to the national planning level.

iii. Existing Land Use

The existing land use in the airport environment is illustrated in **Figure 4-12** showing land use features. In this airport area, the airport environment is divided in the areas such as (i) Institutions of education (schools, college etc.), (ii) Embassy quarter, (iii) Police station, (iv) Railway line and railway stations, (v) Arterial roads (New Airport Road), (vi) Dhaka Mymensingh Road, (vii) Pragati Sharanl Road, (viii) DIT Road etc. The Cultural Features in and around the airport area have been shown in **Figure 4-13**.

Figure 4-12 Spatial View of Existing Land Use Features

There are some land use features in **north side of airport (Annex 3)**. Wetland area in **north-west** side of the runway is used for fishing and as paddy field. Residential area is built-over densely with single storey buildings, partly semi-permanent buildings, in the **north-northeast** side. In the **north-northwest** side planned residential area named Uttara Model Town with buildings of several stories is located.

The land use features in **south side** of airport are shown in**(Annex 4)**.Military area is located in south-southwest of the runway with a green area of the Army Golf Club, and further away there are military buildings. There is a temporary residential area with buildings of sheet metal at immediate southeast side, and there are several ponds/canals that are used for fishery. Further away is the planned residential area named Nikunja1 and Nikunja 2 with higher building of up to 5-floor.

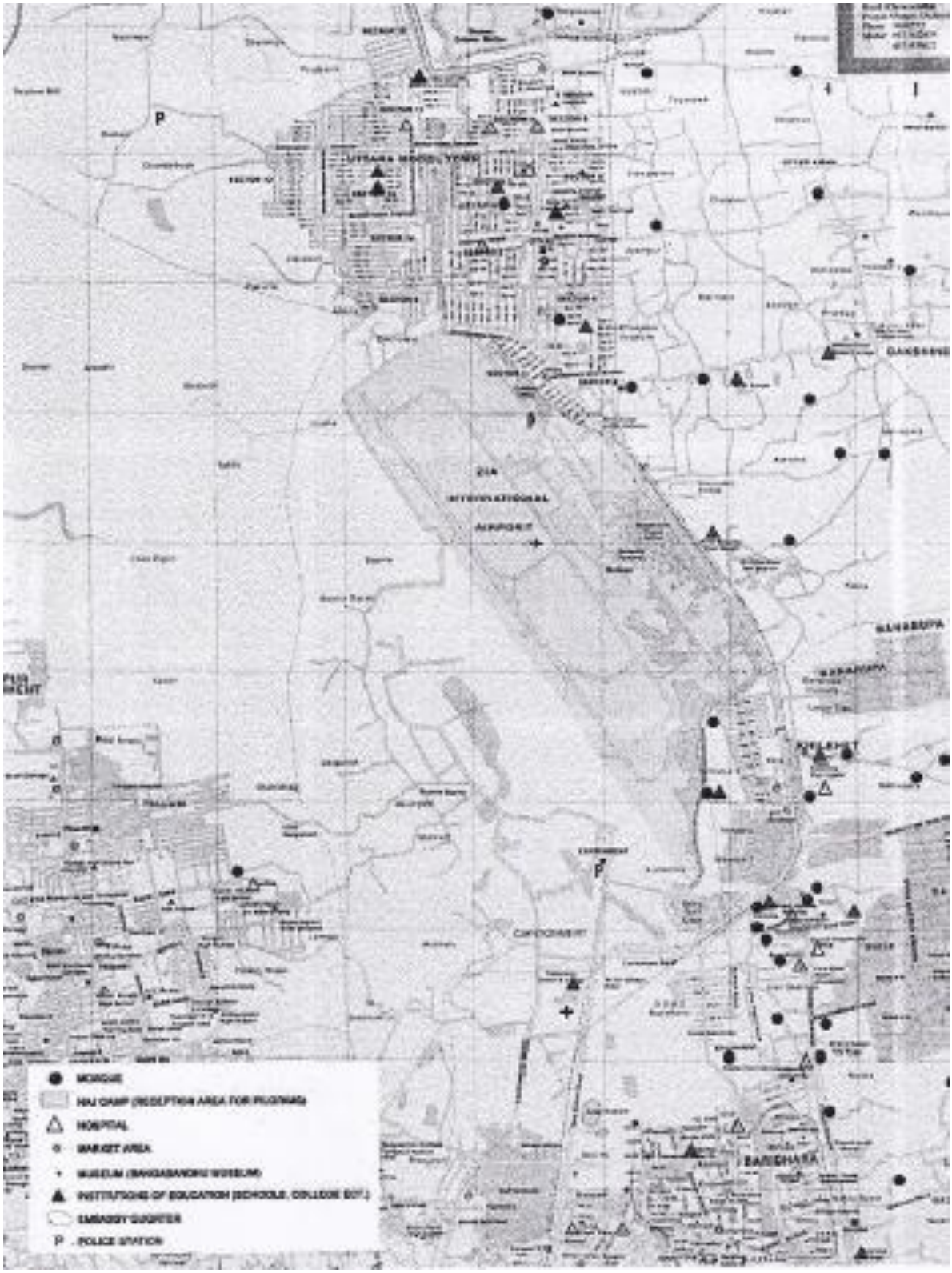


Figure 4-13 Cultural Features in and around the airport project area

The major existing infrastructures such as Runway, Taxiway, Apron, Terminal Building (International & Local), VVIP Terminal, Fire Station, Parking, Cargo Apron, Sewage Treatment Plant etc. have been located inside the airport boundary (**Annex 5**). There are some important existing infrastructures which are located surrounding the airport. A main 3 lane dual carriageway in direction of south-north provides access to the airport and further on to the outskirts of Dhaka. The road is subjected for upgrading further into Dhaka. A railway line is running parallel to the road with a railway station right opposite to the airport terminal in distance approximately 500 m on the opposite side of the main road. Facilities are also provided next to the railway station for pilgrims travelling for Haj. Check-in is made at the facility and the pilgrims are taken via bus directly to aircraft in the airport.

There is a roundabout on the main road right outside the airport terminal and next to the railway station. The road is often congested at the roundabout. A flyover for traffic leaving the airport towards the city would efficiently improve the condition. Around 3 km south of the roundabout the railway line is crossing the road. Also here the road is often congested, and a flyover could cater to ease up traffic.

East west road connections around the airport zone and roads east of the airport are only small roads and movement in that area is fairly difficult.

The area around the airport is encroached upon by residential areas that are affected by activities and noise in and around the airport. The area does not provide for new areas to airport extension possibly required in future.

No provisions for expansion of Hazrat Shahjalal airport are included in the Dhaka Urban Plan. The DMDP mentions in 1995 that the airport authorities have not voiced the request to reserve space for a second runway parallel to the present one. The DMDP further address that consideration should be taken that Dhaka develops very fast east and west of the airport and that the airport facility will be surrounded by urban residential areas in the coming years. In fact this is already taking place. Itappears that selecting a location for a new airport further north, that will not be encroached upon by urbanization would be a better solution to cater to extension with a new runway.

In the Dhaka Metropolitan Development Plan Hazrat Shahjalal International Airport is surrounded by established urban areas to the North, East, and South (**Annexes 3&4**). West of the airport there is a cantonment security zone with an airbase on the Southern half, while the northern half is proposed as new urban development area. The airport and major areas to the South and West is cantonment security zone. A number of urban fringe areas are located within 1 km distance around the airport. Agricultural areas and watershed protection areas are found at greater distance, 7 to 10km, east and west of the airport.

b. Physical Environment

i. Geology, Topography, and Soils

Dhaka and Bangladesh generally is flat low-lying land. The airport and the surroundings are at levels between 4 and 10 m with only very gentle slope. The geology is sedimentary deposit with compact soil, mainly clay, with poor porosity, and percolation capacity. The soil features have been shown in **Annex 7**. The soil surface provides for good run off of rain water in the dry months, while it becomes soft, clayey, and sticky in the monsoon period. The clay has poor

drainage capacity and consequently runoff quantities and evaporation loss is high, and the clay is eroded and dissolves in the drain water. In dry periods the clay is subjected to wind generated transport.

Soil and groundwater contamination has been assessed during survey under the upgrading project of Hazrat Shahjalal International Airport, Dhaka. The survey data is reported in an Architectural and Structural Survey Report 8 of this project [1 & 8]. The main findings of the survey, based on review of records, interview of CAAB staff and site surveys, are:

- No existing assessments of soil and groundwater contamination within the airport area have been identified during the records review.
- Potential sources of oil spill are found at:
  - The BIMAN maintenance hangar.
  - The jet fuel 9 x 4,000 m^3 vertical cylinder tank storage in the southern part of the airport.
  - The tank truck filling station at the jet fuel storage area which is fully paved with concrete and drained without oil traps or other measure.
  - The jet fuel pipeline and jet fuelling pits at the apron.
  - The tank truck fuelling of aircraft (only smaller aircraft).
  - The power plant east of the control tower building, fired with diesel stored in a 20,000 liter tank, placed in a separate tank yard south of the power plant.

Project related soil and groundwater contamination, in areas designated for the project works, is assessed as:

- Tower control building: No sources of soil and groundwater contamination have been identified in the vicinity.
- New Tower CAB: The area of the apron identified for the Tower CAB, between gate 5 and gate 6, is likely to be affected by both soil and groundwater contamination by jet fuel.

ii. Soil Quality Test Results

Soil samples were collected from all three of the project influenced locations at 7th and 8th November, 2016 (**Figure 4-14**). The team from BUET collected the Surface water samples with the assistance of DSCL Team and DDC Team. Investigation of chemical releases to soil usually requires collection of composite samples to characterize a large area or volume of near-surface soil in likely contaminated areas. In this context a composite soil sampling technique was followed to measure the contaminant. Test results of soil sample analysis of the project influenced area are given in **Table 4-2**.

Figure 4-14 Soil Sampling at Project Influenced Area

Table 4-2 Test Results of Soil Quality Analysis of the Project Influenced Area

Parameters	Unit	Soil-01 or SSAP-01	Soil-02 or SSAP-02	Soil-03 or SSAP-03	EU Directive 86/278/EEC for Land Application	Method of Analysis
Iron (Fe)	mg/kg	238	238	238	-	USEPA 200.9; SM 3111 B
Lead (Pb)	mg/kg	4479	4479	4479	1200	USEPA 200.9; Rev 2.2; SM 3111 B
Cadmium (Cd)	mg/kg	0.9	0.8	0.8	40	USEPA 213.2; SM 3113 B
Zinc (Zn)	mg/kg	34.5	27.7	36.7	4000	USEPA 200.9; SM 3111 B
Organic Matter (OM)	%	1.9	2.2	1.5	-	ASTM D2974
Oil & Grease	mg/kg	84.8	29.9	858.1	-	EPA 9071 B {Oil & Grease (O & G) in soil}

BUET & DU Laboratory Test, November 2016

Note: Only the detection level of Organic Matter (OM) is in %. As there is yet not established standards available for Bangladesh EU Directive 86/278/EEC for Land Application is followed for soil quality analysis.
Soil-01 or SSAP-01: Near Radar Area (23.85830°N, 90.39621°E);
Soil-02 or SSAP-02: Near R & R Aviation (23.83608°N, 90.41453°E) and
Soil-03 or SSAP-03:Near Residential Area outside CAAB Boundary (23.85606°N, 90.39993°E)

The above laboratory test results show that, Iron concentration in the three project influenced areas was equal and it was 238mg/kg. Lead (Pb) concentration in those areas was also same and it was 4479 mg/kg which is higher than EU Directive 86/278/EEC for Land Application.

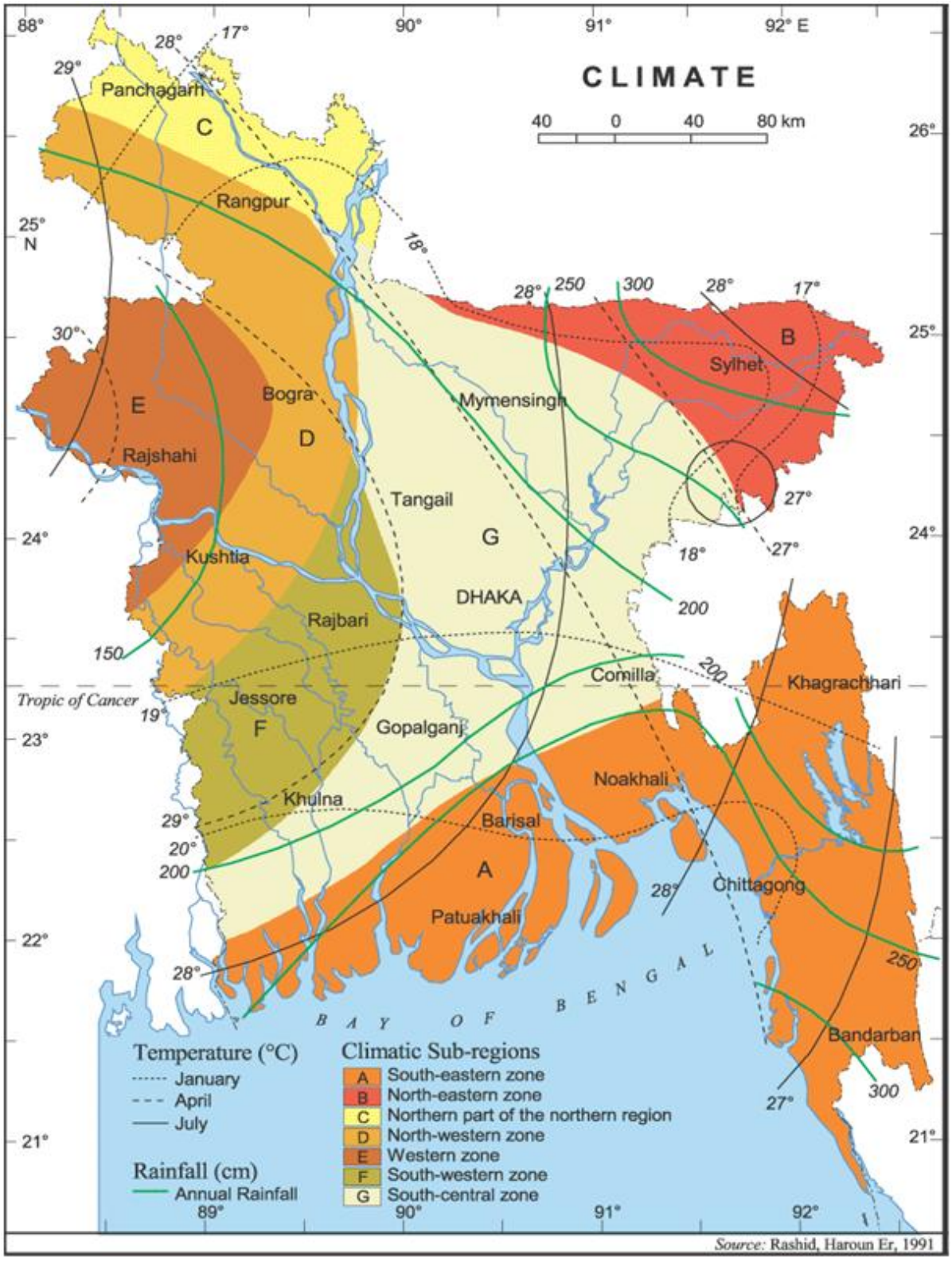
However, as per the test analysis, Cadmium (Cd) concentration was 0.8 to 0.9 mg/kg and Zinc Concentration was 27.7 to 36.7 mg/kg which are within the standards of EU Directive 86/278/EEC for Land Application. The Organic Matter (OM) concentration ranged from 1.5 to 2.2 % in those three areas. At sampling location SSAP-03, Oil & Grease concentration was 858.1 mg/kg which is the highest among the three samples. The laboratory test results are attached in **Annex 15** of this report.

iii. Climate and Meteorology

The climate of Bangladesh is sub-tropical with only little variation across the country. Climatic Sub-region of Bangladesh has been shown in **Figure 4-15** and this project area lies in the South-central climate zone (Sub-region: G) of the country. Gentle north/north-westerly winds with occasional violent thunderstorms called northwester during summer and southerly wind with occasional cyclonic storm during monsoon are prominent wind characteristics of the region. While there are six seasons in a year, winter, summer (pre-monsoon), and monsoon (rainy) are predominant. Seasonal variation of rainfall, temperature, and humidity is the noteworthy aspect of the climate. The winter is predominately cool and dry. The summer (pre-monsoon) is hot and dry interrupted by occasional heavy rainfall. The monsoon (rainy) season is hot and humid, and characterized by heavy rainfall, tropical depression, and cyclone.

Winter is from November to February. Usually winter temperatures are in the range from a minimum 7- 12^0 C to a maximum of 23 - 31^0 C. Maximum summer temperature is 36^0 C approximately.

Summer is known as pre-monsoon season which usually starts in March and ends in May. This season is neither hot nor cold and humidity is average. Rainfall is not very usual in this period.



Source: ASB, 2006

Figure 4-15 Map Showing Climatic Sub-region of Bangladesh

Monsoon (rainy) season is from June to October usually. This period accounts for 80 % of total rainfall. The annual rainfall of the country varies from 1429 to 4338 mm. Annual Rainfall in Dhaka varies from 1169 mm to 2850 mm. Distribution of rainfall in Dhaka over the year in 2013 and 2014 is shown in **Table 4-3** (According to Statistical Yearbook of Bangladesh 2014).

Meteorological condition has been established using data on different metrological parameters accumulated from nearby Dhaka station of the Bangladesh Meteorological Department. Summary of the analysis of metrological parameters are given in the following sections.

Table 4-3 Rainfall statistics in mm in Dhaka over the year 2012-2014

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2014	0	25	107	112	141	496	172	203	259	134	0	45	1694
2013	0	25	96	123	140	473	191	202	264	124	0	45	1683
2012	0	1	3	46	40	392	202	205	209	177	18	0	1293
Avg.	0	17	68	94	107	453	189	203	244	145	6	30	1557

(Source: Bangladesh Meteorological Department, Dhaka Station)

iv. Extreme Weather Events

Rainfall in May, June or July is usually 400 - 500 mm that may concentrate over 4 - 6 days. The airport is surrounded by a dike to prevent flooding from surrounding areas. The drainage system carries water from the airport area through ditches and via a number of ponds to outlet at the Southeast and Northwest corners of the airport. In heavy rainfalls the drainage system is likely to fail and the airport may be flooded temporarily. The area of the airport within the airport boundary is roughly 5 km^2 (500 ha) of which roughly 4 km^2(400 ha) within the dike are airport facilities while the remaining area is used for CAAB offices and auxiliary facilities, and spare areas currently allocated for hotels and a golf course. Duringa normal monsoon period heavy rainfall (500 mm in 5 days) occurs. The quantity of rainwater falling within the airport is 2 million m^3, giving a total runoff quantity of roughly 20 m^3/hr or 5 m^3/s. Peak runoff quantities under heavy rainstorms is considerably higher.

v. Water Resources and Water Quality Aspects

The airport is supplied with water from three numbers of groundwater wells in the airport area. The water is pumped from the wells to three elevated water deposits having storage capacity of 760 m^3, 190 m^3, and 40 m^3. Water quality is subjected to regular control which carried out by analyzing water samples at an external laboratory (**Table 4-4**). The water deposits are filled on a continuous basis, 4 times per day in average, which corresponds to a water consumption of roughly 4,000 m^3 per day. Water is used for CAAB airport operation, offices, living areas for airport personnel (dwelling area east of airport) and for supply to aircraft.

Table 4-4 Result of Water Quality Analysis near the Project Site

Locations	Date	pH	DO (ppm)	COD (ppm)	TSS (g/l)	Total Coliform (number/100ml)
Ponds in Northern Pallabi	2 Oct 2014	7.5	5.8	45.6	288	500,000
MirpurKhal	2 Oct 2014	7.3	0.6	164.0	636.4	500,000
Begunbari Drain	2 Oct 2014	7.6	1.4	141.6	502.1	1,100,000
Bangladesh Standard for Inland Surface Water		6.5-8.5	5 or more	Not yet set	Not yet set	5000 or less

Source: JICA Study Team &Reference [8]

vi. Rainwater Discharges

Rainwater is drained off the airport areas through ditches carrying the water via a number of ponds to outlet at the **Southeast and Northwest** corners of the airport. The airport currently experiences problems with the carrying capacity of the ditches and escape off water through the outlets. Sometimes the outlets are blocked by nearby inhabitants to prohibit flooding in their areas.

Quantities of rainwater in the airport are roughly 8 million m^3 per year with peaks in monsoon period of 0.5 million per day. The site view of rainwater discharge from north end runway towards east on drainage ponds and drainage canal west of runway has been shown in **Annex 7**.

vii. Sewage Water Discharges

Sewage water from the airport is taken through sewerage system to the airports own sewage treatment plant located east of the cargo center in the northern part of the airport area and subsequently discharge to the recipients **north** of the airport**(Figure 4-16)**. The treatment plant is currently not operational, but rehabilitation of this plant is planned by CAAB. The quantity of sewage is not determined and informed, but based on water consumption the quantity of sewage is estimated to be around 1 million m^3 per year. Capacity of the existing sewage treatment plant is not enough to handle the future sewage water generated in the airport vicinity.

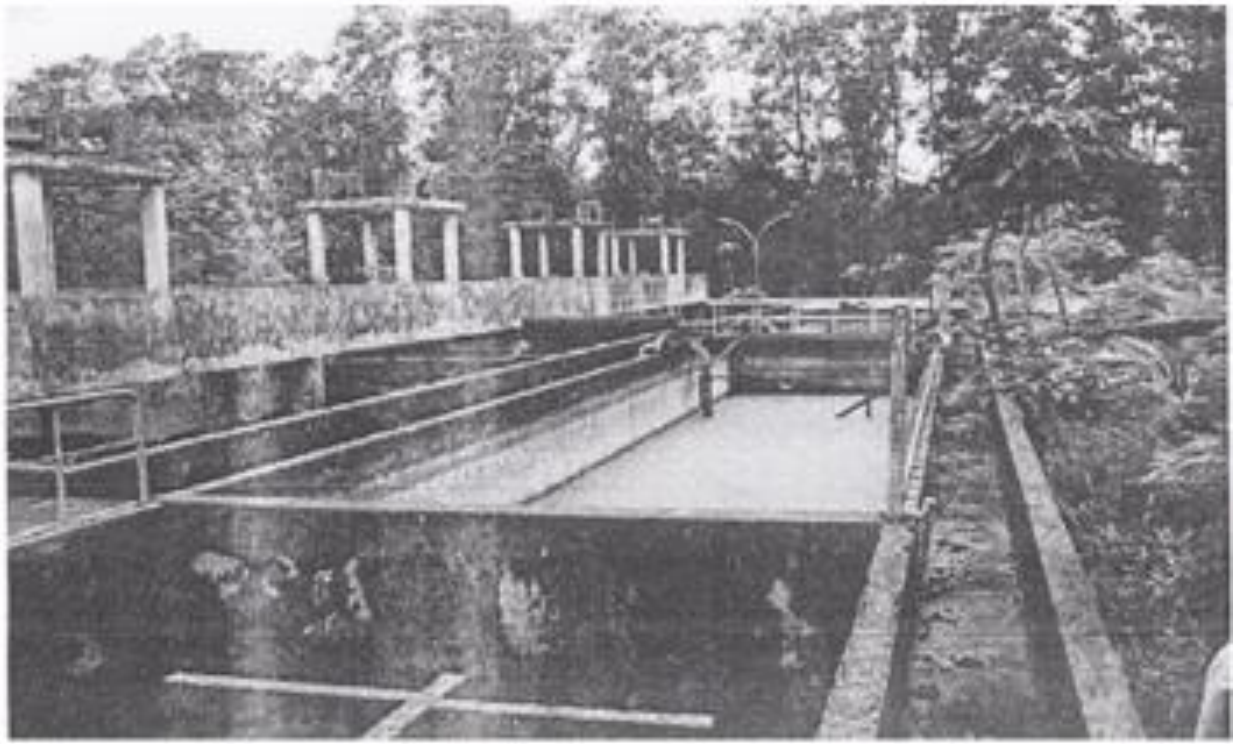


Figure 4-16 Existing Sewage Treatment Plant

viii. Surface Water Quality Test Results

Surface Water samples were collected from three project influenced locations on 7th and 8th November, 2016 (**Figure 4-17**). The parameters measured were pH, Turbidity, Electric Conductivity (EC), Total Dissolved Solids (TDS), Total Suspended Solids (TSS), Ammonia-Nitrogen (NH_3-N), Orthophosphate (PO_4), Iron (Fe), Lead (Pb), Dissolved Oxygen (DO), Chemical Oxygen Demand(COD), Biochemical Oxygen Demand (BOD_5), Zinc (Zn), Sulphate (SO4), Oil & Grease. All samples were collected in plastic sampling bottles, kept in an ice cooler after necessary stabilization/fixing and analyzed within 72 hours of collection. The team from BUET collected the Surface water samples with the assistance of DSCL Team and DDC Team. Test Results of surface water analysis of the project influenced area are given below in **Table 4-5.**

Figure 4-17 Surface Water Sampling at Different Project Influenced Area

Table 4-5 Test Results of Surface Water Analysis of the Project Influenced Area

Parameters	Unit	SW- 01	SW- 02	SW- 03	Standards for Inland Surface Water*	Analysis Method
pH	-	7.47	7.08	6.99	6.5-8.5	USEPA 150.1; SM 4500-H+ B
Turbidity	NTU	8.77	69.4	45.4	10	USEPA 180.1 Rev 2; SM 2130 B
Electrical Conductivity (EC) at 25°	µS/cm	229	209	279	700	USEPA 120.1; SM 2510 B
Dissolved Oxygen (DO)	mg/L	5.02	2.92	0.4	6 or more	USEPA 360.3, 360.2; SM 4500-O B, G

Parameters	Unit	SW- 01	SW- 02	SW- 03	Standards for Inland Surface Water*	Analysis Method
Total Dissolved Solids (TDS)	mg/L	150	165	176	1000	USEPA 160.2; SM 2540 B - D
Total Suspended Solids (TSS)	mg/L	16	155	112	10	USEPA 160.2; SM 2540 B - D
Iron (Fe)	mg/L	0.8	2	2.2	0.3-1.0	USEPA 200.9; SM 3111 B
Ammonia-Nitrogen (NH_3-N)	mg/L	6.5	3.65	7.8	-	USEPA 350.1; SM 4500 – NH3 B
Orthophosphate (PO_4) or Reactivate Phosphate	mg/L	0.580	0.500	0.910	6	USEPA 365.1; SM 4500 – PO4
Sulphate (SO_4)	mg/L	<1	<1	<MDL	400	USEPA 375.4; SM 4500 – SO4
Arsenic (As)	mg/L	0.001	0.001	0.001	0.05	USEPA 206.2; SM 3113 B
Chemical Oxygen Demand (COD)	mg/L	31	40	54	4	USEPA 410.4; SM 5220 D
Biochemical Oxygen Demand (BOD_5)	mg/L	7.2	9	19.2	6 or less	USEPA 450.1; SM 5210 B; SM 5210 D
Lead (Pb)	mg/L	0.028	0.031	0.027	0.05	USEPA 200.9 Rev 2.2; SM 3111 B
Zinc (Zn)	mg/L	0.032	0.057	0.052	5	USEPA 200.9, SM 3111 B
Oil & Grease	mg/L	<0.05	<0.05	5.40	-	APHA 5520.B

BUET & DU Laboratory Test, November 2016

Note:
a. Health based guideline, b. guideline based on other consideration
MDL–Minimum Detection Limit
**Standards for Inland Surface Water is followed Environmental Conservation Rule (ECR)'97*
SW-01 or SWAP-01: Wetland near Radar Building (23.85782°N, 90.39384°E);
SW-02 or SWAP-02: Wetland near R&R Aviation (23.84031°N, 90.41119°E);
SW-03 or SWAP-03: Drainage Canal outside CAAB Boundary wall near Residential Area (23.83608°N, 90.41453°E)

The concentration levels of TSS (16 mg/L), COD (31 mg/L) and BOD (7.2 mg/L) were higher than the DOE Standards for the sampling location SW-01 which is located near Radar Building. According to the test results, the concentration levels of Turbidity (69.4mg/L), TSS (155mg/L), Iron (2mg/L), COD (40mg/L) and BOD (9mg/L) were higher than the DOE Standards at sampling location SW-02 which is located near R&R Aviation. According to the laboratory results, the

concentration levels of Turbidity (45.4mg/L), TSS (112mg/L), Iron (2.2mg/L), COD (54mg/L) and BOD (19.2mg/L) were higher than the DOE Standards at sampling location SW-03 which is located the Drainage Canal outside CAAB Boundary wall near the Residential Area. The laboratory test results are attached in **Annex 13** of this report.

ix. Ground Water Quality Test Results

Ground Water samples were collected from the entire three project influenced locations at 7th November, 2016 (**Figure 4-18**). The parameters measured were pH, Turbidity, TDS, Color, Total Coliform (TC), Fecal Coliform (FC), Total Alkalinity (as $CaCO_3$), Chloride (Cl^-), Iron (Fe), Manganese (Mn) and Arsenic (As). All samples were collected in plastic sampling bottles, kept in an ice cooler after necessary stabilization/fixing and analyzed within 72 hours of being collected. The team from BUET collected the Surface water samples with the assistance of DSCL Team and DDC Team. Test results of ground water analysis of the project influenced area are given at **Table 4-6.**

Figure 4-18 Ground Water Sampling of Project Influenced Area

Table 4-6 Test Results of Ground Water Analysis of the Project Influenced Area

Parameters	Unit	GW- 01	GW-02	GW-03	Standards for drinking water*	WHO Guideline Value, 2004	Analysis Method
pH	-	6.77	6.62	6.68	6.5-8.5	6.5-8.5	USEPA 150.1; SM 4500-H+ B
Turbidity	NTU	0.33	0.31	0.37	10	5	USEPA 180.1 Rev 2; SM 2130 B
Total Coliform (TC)	CFU/100 ml	0	0	0	0	0	USEPA 9132; SM 9221 E
Feacal Coliform (FC)	CFU/100 ml	0	0	0	0	0	SM 9222 G

Parameters	Unit	GW- 01	GW-02	GW-03	Standards for drinking water*	WHO Guideline Value, 2004	Analysis Method
Total Alkalinity (as CaCO3)	mg/L	84	83	110	-	-	USEPA 310.1; SM 2320 B
Chloride (Cl-)	mg/L	8	9	7	150-600	250	USEPA 325.6; SM 4500 Cl-
Iron (Fe)	mg/L	<0.02	0.04	0.02	0.3-1.0	0.3	Phenonthrolin Method, SM 3500- Fe B
Total Dissolved Solids (TDS)	mg/L	137	133	142	1000	1000	USEPA 160.2; SM 2540 B - D
Color	Pt-Co	1	2	1	15	15	USEPA 110.2; SM 2120 C
Manganese (Mn)	mg/L	0.007	0.036	0.012	0.1	0.4	PAN Method
Arsenic (As)	mg/L	0.001	0.002	<0.001	0.05	0.01	USEPA 206.2; SM 3113 B

BUET Laboratory Test, November 2016

Note:
a. Health based guideline, b. guideline based on other consideration
MDL – Minimum Detection Limit
**Standards for Inland Surface Water is followed Environmental Conservation Rule (ECR)'97*
GW-01: BFCC Pump (23.85068°N, 90.40423°E);
GW-02: VIP Pump (23.84437°N, 90.40941°E) and
GW-03:Rab Pump (23.85606°N, 90.39993°E)

According to the laboratory test results of ground water analysis, the concentration levels of pH, Turbidity, TDS, Color, Total Coliform (TC), Fecal Coliform (FC), Total Alkalinity (as CaCO3), Chloride (Cl-), Iron (Fe), Manganese (Mn) and Arsenic (As) were within the DOE Standards at all the three sampling locations. The laboratory test results are attached in **Annex 15** of this report.

x. Air Quality

Air quality is significantly dangerous in the city of Dhaka, compared to the other cities of Bangladesh such as Chittagong, Khulna, Sylhet, and Rajshahi, where rapid pace ofurbanization, industrialization, and overcrowding create major air quality problems. In 1988 the World Bank estimated that 15,000 deaths per year and a million cases of major illness are caused by air pollution in Dhaka, Chittagong, and Rajshahi.

The main atmospheric pollutants are those produced by vehicles and industries and in particular by the burning of fuels. These include particulate matter, hydrocarbons, carbon dioxide, carbon monoxide, sulfur dioxide, oxides of nitrogen, lead, ammonia, and hydrogen sulfide. Many of these cause respiratory problems in humans, plus other diseases if substances accumulate in the tissues. The main causes of the poor air quality are:

- Poor roads and traffic management leading to severe traffic congestion;

- Use of high sulfur diesel by buses and trucks, and inadequate control of emissions;
- Heavy industrialization, and use of cheaper high-sulfur fuels (coal, wood and tiers) by smaller industries like brick kilns; and
- Poor solid waste management, so burning is the common method of treating garbage.

Ambient air quality status in Dhaka followed by Bangladesh air quality standards is indicated in **Table 4-7** in micro gram/m^3 (µg/m^3). Surveys by the Department of Environment (DOE) show levels of Suspended Particulate Matter (SPM) and Sulfur Dioxide (SO2) in Dhaka city exceed Bangladesh Air Quality Standards, and levels of atmospheric lead (Pb) that are above World Health Organization (WHO) standards. These standard values should fall over the next few years however, as laws are enforced reducing the number of fitness less vehicles, and consumers change to vehicles using lower cost unleaded petrol and compressed natural gas. It is likely that the air emissions in the Hazrat Shahjalal international Airport are even higher than those places due to smoke emission by aircraft. North of the airport, in distance around 10 km, there is a big industrial area at Tongi, and huge brick fields at Ashulia and Gabtoli, from where considerable emissions are generated. As the proposed project site is located at the city center of Dhaka, the air quality should be generally better.

Table 4-7 Ambient air quality status in Dhaka City followed by Bangladesh air quality standards (µg/m^3)

Location	NO_x µg/m^3	SO_2 µg/m^3	Pb µg/m^3	SPM 10 µg/m^3	SPM 2.5 µg/m^3
Pallabi along Begum Rokeya Sharani (Oct 19, 2010)	76.90	5.68	0.1823	124.17	54.21
South side of Farmgate along Airport Road (Oct 20, 2010)	126.08	17.15	0.1916	107.22	59.52
South side of BangaBhaban along Folder Street (Oct 26, 2010)	142.45	8.44	0.2420	141.60	61.39
Duration (hours)	24	24	24	24	24
Bangladesh Ambient Air Quality Standards	100 (24 hrs)	365 (24 hrs)	0.5 (24 hrs)	150 (yearly)	65 (yearly)

Source: JICA Study Team

xi. Air Quality Test Results

Ambient air quality refers to the background air quality level in a region, characterized by concentrations of various pollutants in the atmosphere. The presence of air pollutants and their concentrations depends on the type of polluting sources, and other factors that influence their flow and dispersion. Ambient Air quality measurements were carried out from 30th October to 31st October, 2016 and 8th November, 2016 in three locations of the project influenced area and the monitoring results are given in **Table 4-8**. Bangladesh national standards for ambient air quality are followed for the ambient air quality analysis. The key air quality parameters (particulate matter- PM_{10} and $PM_{2.5}$, oxides of sulfur - SOx, oxides of nitrogen – NOx, carbon monoxide- CO, Ozone- O_3, Lead- Pb) were analyzed from samples collected at each sampling sites. The air quality testing was performed at all three of the project influenced areas (**Figure 4-19**).

Figure 4-19 Air Quality Monitoring at Different Sub-projects Location

Table 4-8 Test Results of Ambient Air Quality Analysis of Different Sub-project Locations

Parameter	Unit	AAQ-01	AAQ-02	AAQ-03	Bangladesh Standard	WHO AQGs***	Duration (hrs)	Weather Condition	Method of Analysis
PM_{10}	µg/m^3	145.45	142.50	148.52	150	50	24	Sunny	Gravimetric
$PM_{2.5}$	µg/m^3	74.66	71.54	76.68	65	25	24		Gravimetric
SO_2	µg/m^3	8.62	8.12	9.01	365	20	24		West-Geake
NOx	µg/m^3	57.20	55.10	58.12	100	40	24		Jacob and Hochheiser
O_3	µg/m^3	23.10	22.85	23.31	235	100	24		Spectophotometric Method
Pb	µg/m^3	0.18	0.16	0.23	0.5	0.5	24		AAS Method
CO	mg/m^3	2	3	2	10	10	8		CO Meter

DSCL Laboratory, November 2016

Note:

AAQ-01: VIP Road near VIP pump (23.84419º N, 90.40918º E)

AAQ-02: Near Abdul Momen Ltd. (23.86087° N, 90.39598° E)
AAQ-03: Near last Gate of VIP Road (Inside) (23.83352° N, 90.41299° E)
** CO concentrations and standards are 8-hourly only.*
***The Bangladesh National Ambient Air Quality Standards have been taken from the Environmental Conservation Rules, 1997 which was amended on 19th July 2005 vide S.R.O. No. 220-Law/2005.*
****WHO AQGs have been taken from WHO Air Quality Guideline Standards (AQGs), Global Update, 2006.*
Abbreviation:
PM_{10} - Respirable Dust Content, $PM_{2.5}$ - Fine Particulate Matter, SO_2 - Sulphur Di-oxide, NO_X - Oxides of Nitrogen, O_3 - Ozone, Pb - Lead, CO - Carbon Monoxide, AAS - Atomic Absorption Spectroscopy, µg/m³ - microgram/cubic meter, ppm - parts per million

The results of ambient air quality parameters of the project area are shown in the above mentioned table. The ambient air samples were collected by the high volume sampler for eight hours. The concentrations of ambient air quality parameters are (PM_{10}, SO_2, NOx, CO, O_3, Pb) within the acceptable limit of Department of Environment (DOE), GOB except for $PM_{2.5}$. In those three project influenced areas, particulate matter $PM_{2.5}$ ranged from 71.54µg/m^3 to 76.68µg/m^3. Again WHO Air Quality Guideline Standards (AQGs) is also shown in the test analysis result. According to this guideline, particulate matter (PM_{10} and $PM_{2.5}$) and Oxides of Nitrogen (NOx) were higher than the AQGs. During the sampling the weather was sunny and dry. The laboratory test results are attached in **Annex 16** of this report.

xii. Noise Levels

Level of noise in Dhaka City is now a major concern for the general people because it has exceeded the tolerance level. According to WHO survey at 45 locations of Dhaka City, most of the traffic points and many of the industrial, residential, commercial, silent, and mixed areas are suffering noises exceeding the standard limits of Bangladesh. WHO found noise levels of 70 dB in Dhaka Medical College, 75 dB in Shakhari Patti, 90 dB in English Road, 88 dB in Rajuk avenue, and 85 dB in Tejgaon, though the standard limit for those area are 50, 55, 60, 70, and 75 dB respectively. These are mainly due to vehicular horns and movement, loudspeakers from processions and meetings, high volume of audio players from roadside small business enterprises and others. Huge numbers of motorized and non-motorized vehicles on limited road surface cause extreme traffic congesting, especially near the bus terminals and bus stops. Many of the major roads, lanes and by-lanes remain damaged all year around, which causes high levels of noise.

The noise scenarios, in fact, show an extreme threat to human health, especially for elderly people and children. Moreover, the traffic personnel, rickshaw pullers, open vehicle drivers, road side workers, small scale business enterprise workers etc. are exposed for long-term noise pollution which might cause severe mental and physical health problems.

Noise surveys were conducted at different locations around the airport areas by the Department of Environment on 26-29 October 2010 and survey results have been summarized in **Table 4-9** and **Table 4-10** along with peak Bangladesh noise ceiling levels. The surveyed noise levels far exceeded the standard values at all locations and times.

Table 4-9 Noise Levels Status in Dhaka City Areas (dB)

Locations	Noise Level (Equivalent Sound Level in dB)	
	Day (6:00-21:00)	Night (21:00-6:00)
Pallabi near Police Station, Mirpur	83	78
South side of Farmgate (Ground Level)	90	85
South side of Farmgate (7 m above Ground Level)	89	85
South side of BangaBhaban along Folder Street	91	89

Source: JICA Study Team, 26th-29th October, 2010

Table 4-10 Bangladesh Standards for Noise (dB) as per Noise Control Rules 2006

Locations	Noise Level (Equivalent Sound Level in dB)	
	Day (6:00-21:00)	Night (21:00-6:00)
Silent Zone	50	40
Residential Area	55	45
Mixed Area	60	50
Commercial Area	70	60
Industrial Area	75	70

Noise levels at different points in the airport area have been shown in **Table 4-11**.

Table 4-11 Noise levels at different points in the airport area (dB)

Locations	Noise Level (Equivalent Sound Level in dB)	
	Day (6:00-21:00)	Night (21:00-6:00)
North	92	92
South	98	98
East	90	90
West	97	97

Source: JICA Study Team, 26th-29th October, 2010

xiii. Ambient Noise Level Measurement

Ambient noise level was measured in the airport area on 18 January 2017. Survey point is located in intermediate point between main construction site of this project and residential area. The survey points are shown previous figure. (No.3 and No.4) On this ambient noise survey, the sound level meter is same as aircraft noise survey and equivalent continuous A-weighted sound pressure level for 10 minutes ($L_{Aeq,\ 10min}$) is measured during measuring period. The result of the measuring is shown following **Table 4-12**. The maximum $L_{Aeq,\ 10min}$ of both survey points is less than the standard value of daytime for commercial zone.

Table 4-12 Result of Ambient Noise Measurement (Daytime)

Location		Measuring Period	The maximum $L_{Aeq,10min}$	The minimum $L_{Aeq,10min}$	The average of $L_{Aeq,10min}$
No. 3	Eastside of the airport area/ Nearing of the	9:30am - 9pm 18th January 2017	67.1dB 2:10-2:20pm	53.5dB 11:40-11:50am	58.6dB

Location		Measuring Period	The maximum $L_{Aeq,10min}$	The minimum $L_{Aeq,10min}$	The average of $L_{Aeq,10min}$
	boundary				
No. 4	North side of the airport area/ Nearing of the boundary	9:00am -9 pm 18th January 2017	63.4dB 7:20-7:30pm	50.4dB 8:30-8:40pm	54.8dB

Note: The effect of ajan from mosque is exempted from result

The graphical representation of the results is shown in **Annex 17**.

Figure 4-20 Noise Level Measurement at Different Project Influenced Areas

xiv. Aircraft Noise Measurement

Aircraft noise measurement was one of the tasks under JICA study Team`s Supplementary EIA Works. The survey locations and methods were determined by JICA Survey team. Continuous measurements for 7 successive days (Including recording of airplane model during this noise measurement) were made.

Noise recording has been done in north end and south end or run way 14 and 32. Enumerators from DDC and associates were initially given an orientation on noise measurement instruments, recording modes, and procedures by experts of JICA Study Team (Nippon Koei Co). DDC staffs monitored continuously for the entire 7-day duration.

The 24-hour day was divided into three (3) 8-hour shifts for measurements. Two enumerator teams were engaged for each 8-hour shift. Total 6 teams worked for noise measurements. Noise recording started at landing site on 6th January 20017 at 3pm and takeoff site at 3.45 pm on the

same day. Recording completed on 13th January 2017 at 3pm and at 3.45 pm at landing and takeoff sites respectively. Twelve enumerators with one coordinator and 3 consultants from DDC were engaged in this survey. Each team also recorded in the form other noise events like Ajan (Muslim call for prayer using loud speaker).

Of the two (2) sites, north end site is located near Dolipara, and south end site near Nikunja Housing estate. Both sites were located within the Civil Aviation periphery. Sound meter auto-recorded the measurements. Surveyors recorded every sound event (aircraft, Ajan and other sound) of the Noise Survey Point. The details of the results of aircraft noise measurement have been given in **Annex 19**.

4.3 Ecological Components

a. Flora within Airport Boundary

Different types of flora such as grasses, herbs, and trees are visible within the airport area (**Annex 8)**. Inside the airport boundary (concrete wall fence), the vegetation is dominated by different grass species. At the boundary and to the South/North of the airport area there are also several species of herbs. There are several ponds and drainage canals inside the airport area, where the flora is characterized by a more differentiated species composition, including several wetland species.

The grasses inside the airport area include sun-grass (Imperataaurandinaceae), Durbaghas (Cynadondactylon), Lajjabati (Mimosa pudica), Ulu grass (Imperaracylindrica), and Lantana (Lantana camera).

Inside the airport area near boundary line the vegetation is dominated by smaller bushes and trees. Along the airport boundary, along the runway to the West, the vegetation is smaller and taller trees. The trees along the boundary are fast growing tree species, predominantly Akashmoni (Acaciaauriculiformis) (90%) and Korai (Al-beprocera).At the entrances to the airside there are mango and jackfruit trees. The jackfruit trees are found bearing few fruits in the tree but mangos were not found in the mango trees. All types of fruit bearing trees with fruits attract birds andcertain wild animals.

b. Fauna within Airport Boundary

There are some Fauna exist inside and around the airport boundary areas. Wild animals that reside outside the airport area may enter the airport area in search of food. Duringthe short stay inside the airport, no wild animals could be seen. It is likely that rodent, rabbit, hare, jackal tortoise, lizard, snakes, frog, and mongoose may stay in the area. Insects and worms etc. may attract birds, bats, and other wild animals to the area. Some of the bird species that were seen while visiting the airport area was:

- Wood pecker (B –*KhatThokra*)- a vulnerable species.

- The other birds seen moving in the airport are not endangered which are listed below(Reference - IUCN- Red Book):

- Rock Eagle Owl (B - *Hutumpecha*),
- Pheasant (B - *Kanakuya*),
- Brahminy Kite (B - *Lalchil*),
- Crow,
- House crow (B-*Patikaak*),
- Black dingo(B - *Fingey*),
- Common Myna (B- *Bhat-shalek*),and
- House sparrow (B - *Choroi*) etc.

c. Habitats and Wetlands Just Outside Airport Boundary

North and North-west side from the boundary line of the Hazrat Shahjalal airport is wetland areas where no residential areas are visible. The water level in the wetlands is to be higher in June, and the areas are covered by free water during this time. The areas not covered by water were dominated by different species from the sedge family. Remaining period round the year except the monsoon period, the area is used for growing ofrice. In the Dhaka Metropolitan Development Plan [**Ref. 7**] the wetland area is proposed as residential development area.

South side from the airport boundary is wetland and lowland areas that are also used as residential area. The vegetation near the water areas is dominated by grasses and in the drier period dominated by grasses, single trees, and smaller accumulations of trees.

The surrounding wetland area is used by migratory birds during the monsoon for their feeding. Some of these birds use to enter the airport area for feeding. The visible ponds and canals within the wetland areas retain different fish species and fishery activities are carried out inside these water areas.

d. Natural Protected Areas near Airport Boundary

There are no internationally or nationally protected nature reserves, or nature parks within the close vicinity of the airport. Nearest one is Bhawal National Park at a distance of about 20 to 25 km from the Hazrat Shahjalal International Airport.

e. Supplementary Study on Biological Environment

As part of the EIA of HSIA, an environmental baseline study was carried out in areas surrounding the project site. The specific objective of the baseline study is to gather information on the existing biological environment of the areas (ecosystems dynamics) in and around the project site; to gather and assess peoples' perception on environmental aspects of the proposed project. The baseline ecological survey primarily focused on identifying floral and faunal diversity and distribution within and surrounding the project sites.

The main purposes of the ecological survey were:

- To identify ecosystems diversity in the project area and enlist the plant and wildlife species with their national and international status,
- To enlist keystone, rare and threatened flora and fauna,
- To investigate the distribution and abundance of flora and fauna including fish species,
- To make an assessment of the impacts for the proposed project activities on the ecological environment.
- Trees inventory in the proposed Terminal-3 building

A rapid survey was conducted during field visits during December 2016 to January 2017. The EIA team visited areas surrounding the project site to collect first-hand information on floral and faunal diversity. Literature review and informal interviews with local people were also conducted as a part of the EIA. Information gathering on faunal and mammalian species was through visual observations on walk through the area and also through discussion with the local people. No fisheries activity, survey on flora was conducted through visual and rapid field survey. However, a species regionally identified as rare may not necessarily be threatened for grater geographical context.

According to the IUCN Red Book 2001 species are classified as Extinct, Critically Endangered, Endangered, Vulnerable and Lower Risk based on status of each species to understand the importance for conservation of those species. Species under Critically Endangered, Endangered and Vulnerable are combined termed as Threatened. On the basis of habitat, the species are divided into two major categories viz. (a) aquatic, and (b) terrestrial

i. Fisheries resources in the project area

A small lake exists inside boundary wall of airport. There is no natural fishes exist because it is artificial lake excavated for the requirement of need basis and water supply from this lake on an emergency basis. No fish culture is there in this lake. The major functions of the ponds are to act as retention/ regulating pond for drainage. Several excavated ponds also exist in different locations inside airport.

ii. Environmental Protected Area

Based on the Bangladesh Wildlife (Conservation and Security) Act, 2012, some specific areas of environmental importance are declared as environmental protected areas (EPA) in the name of sanctuaries, national parks, community conservation areas, safari parks, eco-parks, botanical gardens notified under the provisions of sections 13, 17, 18 and 19 under Chapter IV and special biodiversity conservation area established under the provisions of section 22 under Chapter V and traditional heritage and kunjaban are declared under section 23 for some specific purpose of environmental protection. There is no such EPA in HSIA expansion project area.

Moreover, based on the Environment Conservation Act, 1995 and the Environment Conservation Rules, 1997 some specific areas of ecologically important are declared as ecologically critical area (ECA) for conservation of ecological condition of that area restricting certain activities detrimental to the environment. There is no such ECA in the project area.

f. Tree Inventory and Classification

Tree inventory and classification was the requirement of Department of Environment as DOE asked an NOC from Department of Forest (DOF) in their Site Clearance. Due to implementation of the project, trees to be removed and same number of saplings to be replanted in other locations. This study was conducted along the proposed HSIA expansion project area. Most of the trees inventoried from Balaka Airlines office to Hotel La Meridians and VVIP complex to fuel power house. This area has been selected for construction of Terminal Building-3. Most of the trees from this location may be removed before implementation the project.

The tree inventory started with in-situ field training. Tree census data appraiser and the experts from DDC were present during the survey. Help of the officials from the Bangladesh Forest Department and Consultant of Nippon Koei Co. were also taken as and when needed.

Three field inventory groups were made and each group (one enumerator for remove bark, one painting and one measure/ recorded) supervised by one Environmentalist from DDC, each group was assigned the paint, brush, tap, stick, 20 feet height bamboo, recording form, pencil, eraser, and sharpener etc. According to the suggestion from the Department of Forest, trees inventory was done. Enumeration & Counting Lasted 13 Days (28 December 2016 to 9 January 2017). Tree inventoried 1.3-meter height and above 6 inches' girth/ circumference. Below 6 inches' girth of trees only counts the number. DDC provided the PPE (Personal Protective Equipment, like helmet, boots) for all enumerators.

The Environmentalist has worked mostly as supervisor and reviewer of data. A botanical inventory survey has been conducted in the proposed tree plantation site covering local name of the species, girth/ circumference, entire height, bole height and amount of fuel. Following form have been used during inventory of the trees. The detailed results are given in **Annex 20**.

4.4 Socio and Economic Factors

a. Population and Community Structure

The population of Dhaka city is approximately 15 million as a densely populated mega city. The airport is virtually surrounded by permanent and semi-permanent dwellings, commercial areas, and housing areas for over 1 million people within a perimeter of 2 km. Three Strategic Planning Zone (SPZ) such as Uttara in north and east, Cantonment in south, and Mirpur in west and north is surrounded the airport [**Ref. 7**]. The population and area of the zones are as indicated in **Table 4-13**.

Table 4-13 Population and area of three strategic zones

Zones	Area (Acres)	Population	
		1991	2030 (Projected/Forecasted)
Uttara	3631	133,000	425,000
Cantonment	2141	107,000	205,000
Mirpur	1856	430,000	650,000
Total	7628	670,000	1,280,000

Source: Reference 7 & 8.

Uttara includes planned areas at the center; spontaneous developing areas in the east, low lying undeveloped areas in the west and which borders the Hazrat Shahjalal International Airport. The area is developed with about half apartments, half single family units. The unplanned areas for middle and low income groups are developing fairly fast. The low lying undeveloped areas in the west are proposed new urban development areas [**Ref. 7**].

The Cantonment encompasses the airport and private housing known as Defense Officers Housing Society (DOHS) to cater to the needs of a special society. Land uses in the cantonment area are controlled by the Cantonment Board. The restricted zone prevents east west connection and forces a long detour if travelling by road between Mirpur and Uttara or Gulshan.

Mirpur is a planned area largely developed to cater to the needs of the low and middle income population. It was developed to partly mitigate the housing need of the immigrants from India immediately after partition in 1947. Important elements in the zone are the botanical garden, Zoo, national stadium, national swimming pool, indoor stadium, Mirpur ceramic industry,

sanitaryware factory, military academy, and graveyard for martyred intellectuals.The planned areas of the zone are well served by roads.

b. Employment and Distribution of Income, Goods, and Services

The CAAB has employed close to 2,000 people in Hazrat Shahjalal Airport. In total the CAAB has employed 5,000 -6,000 people in all airports in Bangladesh. Hazrat Shahjalal Airport further provides direct employment to around 1,500 people in customs services, immigration, postal services and airlines, mainly in BIMAN. Indirectly between 5,000 and 7,000 people are employed with transport services, customs clearance services, and contractors for works and services in the airport. Income levels range from around 5,000 BDT for a driver to 30,000 BDT for a junior engineer and 60,000 BDT for a senior engineer. Roughly 10% of the CAAB employees are women, mainly occupied as security personnel, office clerks, and cleaning personnel.

c. Community Attitudes and Opinions Surrounding the Airport

The airport is believed to be well accepted in community. Residential areas have developed extensively in the airport surroundings, and it is expected that the airport will be completely blocked by residential areas. The residential areas are nearly beginning on the airport boundary and they are over-flown at very low height, which obviously has a considerable noise impact. While complaints about the airport have not been reported, the residents in these areas, southeast of the airport, occasionally attempt to block the drainage outlets to avoid flooding of their areas. This blocking of drainage may arise flooding inside the airport boundary.

5. PREDICTION OF IMPACTS

This Chapter identifies various pollution sources from the proposed expansion of the Hazrat Shahjalal International Airport and their impacts on different environmental parameters. The identification and assessment of these impacts will further help in formulating mitigation measures in order to reduce or eliminate these impacts. Generally, the environmental impacts can be divided in two separate categories such as primary and secondary impacts. Primary impacts are those, which generate directly from the proposed project, whereas secondary impacts are those, which indirectly include associated investments and changed pattern of social and economic developments. The anticipated impacts due to the proposed project can be broadly divided into three distinct phases:

- During the pre-construction phase, which are considered as temporary or short term impacts
- During the construction phase, which are considered as temporary or short term impacts
- During the operational phase, which are considered to have long term impacts

The earlier chapter provided the information on the baseline conditions of various environmental parameters in and around the project site. This section introduces the various pollution loads and stressors that could impact the environment and the incremental impacts on the environmental parameters during the construction and operation phase of the project. This section will also offer the basis for decision makers to understand the nature of potential impacts and thereby take appropriate decisions regarding the project activities.

The present report assesses the impacts of the proposed activities on various environmental attributes of the project site. A particular methodology has been followed to identify the potential impacts. The issues for consideration have been raised by the following means: (i) input from interested and affected parties, if any; (ii) desktop research of information relevant to the proposed project; (iii) site visit and professional assessment by environment specialist engaged by the implementing agency; and (iv) evaluation of proposed design scope and potential impacts based on the environment specialist's past experience. Categorization of the project and formulation of mitigation measures have been guided by the JICA Checklist for Development **(Annex 1**) and JICA Environment Policy.

5.1 Environmental Impacts during Pre-construction Phase

In the case of this project there are few impacts that can clearly be said to result from the design or location.

a. Relocation

The land proposed for the project belongs to within the boundary of existing airport. CAAB has acquired this land. No impact is anticipated due to the location as the proposed sites are owned by the CAAB.

b. Land Use Change

The project is planned to conduct within the existing boundary of the HSIA area. The major land use of the proposed site is the existing facilities of the airport and the open land which are not

being used yet. Hence no impact due to the proposed development is envisaged. The surrounding area outside the airport is open space, wetland, residential areas, and agriculture land. There will be no impact on land use change as no activities will take place outside the airport boundary.

5.2 Environmental Impacts during Construction Phase

The work comprises the construction activities of Hazrat Shahjalal International Airport project. The following are the scope of work:

Building works in Phase 1 will include New Passenger Terminal Building 3, which will be a 3 story building with area of approximately 220 thousand m^2 including supply of related equipment. The capacity of this terminal will be 12 million passengers per annum (mppa). It will also include Multi-Level Car Parking with tunnel& landside service road and connecting road with DEE (area approximately 62,000 m^2), New Cargo Complex (area approximately 41,000 m^2), VVIP Complex (area approximately 6,000 m^2) as well as the Rescue and Fire Fighting Facilities and Equipment.

Civil works in Phase 1 includes Parking Apron in front of Terminal 3 area having an area of 500,000 m^2, Taxiways (9 numbers connecting to the T3 apron: approx. 42,000m^2), Landside Service Road with Elevated Road and Connecting road with Dhaka Elevated Express way, Improvement of Drainage System, and Taxiways (two rapid exit and one connecting taxiway for the runway 14 threshold having an area an area of approximately 65,000 m^2.

Utility works in Phase 1 include water supply system, sewage treatment plant (approximately 3,000 m^2), Intake Power Plant with Distribution System (approximately 7,000 m^2), Hydrant fuel supply system, and security and terminal equipment.

On the other hand, the Phase 2 works will include:

- Widening of runway;
- Extension of runway and taxiway;
- Expansion of Terminal 3;
- Connector corridor from T3 to T1 and T2;
- Renovation of Terminal 1 and 2
- Construction of new Domestic Terminal

a. Impact on Land Use

During construction there will be no impact on the land use outside the airport area, as all construction works will be carried out inside the airport. Inside the airport area a work site will be established on 1 - 3 areas identified to that purpose, intended for:

- storage for materials (sand, gravel, stone, asphalt, concrete etc.)
- asphalt works
- crushing plant for concrete crushing
- concrete mixing plant
- machines
- facilities for workers

b. Impact on Landscape and Areas of Cultural Value

The only impact on landscape outside the airport will be restricted to:

- the site(s) where raw materials for the construction works, mainly gravel, stones etc. will be extracted.
- the site(s) where excess of materials from the construction works are deposited. It is assumed that excess of materials from the construction works (possibly soil, concrete, sanitary waste, worn-out electrical installations etc.) is deposited/reused or recycled at sites approved by the Bangladesh Authorities.

The impact on landscape is assessed insignificant as site(s) where raw material is extracted, and where excess material is deposited/reused, as approved by the Bangladesh authorities. There will be no impact on areas of cultural value from the project during construction.

c. Impact on Classified or Protected Areas

There will be no impact on classified or protected areas from the project works.

d. Impact of Noise

The impact of noise around the airport will be insignificant because propagation distance of the noise will be ensured from construction site to boundary of the airport. Generally, the noise level of the source will decrease 40dB as per 100m distance. The distance of construction site and boundary has more than 100m in this project. However, inside the airport area there will be noise from the following activities:

- Breaking of pavement on taxiway/apron and transport on trucks to the work areas.
- Crushing of concrete slabs and lean concrete in the crushing plant established at the work site. Noise from transport of material to/from the work areas, and
- Noise from machines during reshaping of slopes etc. of the canals.

The noise at the crushing mill is evaluated to be the most significant noise source of the construction activities, but as mentioned above, noise from crushing of concrete will not be a problem outside the airport, regardless of the location of the activity inside the worksite areas.

e. Impact of Air Pollution

The consumption of fuel (trucks, machines, asphalt plant, crushing plant) will result in consumption of energy and emission of the green-house gas carbon dioxide (CO_2).There will be emissions of pollutants as carbon-monoxide (CO), sulphur dioxide (SO_2), nitrogen oxides(NO and NO_x, hydrocarbons (HC), and Suspended Particulate Matters (SPM) from the different machines and trucks used during construction. Furthermore, there is going to be emissions from the asphalt work during processing of asphalt as volatile organic substances, and emissions of particles from the crushing plant. There will also be impact of dust and re-suspension caused by construction works.

Carbon dioxide is of environmental concern as a green-house gas that has a global warming effect. Sulphur dioxide and nitrogen oxides are pollutants that in the air will be transformed to Sulphuric and nitric acid that have impact on the environment regionally, on the flora etc. Sulphur dioxide and nitrogen oxides can result impacts locally and regionally on human health,

depending on the concentration of the substances in the air. Both hydrocarbons and particles are known to have impact on human health, as carbon monoxide in high concentrations.

The emission of pollutants will not result in concentrations outside the airport area that will have impact on human health, or impact on environment, and it is assessed that the emission of pollutants will not have any impact on the environment/human health of workers, inside the airport area, provided that vehicles/machines used is of good standard, and that the combustion of the engines is completed. The dust and re-suspended soil will not result in significant impact on ambient air quality because dust control such as water sprinkling will be done.

f. Impact of Soil and Water Pollution

The project is not assessed to result in significant pollution of soil and water. Discharge of wastewater with content of suspended particles (from concrete production)/organic pollutants oil components from asphalt production/fuel/wasted oil etc.) from cleaning of equipment or discharged by accident can result in contamination of the water in the canals/ponds inside the airport. It is evaluated that the contamination will be local and not result in pollution of water outside the airport area because of the long residence time of the water inside the airport area resulting in:

- Suspended particles of the water will be deposited on the bottom of the canals/ ponds.
- Decomposition/degradation physical, chemical, and biological of the organic pollutants, before the water leave the airport.

It is evaluated that a part of the soil (and pavement) that is going to be excavated at/ near the aprons more or less contaminated with fuel. Contact with contaminated soil (pavement), can result in indisposition/impact on workers' health, and depending on the concentration and composition of the contamination, have impact on people/workers who stay in the contaminated area. However, this impact will be mitigated because contaminated soil will be kept isolated from non-contaminated soil, and deposited separately.

g. Impact on Vegetation and Fauna

During construction there will be some impacts inside the airport area which are as follows:

- Vegetation on the slopes of the canals will be eliminated when the canals are reshaped. Planting (sowing of grass) of the slopes will be carried out to prevent erosion when it rains.
- Apart from that, the trees along the border between the airport and the military area will be cut down.

h. Impacts of Use of Material and Waste

The use of materials such as concrete, asphalt, brickwork, steel etc. is evaluated not to result insignificant environmental impacts at the sites where the materials are produced, and the use of the materials inside the airport area will not results in significant impacts inside/outside the airport area.

Solid waste from the construction works includes soil (contaminated/not contaminated),mud from dredging of canals and vegetation from reshaping of canals, trees, and bushes from tree cutting along/ west of the runway, concrete waste, worn-out electrical equipment and waste from the

work areas including waste from household rubbish etc. It is assumed that waste that is taken outside the airport area is deposited in accordance to approval from the authorities. The environmental impact of waste generated from the construction works, in accordance to the described assumptions, will not result in significant impacts outside the airport area.

Waste water including sanitary water will be discharged through the existing Sewer system to the non-functioning sewage treatment plant inside the airport area. Wastewater from the construction works, together with waste water from the airport area, will be discharged unclean from the treatment plant to the outside of Hazrat Shahjalal airport.

i. Socio-Cultural Impacts

During the construction period, the employment opportunity will increase locally and regionally. It is assumed that the construction works will be executed by local and/ or regional contractors, purchase of materials for the construction works will be executed both locally and regionally (stones, gravel, sand etc.), while provisioning for the workers and overnight accommodation will be supplied locally.

The total number of workers that will be directly involved in the construction works on the airport project is evaluated to be about 300 persons. Locally hotels, shops, and different sorts of dealers will indirectly be affected by the works.
Workers will increase during construction period. Therefore, adequate mitigation measures should be considered for the risk of diseases when the detailed plan is prepared. There will be a clause on HIV/AIDS prevention measures.

Vehicles for carrying construction materials will increase during construction phase. The increase of traffic accident will be concerned around HSIA. Traffic management plan and road safety plan will be submitted by contractor.

j. Occupational Health and Safety

Impact on Occupational Health and Safety (OHS) is identified as the construction works that will have a safety impact on airport operation in terms of risk to aircraft following from the works carried in the airport under normal operational conditions. Likewise aircraft will represent a safety risk to workers.

When completed, the upgrading will carry safety improvement to aircraft operations following from improved pavements and improved equipment to air traffic management, communication, navigation and surveillance. Likewise the upgrading will cater to improved occupational health conditions for airport staff involved with air traffic management.

Considerations for occupational health of worker on normal construction works e.g. Personal Protective Equipment (PPE) will be implemented. Also, hearing protection for workers on demolition of concrete will be installed.

5.3 Environmental Impacts during Operation& Maintenance Phase

The Impacts coming from the Operation & Maintenance activities of the Hazrat Shahjalal International Airport projects are as follows:

a. Impact on Air quality

Current situation of air pollutant such as nitrogen oxides (NOx) and sulfate oxides(SOx) in airport is same as other monitoring point in Dhaka city. The concentration of these substances is lower than air quality standard value of Bangladesh. That means that future concentration of NOx and SOx will not become significant level in future because current aircraft emission do not affect to air quality in the airport area. On the other hand, particulate matter (PM10, PM2.5) have high concentration in airport and other point in Dhaka city. According to the ADB report "Country Synthesis Report onUrban Air Quality Management", 55% of PM10 comes from soil and 32% comes from vehicles in Dhaka city. Likewise, 46% of PM2.5 comes from Natural gas/diesel burning, and 29% comes from vehicles. That means aircraft is not main source of particulate matter. It seems that reason of high concentration of particulate matter in Dhaka city is soil, air pollutant from stationary source such as gas engine/ diesel engine and gas emission from vehicles. Therefore, the concentration of PM10 and PM2.5 will not become high only because of increasing of taking off and landing of aircraft. The impact from vehicles travelling inside of the airport is expected. As a countermeasure of this, multi storey car parking will be implemented with adequate parking number for reduction of gas emission from waiting cars. Therefore, this impact will be mitigated.

b. Impact on water quality

The impact of water quality around project site will be not significant because sewage from new terminal building will be treated properly in new WWTP of this project.

c. Impact of waste

Waste management will be done under the responsibility of CAAB. Therefore, the impact of waste will not be significant.

d. Impact of soil

The impact to the soil will not be significant because, oil separator will be installed in the fuel farm for preventing soil contamination.

e. Impact on Noise

Aircraft noise is exempted from national noise standard of Bangladesh. But the effect of aircraft noise would be concerned due to increase of aircraft landing and taking off. According to the result of aircraft noise (Lden) simulation, the impact of aircraft noise around HSIA will increase. Environmental quality standard for aircraft noise (Category II area which means normal living condition) is 62dB in Japan. From the isopleth map of Lden, the area with excess standard value of Japan is spreading around airport. The complaint section will be implemented in CAAB as a counter measure of aircraft noise impact.

Aircraft noise prediction is requirement of the International Civil Aviation Organization (ICAO). In Hazrat Shahjalal International Airport (HSIA), the number of handling passenger is increasing drastically. Therefore, the passenger terminal building must be extended since the capacity of the existing terminal building is not enough for future passengers. The new terminal building and some facilities will be installed by this project. Corresponding to the implementation of these facilities, the number of taking off and landing will increase and the effect of aircraft noise will be of special concern in future. This study is executed to grasp change of aircraft noise in future.

The item of prediction is Lden (Day-Evening-Night Average Sound Level) for aircraft noise. Airport operation is exempted from noise regulation of Bangladesh. On the other hand, Lden is

using for assessment of aircraft noise in many countries such as EU countries and Japan. Therefore, Lden is used for prediction item on this study. The detail results of this study have been given in the **Annex 28**.

f. Global Warming

Increase of energy usage associated with the increase of number of passengers and aircraft is expected. However, it is planned to eliminate greenhouse gases emission by introducing energy reducing equipment to air condition and lighting.

g. Summary of Impacts

This section provides a summary of impacts from the airport. The environmental impacts, both outside and inside of the Hazrat Shahjalal International Airport, during the construction and operation period are shown via matrix presentation with the environmental impacts graded according to their:

- Magnitude
- Type
- Extent
- Duration

Graduations that have been applied to identify environmental impacts using matrix presentation are defined in **Table 5-1.**

Table 5-1 Matrix with Definitions of Magnitude, Type, Extent, and Duration of Environmental Impacts

Magnitude	**Definition**
+3	Major positive benefit
+2	Significant improvement
+1	Moderate improvement
0	No change
-1	Negative impact within acceptable levels
-2	Significant negative impact, preventive measures are feasible
-3	Major negative impact, preventive measures are extensive and / or impossible
Type	**Definition**
Direct	As increase in workplaces during construction
Indirect	As increase in trade locally from the project by workers etc.
Extent	**Definition**
Local	Can be observed within 1 km distance
Regional	Can be observed beyond 1 km
Duration	**Definition**
Short term	Impacts with duration: <year
Long term	Impacts with duration: >year

Graduation of the environmental impacts as described in previous sections related to the construction period to operation is given in **Table 5-2.**

Table 5-2 Matrix with Graduation of Environmental Impacts Related to Design, Construction and Operation

Environmental Parameters	**Impacts based on magnitude**			**Comments**
	Design Phase	**Construction Phase**	**Operation Phase**	
Land use		0	0	
Landscape and areas of cultural value		0	0	
Areas classified or Protected		0	0	
Noise		-1	-2	Impact inside the airport area
Air		(-1) to (-2)	-1	Impact inside airport area. (-1) using well functioning machines; (-2) using old machines
Soil and water		-1	0	
Vegetation and fauna		-2	0	
Materials and waste		-1	0	
Socio-culture		+1	+1	Positive impact: during construction as benefit to employment; in operation as improved safety as a benefit from the upgrading
Occupational health and safety		-1	+1	The construction works increase risk for accidents

6. EVALUATION OF IMPACTS

6.1 Assessments of Impacts

Based on the impacts assessment shown in **Table 5-2,** the issues such as Infrastructure, Transportation and communication, Health &education facilities, and History, culture,& tourism have the **most/major positive significant** impact. In addition, Industry and agriculture have the **moderately positive** impact. Moreover, Demography has **minor positive** impact. From this airport improvement project the above issues would be beneficial for the studied area. Since these parameters have positive impacts, no mitigation measures are required and recommended.

However, air quality and noise have the **most/major negative** impact. Besides, Soil, water, and occupational health& safety have the **moderate negative** impact because of the project activities. Furthermore, Climate, Solid waste, and Wetland habitats have the **minor negative** impact from this improvement project. These issues might be problematic, concerned with environmental issues, for the studied area if necessary mitigation measures would not be taken into consideration.

The remaining studied environmental parameters such as Topography, Land use, Vegetation, Fauna, Protected areas, Landscape, and areas of cultural value have **no impacts** from the activities of the upgrading project.

Graduation matrix of the environmental impacts is given **Table 6-1.**

Table 6-1 Matrix with graduation of environmental impacts in terms of magnitude, type, extent and duration

Parameters		**Impact**						
		Magnitude (Weight, W)	**Factor (F)**	**Total Impact T=W*F**	**Type**	**Extent**	**Duration**	**Color**
Environmental	Topography	1	0	0	-	-	-	
	Climate	-2	1	-2	Indirect	Regional	Long	
	Air	(-2) to (-3)	3	-9	Direct/ Indirect	Local/ Regional (*1)	Short/ Long	
	Soil and water	-1	3	-3	Direct	Local	Short	
	Noise	-3	3	-9	Direct/ Indirect	Local/ Regional	Short/ Long	
	Solid Waste	-1	2	-2	Direct	Local	Short	
Economy	Land use	0	2	0	-	-	-	
	Industry and Agriculture	+1	3	+3	Indirect	Local/ Regional	Short/ Long	
	Infrastructure	+2	3	+6	Indirect	Local/ Regional	Short/ Long	
	Transportation and	+2	3	+6	Indirect	Local/ Regional	Short/ Long	

Parameters		Impact						
		Magnitude (Weight, W)	Factor (F)	Total Impact T=W*F	Type	Extent	Duration	Color
	communication							
Ecological	Vegetation and Fauna	-2	3	-6	Direct	Local	Short	
	Areas classified or Protected	0	3	0	-	-	-	
	Wetland habitats	-1	2	-2	Direct/ Indirect	Local	Short/ Long	
Socio-Cultural	Landscape and areas of cultural value	0	2	0	-	-	-	
	Demography	+1	2	+2	Direct/ Indirect	Local/ Regional	Short/ Long	
	Health and Educational facilities	+2	3	+6	Indirect	Local/ Regional	Short/ Long	
	History, culture, and tourism	+2	3	+6	Direct/ Indirect	Local/ Regional	Short/ Long	
	Occupational health and safety	-1	3	-3	Direct/ Indirect	Local	Short/ Long	

*1: Green-house effect from carbon dioxide (CO_2) is Global.

Representation of factors

Not Significant (1)	Moderately Significant (2)	Significant (3)

Representation of Weights

Major Negative (-3)	Moderate Negative (-2)	Minor Negative (-1)	No impact (0)	Minor positive (+1)	Moderate positive (+2)	Major Positive (+3)

6.2 Assessment of Project Impacts as per JICA Guidelines

The objective of environmental scoping is to identify significant environmental impacts for the HSIA Expansion Project. In this process of the environmental scoping, collection of existing data from all possible sources was carried out. Then, an environmental reconnaissance was conducted with below check list in hand to identify and delineate the significant effect of the project and eliminate the others from further considerations. The mitigation measures were proposed for the identified environmental impact items. It is noteworthy that the check list including 30 general environmental impact items were prepared referring the JICA Guidelines.

Table 6-2 Result of the Assessment

Category	No.	Environmental Item	Ratings After Surveying		Brief Description
			Pre-construction/ Construction	Operation & Maintenance	
Pollution control	1	Air pollution	B-	B-	Pre-Construction/ Construction: The dust and re-suspended soil will not result in significant impact on ambient air quality because dust control such as water sprinkling will be done.

Category	No.	Environmental Item	Ratings After Surveying		Brief Description
			Pre-construction/ Construction	Operation & Maintenance	
					Operation: The impact of air quality is small because, current concentration of nitrogen oxides(NOx) and sulfate oxides(SOx) in airport are low level. Furthermore, concentration of particulate matter(PM) is mainly affected from many sources except aircraft. The impact from vehicles travelling inside of the airport is expected. As a countermeasure of this, multi storey car parking will be implemented with adequate parking number for reduction of gas emission from waiting cars. Therefore, this impact will be mitigated.
	2	Water Pollution	B-	B-	Pre-Construction/ Construction: Temporary water pollution due to construction activity is expected. The Impact will be mitigated because turbid water treatment will be done such as sedimentation and collection before discharge to the canals in the airport. Operation: It is expected to impact of water quality around project site from generated waste water. However, this impact will be mitigated because of waste water treatment and installation of oil separator.
	3	Solid waste	B-	B-	Pre-Construction/ Construction: It is expected to impact of solid waste from construction work. However, this impact will be mitigated because of proper disposal of solid waste by contractor. Operation: It is expected to impact of solid waste from new terminal building. However, this impact will be mitigated because of proper collect and dispose all internally generated solid waste as a responsibility of CAAB.
	4	Soil contamination	B-	B-	Pre-Construction/ Construction: It is expected to impact of soil contamination. However, this impact will be mitigated because contaminated soil will be kept isolated from non-contaminated soil, and deposited separately. Operation: It is expected to impact of soil contamination due to fuel leak. However, this impact will be mitigated because of installation of oil separator.
	5	Noise/Vibration	B-	A-	Pre-Construction/ Construction: Limited noise and vibration resulting from construction activities and construction vehicle movement are predicted. The impact of noise around the airport will be mitigated because propagation distance of the noise will be ensured from construction site to boundary of the airport. And, periodic maintenance of construction machinery will be done. Operation: The area in where aircraft noise is

Category	No.	Environmental Item	Ratings After Surveying		Brief Description
			Pre-construction/ Construction	Operation & Maintenance	
					over Japanese standard will distribute around the airport. As a countermeasure of this issue, CAAB will promote the using of low noise aircraft recommended by ICAO by giving incentives. It is difficult to give subsidy for anti-noise works likewise Japan because the aircraft noise is exempted from standards on government law. Thus, complaint section for noise will be implemented by CAAB. The above countermeasures will mitigate the impact. The impact from vehicles travelling inside of the airport is expected. The impact of noise around the airport will be insignificant because propagation distance of the noise will be ensured from construction site to boundary of the airport.
Social Environment	6	Local economies, such as employment, livelihood	B+	B+	Pre-Construction/ Construction: Positive impacts such as creation of local employment are predicted. Operation: Increase of flights will ultimately contribute to the local economy.
	7	Land use and utilization of local resources	A+	A+	Pre-Construction/ Construction/ Operation: Significant positive impact on use of local resources is predicted.
	8	Existing social infrastructures and services	B-	B-	Pre-Construction/ Construction: Due to construction activities, decrease in the convenience of the airport users is expected, but very minimum. And the carrying road will be implemented in the airport area so, negative impact around the airport will be mitigated. Operation: Due to increasing users of the airport, road traffic will be affected. However, the impact will be mitigated because the new road infrastructures will be implemented.
	9	Local conflicts of interest	B-	D	Pre-Construction/ Construction: There are some former lease holders located within the proposed Project area. CAAB is now negotiating for their relocation. Operation: Other local conflict of interests is not predicted.
	10	Landscape	B-	B+	Pre-Construction/ Construction: Due to the construction activities, the disturbance to the scenery is expected. However, this impact will be mitigated because of cleanup activity in construction site. Operation: Renovation of the international terminal and VVIP terminal will enhance the landscape.
	11	Gender	B+	B+	Pre-Construction/ Construction: Construction will create female job opportunity.

Category	No.	Environmental Item	Ratings After Surveying		Brief Description
			Pre-construction/ Construction	Operation & Maintenance	
					Operation: Operation will create female job opportunity.
	12	Infectious disease such as HIV/AIDS	B-	D	Pre-Construction/ Construction: Inflow of construction workers may increase the risks on communicable diseases. However, this impact will be mitigated because of clause of contract documents on HIV/AIDS prevention measures. Operation: No activities that will increase the risk of communicable diseases in the local communities around airport are expected.
	13	Working Environment (includes work safety)	B-	D	Pre-Construction/ Construction: Inappropriate management of working environment will raise the risk of accident and casualty. However, this impact will be mitigated because of using Personal Protective Equipment (PPE), hearing protection for workers on demolition of concrete. Operation: No activities that will increase the risk of the working environment are expected.
Others	14	Accidents	B-	B-	Pre-Construction/ Construction: The effect of construction vehicles to the local community is predicted. However, this impact will be mitigated because of traffic management plan and road safety plan for preventing road accident around the airport. Operation: With the increase of airport users, the risk of traffic accidents near the airport will also increase. However, this impact will be mitigated because of implementing road infrastructures.
	15	Global Warming	D	B-	Pre-Construction/ Construction: Impacts on trans-boundary effects and global warming are negligible, since the construction works of this project is limited in time, volume, and the area. Operation: The emission of GHG will be increased because of energy consumption in new terminal building. The impact will be mitigated because of implementing energy reduction equipment for lighting or air conditioning.

A+/-: Significant positive/negative impact is expected.
B+/-: Positive/negative impact is expected to some extent.
C+/-: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)
D: No impact is expected.

Source: JICA Study Team

7. MITIGATION OF IMPACTS

Measures to mitigate environmental impacts related to design, construction, and operation of the airport project are suggested to include environmental management and considerations in respect of planning of works as discussed below.

7.1 During Construction Phase

Measures to mitigate environmental impacts related to construction works of the airport project are suggested as discussed below.

a. Noise

The noisiest activities are the crushing of concrete at the crushing plant and when concrete is broken at the taxiway/apron. Mitigation measures against noise can be:

- Using of good standard machines and/or machines with noise limiting measures.
- The use of hearing protection by the workers when working at the places where noisy activities are carried out.

b. Air

Mitigation measures against air pollution can be as follows:

- Impact on the environment from emission of pollutants and dust to the air can be reduced by: Using of good standard machines/engines and/or machines/engines where the combustion is complete.
- Dust from works with soil, concrete etc. can be reduced by irrigation of carriage roads, piles of soil, and other materials that will result in dust when handled or because of high wind speed. Regular cleaning of carriage roads inside, and also immediately outside the airport area.
- Using of dust protection measures.

c. Soil and Water

Reduction of environmental impact, inclusive impact to humans, from contaminated soil and water can be taken by:

- Avoiding direct contact with the contamination.
- Using protective measures, where the type of protection is depending on the concentration and the composition (as content of volatile substances) of the contamination.
- Treatment of contaminated water, if it is going to be discharged to the canals.
- Securing that contaminated soil will be kept isolated from clean soil, deposited separately, and marked.

d. Socio-culture

The impact at the airport from increased traffic along with trucks having construction materials to the work areas can be reduced by planning, so that trucks enter the airport area from outside at rush-hour traffic.

e. Occupational Health and Safety

The risk of impact on the safety in the airport during construction activities should be eliminated by detailed planning of all the different activities by the contractor inside the airport area.

7.2 During Operation Phase

Measures to mitigate environmental impacts related to operation and maintenance works of the airport project are suggested as discussed below.

a. Environmental Management

Mitigation measures as described in this report should be carried out in accordance to the Environmental Management Plan (EMP) for establishment and operation of the airport project that facilitates compliance to environmental objectives and to requirements, regulations, and conditions. The EMP builds on the principles of environmental management in ISO 14001 and contains description of environmental aspects, requirements, and regulations, and activities related to mitigation, monitoring, and follow-up of environmental issues. The significant impact of global carbon emission during operation phase can be adopted and mitigated by developing new technologies, and new aircraft engine requiring low carbon emitting fuel, etc.

b. Environmental Monitoring

Monitoring of impacts and implementation of mitigation measures in construction and operation will, as mentioned in Mitigation Section, be subject to an Environmental Management Plan (EMP).

There is assessed to be no need of monitoring outside the airport area. Inside the airport area monitoring will be limited to:

- Regular monitoring/control of the discharge of water from the construction activities.
- Regular Control of the cleaning of carriage roads for soil etc. from trucks.
- Control of sites where surplus of materials from the activities will be deposited/placed for long durations.
- Control of quantities of water that are pumped from the pump stations to the outside of the airport area.

c. Management of Noise Pollution

It is recommended that:

- CAAB will take necessary actions when any noise complaint arises; and
- CAAB will consider to introduce an incentive scheme (like, discount landing fee, etc.) to promote operation of low-noise type aircraft by airline companies (to prevent from noise problem after the operation of new T3), if significant noise complaint arises.

8. ENVIRONMENTAL MANAGEMENT PLAN

8.1 General

An Environmental Management Plan (EMP) is a site specific plan developed to ensure that the project is implemented in an environmentally sustainable manner where all contractors and subcontractors, including consultants understand the potential environmental risks arising from the proposed project and take appropriate actions to properly manage that risk. EMP also ensures that the project implementation is carried out in accordance with the design and the mitigation measures as recommended in the Initial Environmental Examination (IEE), Environment Impact Assessment (EIA) study to reduce the adverse impacts during the project's life cycle. The plan outlines existing and potential problems that may adversely impact the environment and recommends corrective measures where required. Also, the plan outlines roles and responsibility of the key personnel and contractors who are charged with the responsibility to manage the proposed project site and its surroundings. The EMP is generally:

- Prepared in accordance with the approved TOR given by the DOE and in compliance with the rules and requirements of the Environmental Conservation Rules;
- To ensure that the proposed facilities are operated in accordance with the design;
- A process that confirms proper operation through supervision and monitoring;
- A system that addresses public complaints during construction and operation of the facility and take appropriate corrective action plans to overcome those unwanted situation; and
- A plan that ensures remedial measures is implemented immediately.

The key benefits of the EMP are that it provides the organization with means of managing and improving its environmental performance thereby allowing it to contribute to better environmental quality. The other benefits include cost control and improved relations with the stakeholders. EMP includes four major elements;

- Commitment & Policy: The proposed project management will strive to provide and implement the Environmental Management Plan that incorporates all issues related to environmental and social components and will comply with the suggestions given by the Department of Environment (DOE) under Ministry of Environment and Forests (MOEF)
- Planning: This includes identification of environmental impacts, and setting environmental objectives. The various potential impacts are discussed under SectionV.
- Implementation: This comprises of resources available to the developers, accountability of contractors, training of operational staff associated with environmental control facilities and documentation of measures to be taken.
- Measurement & Evaluation: This includes monitoring of implementation of the mitigation measures, corrective actions and record keeping.

The environmental impacts for the proposed project have been identified and quantified in Section V. Appropriate mitigation measures have also been recommended to minimize the impact on the environmental and social parameters.

a. Environment Management Cell

For the effective implementation of the mitigation measures and consistent functioning of the proposed airport, an Environmental Management System (EMS) has been proposed. The EMS will include the following:

- An Environmental Management Cell
- Environmental Monitoring Program
- Personnel Training
- Regular Environmental Audits and Corrective Action Plan
- Documentation – Standard operating procedures of Environmental Management Plans and other records

b. Structure of the Cell

A permanent organizational set up will be formed to ensure the effective implementation of mitigation measures and to conduct environmental monitoring. The major duties and responsibilities of Environmental Management Cell will be as follows:

- To implement the environmental management plan in planning, construction and operation phase,
- To ensure regular operation and maintenance of pollution control devices,
- To assure regulatory compliance with all relevant rules and regulations,
- To minimize environmental impacts of operations by strict adherence to the EMP,
- To initiate environmental monitoring as per approved schedule.
- Review and interpretation of monitored results and corrective measures in case monitored results are above the specified limit.
- Maintain documentation of good environmental practices and applicable environmental laws as ready reference.
- Maintain environmental related records.
- Coordination with regulatory agencies, external consultants and monitoring laboratories.
- Maintaining log of public complaints and the action taken.

c. Hierarchical Structure of Project Implementation Unit (PIU)

Normal activities of the EMP cell will be supervised by a dedicated person who will report to the site coordinator of the airport project. The Environmental Monitoring Framework with a view to ensuring smooth environmental management is given in the following **Figure 8-1**.

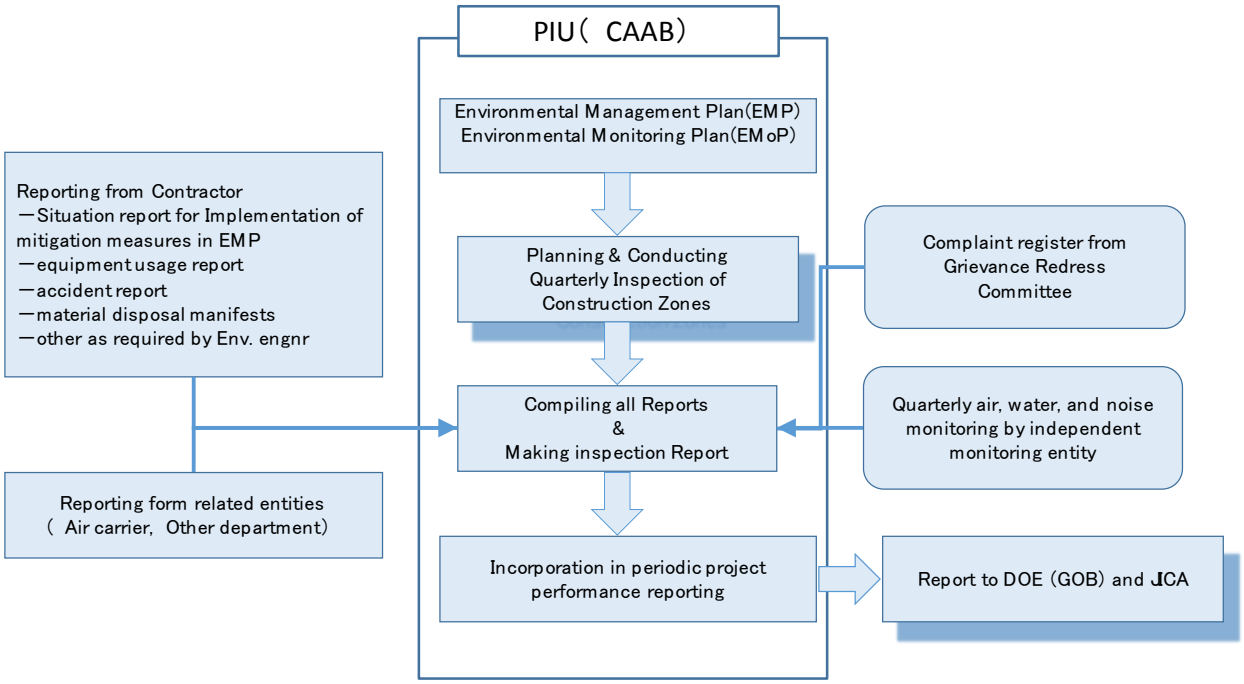


Figure 8-1 Environmental Monitoring Framework

Implementation of EMP during operational stage: EMP will be implemented during operational stage by developing Institutional strengthening. Young CAAB staffs and Environment & Social Safeguard experts as consultants will be involved in the institution to implement EMP.

d. Record Keeping and Reporting

Record keeping and reporting of performance is an important management tool for ensuring sustainable operation of the proposed airport. Records will be maintained for regulatory, monitoring and operational issues.

e. Environmental Audits and Corrective Action Plans

To assess whether the implemented EMP is adequate, periodic environmental audits will be conducted by the Department of Environment (DOE) and the Consultant parties. The audits will provide an assessment of effectiveness of mitigation measures and institutional development and whether any unanticipated effects occur due to the project activities. These audits will be followed by Corrective Action Plans (CAP) to modify various issues identified during the audits.

8.2 Implementation Mechanism for Mitigation Measures

The environment management cell developed for the upcoming project will ensure the implementation of the mitigation measures suggested for the proposed project. The details of the implementation mechanism for the mitigation measures have been discussed below:

a. Construction Phase

i. Air Environment

The management plan for the air environment focuses on dust control trough paving of major access roads, water sprinkling, gaveling of other roads, proper material storage and reduction of vehicular speeds by provision of speed breakers. The plan also focuses on some of the basic procedural changes in activities associated with the construction pattern like idling time reduction of vehicles, temporary construction of portable concrete/ asphalt plant at sites, improved maintenance of machineries and equipment, etc. To ensure the implementation of mitigation measures, following actions will be adopted:

- Pollution control check points will be provided within site
- Visual inspection for black smoke generating equipment and vehicles
- Inspection of covering sheets for vehicles transporting construction materials
- Paving of roads to be scheduled prior to commencement of heavy vehicular movement
- Adoption of dust control measures like use of dust suppressors will be made apart of the contractual agreement of the site contractor
- Site contractor to furnish monthly reports for the progress of the work and compliance with the agreement.
- Ambient air quality monitoring during construction phase as per the environmental monitoring plan.

ii. Noise Environment

The mitigation measures recommended for noise control include providing construction workers with earmuffs/earplugs, limiting time of exposure by job rotation and restricting construction activities during daytime. The implementation mechanism for the noise environment has been described as follows:

- Machinery to be procured for the construction activities will be in conformance to the emission standards of CAAB.
- The workers employed in high noise areas will be provided with protective equipment on a daily basis.
- Log book for monitoring the shifts of the workers will be maintained by the site supervisor.
- Monthly inspection of construction equipment will be done and the old and high noise generating equipment will be replaced.
- The greenbelt development plan, which is described later on in this report, will be scheduled along with the construction activities.

iii. Water Environment

The management plan for the water environment focuses on the prevention of contaminated runoff from flowing into the existing drains by installing silt traps. The water demand for the curing operations will also be reduced by direct spraying of water on concrete structures, painting of concrete structures with curing chemicals and covering of concrete structures with thick gunny bags. The compliance with mitigation measures will be checked using the following measures:

- The construction work will be carrying out mainly before or after the monsoon period in order to avoid the water contamination during monsoon season;
- Monitoring the water use by installation of water meters;
- Visual inspection of silt traps;
- Net imperviousness of the site will be checked by the contractor to ensure that it does not exceed the imperviousness factor;
- Periodical site maintenance reports for drainage system and performance of septic tank will be furnished by the site contractor;
- Regular maintenance of imperviousness of the surface drains in order to avoid ground water contamination;
- Water saving measures will be made a part of the contractual agreement and compliance with the terms of the agreement will be delivered on a monthly basis; and
- Monitoring of surface and groundwater quality as per the Environmental Monitoring Plan.

iv. Land Environment

The major areas of concern on land environment will be soil erosion and disposal of construction waste. The soil erosion will be controlled by adopting structural and nonstructural controls and by the provision of vegetative cover. Topsoil shall be stripped off and stockpiled for future use in landscaping. A detailed waste management plan has been developed for the construction phase. The details of implementation of the mitigation measures have been discussed below:

- Inventory of waste and maintenance of proper records
- Monitoring reuse of construction waste
- The contractor will arrange details of domestic waste disposal areas prior to commencement of construction activities and will furnish the details of the same
- Net imperviousness of the site will be checked by the contractor to ensure that it does not exceed the imperviousness factor.

v. Ecological Environment

During the construction phase, proper management plan should be adopted to implement the mitigation measures that have been taken into consideration to reduce the overallimpact.Priorto the starting of construction, temporary fence should be erected along the proposed project site. This will reduce risk of wild animal causality. If some young animals are noticed during the cutting and clearance phase, they should be properly handled or work should be suspended in that portion for the time being during which relocation of that animal should be carried out, if possible. Before cutting of the trees, inspection of nest over the trees should be carried out to avoid chicks' casualty.

Furthermore, to conserve the ecological resources, minimal tree cutting will be proposed and the details of the tree felling will be properly compiled and a list of plantations, that can be carried out on the site will be furnished by the site contractor. Maintenance reports for the green areas will be submitted periodically to the site in charge. Creeper grasses may be considered for plantation over the paved slope of the canals.

vi. Socio Economic Environment

During this time of construction and pre-construction phase, following steps would be carried out as a part of the management plan to ensure successful implementation the mitigation measures:

- Contractors will be required to abide by the Bangladesh and/ or International Labor Laws regarding standards on employee working conditions, minimum wages for workers etc. whereas the occupational health and safety standards will be followed as per the guidelines of Building and Other Construction Workers (Regulation of Employment and Working Conditions Act, 1996 and Factories Act 1948).
- The project would provide some kind of enjoyment facilities to the workers in order to encourage them further in their work practices.

b. Operation Phase

i. Energy Conservation Measure

Airport terminals require large amounts of energy (lighting, heating, ventilation, air-conditioning, etc.). Many airport operators have reduced operating expenses by focusing on energy efficiency, considering both energy supply and energy consumption. Some airports have used terminal roofs or land areas to host alternative energy systems. Many airports have eliminated unnecessary energy use in airport facilities as a way to reduce operating expenses. For example, airports have updated mechanical systems and lighting technology to current standards, and some airports have used available rebates to install up to date technology. Some of the most successful practices for energy conservation in airports are:

- Strategies to reduce redundant electric lighting and use daylight when available.
- Energy use metering.
- Passive solar applications.
- Recapture of waste heat from existing equipment
- Tightening up building envelopes to reduce energy loss.
- Lighting controls, including occupancy sensors.
- Light positioning.
- Host third party alternative energy production opportunities
- Operational changes such as low-cost HVAC optimization, systematic maintenance of equipment, regular O&M energy audits
- Energy efficient remodeling/commissioning practices
- No-cost activities such as prohibiting vehicle idling, turning off equipment when not needed, temperature controls.
- Identifying energy efficiency resources and checking resources regularly.

Use of energy conservation measures as part of airport design and operations, will be part of the Master Planning and the specifications as part of awarding development work of this airport to a private contractor.

ii. Air Environment

The main source of emissions during the operation phase will be the vehicular movement within site and stack emissions from DG sets installed for power back up. The control measures will include development of proper traffic management plan and provision of adequate stack heights for DG sets and compliance with the ICAO standards in operating the aircraft. The following implementation mechanism will be adopted:

- Registration of vehicles will be done to estimate the adequacy of parking facilities
- The internal road design of the airport with proper sections, medians and intersections will be as per Bangladesh codes of practices in order to ensure smooth traffic flow
- Road signage will be provided to facilitate smooth flow of traffic
- Scientifically designed traffic signaling system will be provided within the site boundary
- Aircrafts in the airside area shall run on the low sulfur diesel
- Time to time monitoring of the stack of Aircrafts will be maintained by the contractor as per the monitoring schedule.
- All passenger coaches shall run on CNG and shall have a mandatory pollution under control certificate.

iii. Noise Environment

The noise emissions will be due to the vehicular movement within site and aircraft operation. In the feasibility study the noise level for the operation of aircraft has been forecasted as 50dB along the boundary line of airport; which noise level is within the acceptable limit for residential areas at day time. Even though, the following implementation mechanism will be adopted to reduce noise impact:

- Appropriate traffic infrastructure facilities will be provided to avoid traffic congestion and excessive honking.
- The greenbelt development plan, which is described later on in this report, will be scheduled both side nearby the Dhaka Mymensingh highway along with the boundary line of airport and the airport residential area.
- The noise levels will be monitored on a regular basis to check the efficacy of the mitigation measures.
- Existing and future land use planning of the nearby areas, where the noise impact will be the highest can be modified by the contractor after studying the Master Plan and continuous liaison with the Government planning authorities.
- The site in-charge of the environment management cell will continuously keep record of all the aircrafts, so that the noisiest aircraft operation can immediately be restricted.

iv. Water Environment

The mitigation measures for the water environment will include appropriate treatment of wastewater in a sewage treatment plant, reduction of fresh water demand by using the treated effluent to the maximum extent possible and collection and use of storm water to recharge the ground water level. The implementation of mitigation measures will be ensured in the following manner:

- Installation of water meter as per ISO standards at the inlet point of the water uptake and the discharge point to monitor daily consumption
- By monitoring the groundwater level for the pre monsoon and post monsoon season to estimate the drawdown curve
- By carrying out regular inspection and cleaning of storm water drains
- By maintaining and cleaning the rain water harvesting structures regularly to facilitate the collection and recharging of ground water
- The STP operator will be made to set a laboratory for monitoring the quality of the effluent

- Climate change impact has been considered to accumulate heavy rain/ storm water in the proposed three retention ponds located inside the project site (**Annex 8**: "Drainage Ponds and Drainage Canal of Rainwater Discharge" and find details in design documents).

v. Land Environment

The project activities will lead to generation of waste. A detailed waste management plan has been developed for the site which includes waste segregation, treatment and disposal. Visual inspection of bins, segregation yard and inventory of waste being treated and disposed of will be maintained.

vi. Ecological Environment

During the operational phase of the proposed project, plantation shall be done for three specific reasons:

- Plantation in and around the airport to reduce noise impact
- Plantation to absorb air pollutant
- Re-plantation, pertaining to the cutting of trees
- Plantation of Creeper grasses over the paved slope of the canals

During the operational phase, air emissions will be from the vehicular traffic and operation. An adequate greenbelt development at and around the project site has been suggested to reduce the impact on the flora and fauna as the plant species will act as air and noise pollutants sink. Green belt will be developed in and around the airport area and along the road side.

Based on the location, suitable type of trees and plants will be recommended as a part of the greenbelt development plan to mitigate the impact and to restore the damaged habitat of the region.

Guideline for Plantation & Landscaping: Selection of plant species is to be done on the basis of their adaptability to the existing geographical conditions and the vegetation composition of the topography of the region.

As the area is an open area and open scrub, suitable native species of flora to be planted, those are found in that geographical region.

Selection of plant species will be done carefully, as such they are of fast growing verity, perennial and evergreen with thick canopy cover, large leaf area index (LAI) and a high pollution attenuation factor (PAF) for effective dry deposition of particles and fibers. On the same time, the species selection must take into consideration those trees, which do not attract the birds in order to avoid the chances of bird hitting with aircraft.

Green Belt Development Plan: in order to assure proper greenbelt development, following management plan will be adopted:

- Healthy and established sapling having 1m height should be selected for planting in greenbelt to avoid mortality of plants.

- Pit measurements of 0.6 m x 0.6 m x 0.6 m are to be dug up at desired point in triangular pattern.

- The tall shrubs and dwarf trees with 3 m spacing between plants and rows is sufficient while medium and tall trees in middle and rear rows are to be planted at a distance of 6-7m and 8-10m apart respectively depending upon the space available.

- Close plantation is recommended for accommodating more number of trees per unit area resulting in more leaf surface.

- The pit should be filled with mixture of cow dung manure and soil in ratio of 1:4. 10 grams BHC of 10% concentration should be properly mixed with the soil and manure to kill the termites and insect.

- Close plantation with three tiers system keeping dwarf trees with round canopy exposed to the source of emission followed by medium and tall trees with cylindrical canopy is ideal design for the polluted area, because all plants are exposed to the pollutants. This plantation shall be done inside the airport boundary lines and inside the airport residential area boundary lines nearby Dhaka Mymensingh highway. The minimum thickness of this proposed green belt is 100 meter as per recommendation of IATA. Plan detailing the location of Green Belt will be prepared and it will be followed during implementation.

- Close plantation also result in tall trees with deeper roots and ultimately yield more bio-mass per unit area and more efficient absorption of pollutants. Plantation of trees in staging arrangement in multiple rows across the direction of the wind is recommended for better trapping and absorption of the pollutants.

- Provide Heterogenic trees in green belts development.

vii. Socio Economic Environment

The following plans will be taken into considerations by the contractor for successful implementation of the mitigation measures:

Grievance Cell: A public grievance cell will be maintained for the people, the site manager will immediately look into raised concern. A complaint book will also be maintained within the site and suggestions given by the people will be taken into account for further development.

Regular Training Programs: The Environmental and Social Specialists of the Management Cell will arrange regular training program for the CAAB officials and the contractor's representatives to implement EMP properly. Then contractor will arrange training facilities for labors and other site staffs on environmental, social and safety issues as per the project needs. Environmental Management Cell will monitor the training activities.

c. Summary of Implementation Mechanism

The summary of implementation mechanism for the mitigation measures during construction and operation phases has been shown in the following **Table 8-1**.

Table 8-1 Summary Mechanism for Implementation of Mitigation measures

No.	Environmental Items	Mitigation Measures	Implementing agency	Responsible Agency
Construction Phase				
1.	Air pollution	• Water sprinkling for preventing re-suspended soil • Cleaning activity of inside hauling road and entrance of the airport • Using of low air pollutant emission type machinery for construction	Contractor	CAAB
2.	Water Pollution	• Using wastewater treatment such as sedimentation tank for discharge to the canals	Contractor	CAAB
3.	Solid waste	• Segregation and sorting of the waste for appropriate reusing and recycling	Contractor	CAAB
4.	Soil contamination	• Securing that contaminated soil will be isolated from clean soil.	Contractor	CAAB
5.	Noise/Vibration	• Using of low noise type machinery for construction	Contractor	CAAB
6.	Existing social infrastructures and services	• Installation of inside hauling road for reducing impact to outside road.	Contractor	CAAB
7.	Local conflicts of interest	• Negotiating for relocation	CAAB	CAAB
8.	Landscape	• Cleanup activity in construction site for impact mitigation of scenery to the airport users and residents	Contractor	
9.	Infectious disease such as HIV/AIDS	• Complying with clause of HIV/AIDS prevention measures.	Contractor	CAAB
10.	Working Environment (includes work safety)	• Installing Personal Protective Equipment (PPE), hearing protection for workers on demolition of concrete.	Contractor	CAAB
11.	Accidents	• Preparing traffic management plan and road safety plan for preventing road accident around the airport.	Contractor	CAAB
Operation & Maintenance				
1.	Air pollution	• Installing multi storey car parking with adequate parking number for reduction of gas emission from waiting cars.	CAAB	CAAB
2.	Water Pollution	• Installing wastewater treatment facility for complying with the standards mentioned in Schedule 10 of the ECR 1997 for inland water discharge	CAAB	CAAB
3.	Solid waste	• Proper collection and disposing all internally generated solid waste	CAAB	CAAB
4.	Soil contamination	• Installing Oil separator for drainage in oil farm	CAAB	CAAB
5.	Noise/Vibration	• Establishing complaint section for issue of airport activity including aircraft noise	CAAB	CAAB
6.	Existing social infrastructures and services	• Installing road infrastructure for smooth traffic and human movement near airport.	CAAB	CAAB
7.	Accidents	• Installing road infrastructure for smooth traffic and human movement near airport.	CAAB	CAAB
8.	Global Warming	• implementing energy reduction equipment for lighting or air conditioning.	CAAB	CAAB

8.3 Bangladesh's Policy on the Airport Infrastructure

Bangladesh's Policy on Airport Infrastructure states in its preamble that "It is now increasingly recognized that aviation, far from being a mere mode of transportation for an elite group, is crucial for sustainable development of trade and tourism".

a. Environmental Issues for Airport Development

The operation of airports has to be in full accord with the provisions relating to prevention of air, water and noise pollution. All effluents would require to be treated before these are allowed to leave the airports. There will be close liaison with state governments and municipal authorities to maintain cleanliness and remove encroachments in airports and surrounding areas, so as to obviate the menace of bird hits. Large scale plantations and other eco-friendly activities like construction of golf courses would be encouraged around airports, both for environmental purposes as also to provide relaxation to transit passengers. Such environmental issues would need close interaction with regional planning bodies.

The airports would be set up after the requisite environmental clearances and a timeframe of 90 days would be prescribed by Ministry of Environment and Forests for completing the processing of applications for such clearances.

Improved connectivity between airports and adjacent population centers should form an integral part of each airport infrastructure development projects and not be left to evolve by it.

b. Commercial Activities

Across the world, the trend is towards a very high percentage, ranging from 60 to 70%, of the total revenue of airport operators being generated from non-aeronautical source sat major airports. In Bangladesh, although these services are even now provided by private agencies, the comparable figure for AAI at international airports is just 22%. There will be a major thrust towards increasing the share of commercial revenue emerging from on-aeronautical sources. This will help in optimal exploitation of the full commercial potential of airports and make many airports not only viable but capable of generating surpluses for further expansion and development.

In order to maximize the revenue while at the same time maintain transparency, there will be a master plan for development of commercial activities and facilities, as part of the overall master plan approved by the management, for the airport as a whole. The space-use patterns will normally not be deviated from.

In the allocation of space among concessionaires, there will be a strict adherence to stipulated procedures, while maintaining sufficient flexibility in order to ensure quality products and services and attract the holders of reputed brand-names. For this purpose, innovative tendering procedures involving limited tenders, two-bid system, use of net present value of bids spread over several years, grant of management contracts, bunching of similar facilities etc. will be devised.

Except for user developmental fees, there will be total freedom for airport operators in the matter of raising revenue through non-aeronautical charges and there will not be any Government control over the same.

8.4 Environmental Management Action Plan

The environment management cell developed for the upcoming project will ensure the implementation of the mitigation measures suggested for the proposed project. The details of the implementation mechanism for the mitigation measures have been discussed below in **Table 8-2.**

Table 8-2 Environmental Management Action Plan

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/ Standards
Planning Phase						
Updating of safeguard documents	- IEE/ EMP will be updated at the time of detailed design and will be revised by the DSC team if needed.	DSC with input from the contractor	PIU	Updated IEE/EMP	---	JICA Environment Guideline, 2010 ECR 1997
Capacity Building	- Develop and submit for approval a capacity building and training program to achieve the expected standards.	Contractors	DSC PIU	Capacity building and training program	---	All applicable laws and regulations
Work schedule	- Ensure careful planning and scheduling of the activities (CEMP).	Contractors	DSC PIU	Plan and schedules	Prior to start of construction	EIA report All applicable laws and regulations
Traffic Management Plan	- Prepare a traffic management plan and road safety plan.	Contractors	DSC PIU	Plan and schedules	Prior to start of construction	EIA report All applicable laws and regulations
Barricades and warning signs	- Use easily transportable barricades and warning signs such as those made of high reflector plastic materials. - Also use aluminized rolled warning signs to warn the public.	Contractors	DSC PIU	Lists and samples of warning signs and barricades	Prior to start of construction	Detailed design documents
Workers	- Employ workers with adequate experience, training, and know-how.	Contractors	DSC PIU	Workers list (for internal monitoring)	Prior to start of construction	Detailed Design documents
Legislation, permits, and agreements	- In all instances, CAAB, contractors and consultants must remain in compliance with relevant local and national legislation. - A copy of the EIA must be kept on-site and disclosed in CAAB websites.	PIU Contractor	DSC PIU	All applicable permits and approvals	Prior to start of civil works and as necessary	Ensure location clearance and ECC from DOE as per guidance provided in ECR 1997 is obtained

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/ Standards
Access to site	- Access to site will be via existing roads. The contractor will need to ascertain the existing condition of the roads and repair damage due to construction.	Contractor	DSC PIU	Traffic management plan Road condition	Prior to start of construction	Minimal traffic disturbance
Setting up of construction camp	Finding Suitable location as approved by the concerning authority.	Contractor	DSC PIU	Location plan Facilities plan	Prior to start of construction	Approved location plan Construction method Facilities plan
Establishing equipment lay-down and storage area	- Storage areas should be secure to minimize the risk of crime and should be safe from access by children, animals, etc. - Hazardous materials should store at secure place.	Contractor	DSC PIU	Location plan Facilities plan	Prior to start of construction	Approved location plan Construction method Facilities plan
Education of site staff on general and environmental conduct	- Environmental awareness training for staffs. - Staff must be trained up for operating equipment - All employees must undergo safety training.	Contractor	DSC PIU	Records of training	Prior to start of civil works and every new employee	Revised/Updated IEE/EMP (capacity building) Bid document CEMP
Construction Phase						
Occupational health and safety	-Using PPE, hearing protection for workers on demolition of concrete -Avoiding direct contact with the contaminated water and soil	Contractor	DSC	-The number of workers and the number of installation of hearing protections on demolition site Use of PPE	As work progresses	Construction method Detailed design documents Bid document JICA Construction Safety Guidelines
Construction camps and storage areas	-Open areas or surrounding bushes are not being used as toilet facility. - Litter is to be collected daily. - Bins and/or skips should be emptied regularly and waste should be disposed of at the pre-approved site.	Contractor	DSC	As mentioned in relevant impacts & mitigation section of the report	As work progresses	Approved location plan Bid document JICA Construction Safety Guidelines

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/ Standards
	- Camp and working areas are kept clean and tidy at all times. - Camp is to be checked for spills of substances i.e. oil, paint, etc. - Camp is to be remake to its initial situation.					
Dust and air pollution	-Sprinkling water to the carrying road and working site in the airport area. -Cleaning of carrying route in airport area and around the entrance of the airport. -Using of low air pollutant emission type machinery for construction	Contractor	DSC	-The number of sprinkling times and the number of cleaning times to the carrying road and entrance of the airport	As work progresses	No visible increase in dust and particulate matters Compare against baseline data Bid document JICA Construction Safety Guidelines
Noise levels	-Using of low noise type machinery for construction	Contractor	DSC	Complaints from community Noise level monitoring record	Regular monitoring during construction (e.g. 3 monthly)	ECR 1997 Compare against baseline data Bid document JICA Construction Safety Guidelines
Water quality	-Using appropriate measures for avoiding spread of pollution based on chemical analysis -Using wastewater treatment such as sedimentation tank for discharge to the canals (if any)	Contractor	DSC	Complaints from community Waste disposal manifest/record -The concentration of SS in the treated discharge water	-Regular monitoring during discharging (e.g. 3 monthly)	No increase in water pollution due to the project Compare against baseline data Bid document JICA Construction Safety Guidelines
Waste management	-Segregation and sorting of the waste	Contractor	DSC	Complaints from community Waste disposal manifest/record	Regular monitoring during construction (e.g. 3 monthly)	No dumped wastes and litter at work sites at all times Bid document JICA Construction Safety Guidelines
Conservation of natural	-Avoid unnecessary tree cutting	Contractor	DSC	-The number of cutting tree and	-Before the construction and	

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/ Standards
environment	-Plantation of tree			planting tree	after the construction	
Cultural and historical environment	-Complying with relevant law and order of relevant department	Contractor	DSC	sudden finding	As necessary	All finding shall be reported and turned over to the Department of Archaeology.
Operation and Maintenance phase						
Land contamination	-Securing that contaminated soil will be isolated from clean soil.	Contractor (up to service delivery period) CAAB	CAAB Independent Monitoring Agency	Specifications in the O&M Manual	As determined in the O&M Manual	As specified in the O&M Manual and all applicable laws and regulations
Wastewater	- After treatment, the discharge standards need to be followed similar to the standards mentioned in Schedule 10 of the ECR 1997 for inland water discharge	Contractor (up to service delivery period) CAAB	CAAB Independent Monitoring Agency	Specifications in the O&M Manual	As determined in the O&M Manual	ECR 1997 (Rule 13: The standard limits of the discharge of liquid wastes shall be determine in accordance with the standards specified in Schedule 10)
Noise	- Promote the using of low noise aircraft to airlines companies recommended by ICAO. -Implement of the complaint section for noise.	- CAAB -Contractor (up to service delivery period) CAAB	CAAB Independent Monitoring Agency	ICAO Environmental Technical Manual -Specifications in the O&M Manual	-Regular monitoring (e.g. 3 monthly) -As determined in the O&M Manual	ICAO Environmental Technical Manual -As specified in the O&M Manual and all applicable laws and regulations
Water use	- Minimize water use through dedicated metering of water consumption	Contractor (up to service delivery period) CAAB	CAAB Independent Monitoring Agency	Specifications in the O&M Manual	As determined in the O&M Manual	As specified in the O&M Manual and all applicable laws and regulations
Health, hygiene, and safety	-Safety training for all staff	Contractor (up to service delivery period) CAAB	CAAB Independent Monitoring Agency	Specifications in the O&M Manual	As determined in the O&M Manual	As specified in the O&M Manual and all applicable laws and regulations

Note: DSC = Design and Supervision Consultants, PIU= Project Implementation Unit

8.5 Effectiveness of EMP

It is expected that the mitigation measures mentioned in the EMP will be effective to reduce the adverse impacts and enhance the beneficial impacts. The following **Table 8-3** presents the Matrix with graduation of environmental impacts in terms of magnitude, type, extent and duration after proper implementation of mitigation measures as suggested in the EMP.

Table 8-3 Matrix with graduation of environmental impacts after implementation of EMP

Parameters		**Impact**						
		Magnitude (Weight, W)	**Factor (F)**	**Total Impact T=W*F**	**Type**	**Extent**	**Duration**	**Color**
Environmental	Topography	1	0	0	-	-	-	
	Climate	-2	1	-2	Indirect	Regional	Long	
	Air	-1	3	-3	Direct/ Indirect	Local/ Regional (*1)	Short/ Long	
	Soil and water	-1	3	-3	Direct	Local	Short	
	Noise	-1	3	-3	Direct/ Indirect	Local/ Regional	Short/ Long	
	Solid Waste	0	2	0	Direct	Local	Short	
Economy	Land use	0	2	0	-	-	-	
	Industry and Agriculture	+1	3	+3	Indirect	Local/ Regional	Short/ Long	
	Infrastructure	+2	3	+6	Indirect	Local/ Regional	Short/ Long	
	Transportation and communication	+2	3	+6	Indirect	Local/ Regional	Short/ Long	
Ecological	Vegetation and Fauna	-1	3	-3	Direct	Local	Short	
	Areas classified or Protected	0	3	0	-	-	-	
	Wetland habitats	-1	2	-2	Direct/ Indirect	Local	Short/ Long	
Socio-Cultural	Landscape and areas of cultural value	0	2	0	-	-	-	
	Demography	+1	2	+2	Direct/ Indirect	Local/ Regional	Short/ Long	
	Health and Educational facilities	+2	3	+6	Indirect	Local/ Regional	Short/ Long	
	History, culture, and tourism	+2	3	+6	Direct/ Indirect	Local/ Regional	Short/ Long	
	Occupational health and safety	0	3	0	Direct/ Indirect	Local	Short/ Long	

*1: Green-house effect from carbon dioxide (CO_2) is Global.

Representation of factors

Not Significant (1)	Moderately Significant (2)	Significant (3)

Representation of Weights

Major Negative (-3)	Moderate Negative (-2)	Minor Negative (-1)	No impact (0)	Minor positive (+1)	Moderate positive (+2)	Major Positive (+3)

8.6 EMP Budget

During construction period all kinds of expenditure related with environmental management purpose will carry out by contractors. After construction Civil aviation will monitor the environmental quality (air, water, soil and noise). The budget shown in **Table 8-4** is prepared to show the cost separately for the CAAB as well as for Contractor. CAAB will bear the costs during pre-construction and operation phase. The contractor will be responsible for the construction phase.

Table 8-4 EMP Budget Details

Sl. No.	Environmental Component	Items	Unit	Quantity	Rate, BDT	Amount, BDT (CAAB)	Amount, BDT (Contractor)
	A. Pre-Construction Stage						
1	Technical Support	Review of EIA and preparation of updated EMP	L. S.			Included under Civil Works	0
2	Land Acquisition and Resettlement	Compensation against land acquisition	L. S.			Included under Resettlement Plan	0
3	Flora and Fauna	Remove trees and wildlife conservation	L. S.			Included under Civil Works	0
4	Air & Dust	Ambient air quality measurement	Number	5	70,000	3,50,000	0
5	Noise Level	Purchase sound level meter and do monitoring as prescribed in the monitoring plan	Number	5	15,000	75,000	0
6	Surface water quality	Measurement of surface water quality	Number	5	50,000	2,50,000	0
7	Ground water quality	Measurement of ground water quality	Number	5	50,000	2,50,000	0
	Sub-total for pre-construction stage					**9,25,000**	**0**
	B. Construction Stage						
8	Drainage Congestion	Provision of adequate opening	L. S.			0	2,00,000
9	Erosion and Siltation Control	Protection for excavation works	L. S.			0	2,50,000
10	Air & Dust	Measuring ambient air & dust quality	Number	10	50,000	0	5,00,000
11	Surface water Quality	Surface water quality	Number	4	50,000	0	2,00,000

Sl. No.	Environmental Component	Items	Unit	Quantity	Rate, BDT	Amount, BDT (CAAB)	Amount, BDT (Contractor)
12	Ground water Quality	Ground & drinking water quality	Number	3	50,000	0	1,50,000
13	Solid Waste	Disposal and management of solid waste	L. S.			0	3,00,000
14	Occupational Health and Safety Environment (HSE)	PPE, ambulance, clinic, First Aid Box etc.	L. S.			0	4,00,000
15	Traffic signs and Road Safety	Installation of traffic signs and ensure road safety	L. S.			0	2,00,000
	Sub-total for construction stage					**0**	**22,00,000**
	C. Operation Stage						
16	Surface water	Surface water quality	Number	5	10,000	50,000	0
17	Ground water	Ground water quality	Number	5	10,000	50,000	0
	Sub-total for Operation Stage					**1,00,000**	**0**
	D. Training and Miscellaneous						
18	Training and Awareness Programs		L. S.			1,000,000	0
19	Management Information System		L. S.			500,000	0
	Sub Total for Training and Miscellaneous					**15,00,000**	**0**
	Total (A+B+C+D)					**25,25,000**	**22,00,000**
	Contingencies 10%					**2,52,500**	**2,20,000**
	Grand Total Environmental Cost in BDT					**27,77,500**	**24,20,000**
	Grand Total Environmental Cost for CAAB & Contractor in BDT					**51,97,500**	

Institutional arrangement

Civil Aviation will make a cell with an environmentalist, a technical person and a monitoring officer they will responsible and M&E the implemented activities and ensure environmental quality. They will be permanent staff of civil aviation.

8.7 Environmental Monitoring Plan

Environmental Monitoring Plan has been prepared to guide the monitoring process smoothly. Identified parameters will be monitored during the construction, and operation and maintenance phae as per plan mentioned in **Table 8-5** below:

Table 8-5 Environmental Monitoring Plan

Project stage	Monitoring Item	Parameter	Method of monitoring	Monitoring area/ point	Term / Frequency	Place of submission
Construction Phase	Occupational health and safety	1.W=The number of workers on demolition site 2.I=The number of installation of hearing protections on demolition site 3. Ratio (IR)=I/W 4. Number of PPE must be equal or more than W.	To monitor the state of implementation/ Collecting implementation data from contractor	Whole of the project site	During the demolition of concrete/ Reporting for once in 3 months	CAAB, DOE
	Dust, Air pollution	1. The number of times of water sprinkling to the carrying road and entrance of the airport 2. The number of times of cleaning of the equipment and work site	To monitor the state of implementation/ Collecting implementation data from contractor	Carrying road and entrance of the airport Equipment and work site	During the construction/ reporting for once in 3 months	CAAB, DOE
	Noise	Construction Noise	Noise survey	Around the construction area	During the construction/ Every 3-month survey at a.m. and p.m. of typical day	CAAB, DOE
	Water quality	pH, Temp, Turbidity, EC	Water quality survey	Discharging point to the canal	During the construction/ Every 3-month survey at typical day	CAAB, DOE
	Solid waste	1.Types of waste 2.Monthly quantity of waste	Collecting data from contractor	Whole of the project site	During theconstruction/ Reporting for once in 3 months	CAAB, DOE
	Natural	1.The number of	1.Inventory survey	Whole of the	1.Before the	CAAB,

Project stage	Monitoring Item	Parameter	Method of monitoring	Monitoring area/ point	Term / Frequency	Place of submission
	environment	cutting tree 2. The number of planting tree	2. Implementation survey	project site	construction 2.After the construction	DOE
Operation and Maintenance Phase	Land contamination	1. Quantity of contaminated soil 2. Method of the storing and managing contaminated soil	To monitor the state of implementation	Whole of the project site	During operation/ Annual report	CAAB, DOE
	Air quality	NOx, SO2, PM10, PM2.5	Air quality survey	Project site	During operation/ Annual report	CAAB, DOE
	Wastewater	pH, Temp, SS, EC, TDS, NH3, COD, BOD, Coli, Oil& Grease	Water quality survey with laboratory analysis	Discharging point of the treated water	During operation/ Annual report	CAAB, DOE
	Aircraft noise	1. The status of promoting the operation of low-noise aircraft recommended by ICAO 2. The status of implementation complaint section 3. L (den)	1. Frequency of low-noise aircraft operations from/to HSIA 2. To monitor the state of implementation 3. Continuous measurement and calculating L(den) and compare with baseline	1. Project site 2. Project site 3. At the point of near residential area	During operation/ Once	CAAB, DOE

8.8 Environmental Monitoring Format

During construction monitoring will be conducted for parameters like occupational health and safety, dust and air pollution, construction noise, water quality, solid waste, and natural environment. During operation and maintenance phase, parameters like land (soil) contamination, air quality, waste water quality, ambient noise level, aircraft noise, etc. will be monitored. Monitoring formats for the above parameters have been prepared and given in **Annex 2**.

9. INFORMATION DISCLOSURE AND STAKEHOLDERS CONSULTATION

9.1 Project Stakeholders

Primary stakeholders are:

- Companies that construct and operate on the proposed HSIA site;
- People who work at the site, either employed by a company or self-employed;
- Companies and workers operating in areas adjacent to the HSIA site;
- Companies and private individuals who are benefitted from the existing HSIA site.

Secondary stakeholders are:

- Civil Aviation Authority of Bangladesh(CAAB) as implementer;
- Other Government institutions whose remit includes areas or issues affected by the project (City Corporations, Planning Authorities, Department of Public Health Engineering, Ministry of Finance, Ministry of Health, Ministry of Environment, Roads and Highways Department, etc.);
- NGOs, CBOs and other representatives of persons who may be affected by the project;
- The beneficiary community in general; and
- The JICA.

9.2 Consultation and Disclosure

CAAB with the engaged Consultants will extend and expand the consultation and disclosure process significantly during implementation of HSIA Expansion Project. The CAAB will engage experienced personnel to handle this key aspect of the program, who will conduct a wide range of activities in the target areas to ensure that the needs and concerns of stakeholders are registered, and are addressed in project design, construction or operation where appropriate. The program of activities will be developed during the detailed design stage, and is likely to include the following:

Consultation during detailed design:

- Focus-group discussions with affected persons and other stakeholders to hear their views and concerns, so that these can be addressed in project design where necessary; and
- Structured consultation meetings with the institutional stakeholders to discuss and approve key aspects of the project.

Consultation during construction:

- Public meetings with major stakeholders to discuss and plan work programs and allow issues to be raised and addressed once construction has started; and
- Smaller-scale meetings to discuss and plan construction work with primary stakeholders to reduce disturbance and other impacts, and provide a mechanism through which affected persons can participate in project monitoring and evaluation.

Project disclosure:

- Public information campaigns (via newspaper, TV and radio) to explain the project to the urban populations and prepare them for any disruption they may experience once the construction program is underway;
- Public disclosure meetings at key stages to inform the public of progress and future plans, and to provide copies of summary documents in the Bangla language; and
- Formal disclosure of completed project reports by making copies available at convenient locations in each target town, informing the public of their availability, and providing a mechanism through which comments can be made.

9.3 Public Consultations Conducted

Different techniques of consultation with stakeholders were used by the Consultants during the planning stage of project preparation (interviews, public meetings, group discussions, etc). Details of these consultation meetings in the planning stage have been presented in the Annexes. A questionnaire was designed and environmental information was collected. Apart from this, a series of public consultation meetings were conducted during the project preparation. Various forms of public consultations (consultation through ad hoc discussions on-site) have been used to discuss the project and involve the community in planning the project design and mitigation measures. Issues discussed and feedback received during preparation of EIA report along with details of date, time, location, and list of participants are given in the Annexes mentioned below.

i. Individual Consultation

Conducted interview with various local people those are living close airport area for gathering their opinion on the Project and its impact. Interviewees were different professionals. Individual Consultations by JICA Study Team has been detailed in **Annex 24**.

ii. Focus Group Discussion

Two Focus Group Discussions (one by DDC and the other by JICA Study Team)were organized with the participants of the representatives from different Stakeholders of various occupations around the project location who are directly or indirectly benefited or affected by the project. The discussion program was arranged as a medium of expressing opinions of the local people about the project. The details of these public consultations are given in **Annex 10 and 22.**

iii. Key Informants Interview

KII was conducted with different high professionals like Environmentalist, sociologist, architecture, climate change specialist. A guideline was developed for conducting interview with the key personnel. Their suggestions and recommendations will be given priority for the development of project. The detailed outcome of the meeting has been elaborated in **Annex 23.**

iv. Information Disclosure Meeting (IDM)

Information Disclosure Meeting (IDM) was conducted with Government and Non-Government and stakeholders. All findings were disclosed in the meeting including the results of the Source Testing of Air, Water, Soil, Noise Modeling, Tree Inventory, Social Study, Field Observations, Expert Opinions, etc. and public opinions were recorded on these issues. The detailed outcome of the meeting has been elaborated in **Annex 26.**

v. Consultation with Former Lease Holders

Within the proposed 3rd terminal building, there are some existing structures, which have to be

removed for the Project. There are 2 former lease holders, who are still using the area and have their permanent structures. As the leases, have been expired in 2012, CAAB didn't renew the leases and asked them to evacuate. However, cases have been filed with the court of law and there is stay order. CAAB won the cases in the lower court in 2015 and now the litigation is pending with high court. Under this back drop, JICA Study Team wishes to listen to position/ views of the former lease holders and requested CAAB to arrange such meeting. The detailed outcome of the meeting has been elaborated in **Annex 25**.

10. CONCLUSIONS AND RECOMMENDATIONS

This study aims to understand initial environmental impacts for the HSIA airport upgradingproject in Dhaka as well as the relevant mitigation and monitoring plans would be asserted. In this section, in order to fulfill the aims of the study, the conclusions and recommendations have been conducted.

Based on the environmental assessment, all possible environment aspects have been adequately assessed and necessary control measures have been formulated to meet with statutory requirements, in the preparation of the IEE, EIA and EMP.

The overall conclusion is that if the mitigation, compensation and enhancement measures are implemented in full, there should be no significant negative environ-mental impacts as a result of location, design, construction or operation of this airport expansion project. There should in fact be some benefits from recommended mitigation and enhancement measures and major improvements in quality of life and individual, education, job and public health once the scheme is in operation.

The benefits of the project can be summarized as follows:

- This project aims at the infrastructural development of the area.
- The project will provide impetus to the growth of the area.
- Employ in the workforce people who live in the vicinity of the construction site to provide them with a short-term economic gain and
- Plant large-growing trees at the periphery of the site by the contractor to mask it from view and give it a more natural and pleasing appearance.

The proposed project is aimed at the infrastructural development of the area. The project will provide impetus to the growth of the area. Thus implementing this project will not have any significant negative impacts. Thus, the proposed project is a sustainable development and may be accorded environmental clearance.

Two straight recommendations which are as follows need to be followed by the concerning authority to ensure sound environmental and socio-economic condition**:**

- All mitigation, compensation and enhancement measures proposed in this EIA report needed to be followed.
- The Environmental Management and Monitoring Plan proposed in this report also need to be followed.

References

1. CivilAviationAuthorityof Bangladesh (CAAB),Feasibility Study,Upgradingworks ofHazratShahjalal InternationalAirport, Dhaka, The Government of the People's Republic of Bangladesh,October 2002

2. Danida, Mixed Credits, Appraisal, Upgrading of HazratShahjalal International Airport, Bangladesh, December 2003

3. Bangladesh Environment Conservation Act 1995

4. Bangladesh Environment Conservation Rules, 1997

5. Guide to the Environmental conservation Act 1995 and Rules 1997. Bangladesh Centre forAdvanced Studies, 1999

6. Statistical Yearbook of Bangladesh 2004

7. DhakaMetropolitan DevelopmentPlan (1995-2015), Structure Plan, Master Plan, and DetailedArea Plan for Dhaka City, VolumeIDhaka Structure Plan (1995-2015), Volume II Urban AreaPlan(1995-2005), December 1995

8. Upgrade of HazratShahjalalInternational Airport, Dhaka, Bangladesh, The Government of the People's Republic of Bangladesh, Tender Documents, Book 8, Environmental Reports, May 2010

Annex-1: JICA Environmental Checklist

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
1 Permits and Explanation	(1) EIA and Environmental Permits	(a) Have EIA reports been already prepared in official process? (b) Have EIA reports been approved by authorities of the host country's government? (c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied? (d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	(a) Y (b) N (c) TBC (d) N	(a) IEE Report and EIA TOR were submitted to Department of Environment (DOE). DOE approved them on 8th Sep, 2016. Based on the DOE approved TOR, a draft EIA report has been prepared in December 2016; and has been submitted to DOE. The draft EIA is now being updated and final EIA is expected to be submitted by early March. (b) Approval of EIA report will be requested from DOE after draft EIA report is updated. (c) To be confirmed later (d) "No Objection Certificate" will be obtained from relevant local authority and Department of Forest.
	(2) Explanation to the Local Stakeholders	(a) Have contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the Local stakeholders? (b) Have the comment from the stakeholders (such as local residents) been reflected to the project design?	(a) Y (b) Y	(a) Public consultation meeting and information disclosure meeting are conducted during EIA preparation between November 2016 and January 2017. (b) One comment from the stakeholders regarding water logging has been investigated in the EIA preparation and will be addressed in the Project.
	(3) Examination of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	(a) Y	(a) Various alternative plans including scope, extent, phasing, location, construction method, etc. have been examined in EIA. Also a "no project' situation has been examined.
2 Pollution Control	(1) Air Quality	(a) Is there a possibility that air pollutants emitted from the project related sources, such as airplanes will affect ambient air quality? Does ambient air quality comply with the country's air quality standards? Are any mitigating measures taken? (b)If the air pollution situation already exceeds the environmental standards near airports and incidental facilities and then the project will deteriorate the air quality, are the countermeasures of air quality taken?	(a) Y (b) N	(a) The current air quality (such as NOx or SOx) in project site is lower than other monitoring point in Dhaka. That means the influence of constructionactivity and aircraft emission is limited and there will be less possibility to exceeding the criteria of ambient air quality. And on particulate matter (PM10 and PM2.5), it is predicted that the impact from aircraft is small. (b)This project is not expected to deteriorate air quality.
	(2) Water Quality	(a) Do pollutants, such as Suspended Solids (SS), and oils contained in effluents comply with the country's effluent standards (BOD, COD etc)? Is there a possibility that the effluents from the project will cause areas not to comply with the country's ambient water quality standards?	(a) N	(a) The appropriate wastewater treatment plant will be installed complying with national effluent standard, so there will be no risk of pollution during operation stage. Oil separator will be installed at fuel farm to prevent oil entering into wastewater. During construction period, proper disposal of wastewater is responsibility of contractor and that will be ensured by appropriate clauses in the bidding document, for example, treatment for Suspended Solid, septic tank for sewerage, etc.
	(3) Wastes	(a) Are wastes generated from the airports and other project facilities properly treated and disposed of in	(a) Y	(a) During construction period, proper disposal of solid waste is responsibility of contractor and that will be ensured by appropriate clauses in the bidding

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		accordance with the country's regulations?		document, for example, separation of waste based on category, storage and disposal based on category, inventory control, etc. During operation stage, CAAB will be responsible to collect and dispose all internally generated solid waste according to Airport Maintenance Manual.
	(4) Noise and Vibration	(a) Does noise from aircraft comply with the country's standards? (b) Is there a possibility that noise and vibrations from various sources, such as airport users vehicles and vehicles for airport operations will adversely affect ambient noise levels? If impacts are anticipated, are adequate noise mitigation measures considered?	(a) Y (b) N	(a) Airport operation is exempted from country's noise regulation. However, the noise survey of current situation is done for comparing with the aircraft noise standard of Japan and the aircraft noise prediction is also executed based on the future landing and takeoff. The area in where aircraft noise is over Japanese standard will distribute around the airport. As a countermeasure of this, CAAB will promote the using of low noise aircraft recommended by ICAO. Complaint section for noise also will be established/implemented by CAAB. (b) Not likely. During construction period, proper noise management is responsibility of contractor and that will be ensured by appropriate clauses in the bidding document, for example, periodic maintenance of construction machinery, noise barrier, using low noise type machinery for construction, etc. However, the impact of noise around the airport will be insignificant because propagation distance of the noise will be ensured from construction site to boundary of the airport. Additionally, periodic maintenance of construction machinery will be done. The low noise type machinery will be utilized for construction. After the operation, the impact from vehicles travelling inside of the airport is expected. After the operation, the impact of noise around the airport will be insignificant because propagation distance of the noise will be ensured from construction site to boundary of the airport.
	(5) Soil Contamination	(a) Has the soil in the project site been contaminated in the past? Are adequate measures taken to prevent soil contamination by leakage of fuels?	(a)Y	(a) According to the result of the soil quality analysis, there are contaminated soils by lead (Pb) in the project site. During construction period, proper management is responsibility of contractor and that will be ensured by appropriate clauses in the bidding document, for example, contaminated soil will be kept isolated from clean soil, and deposited separately. During operation, soil contamination may happen due to fuel leak, but that will be minimized by appropriate measures, for example, oil separator at fuel farm and drainage system.
	(6) Subsidence	(a) In the case of extraction of a large volume of groundwater, is there a possibility that the extraction of groundwater will cause subsidence?	(a) N	(a) Soil improvement will be conducted by the Project for reclamation of large ponds with soft soil layers in order to prevent unequal settlement of pavements and to avoid damages by liquefaction during the event of earthquake.
	(7) Odor	(a) Are there any odor sources?Are adequate odor control measures taken?	(a) N	(a) Not likely.
3 Natural	(1) Protected Areas	(a) Is the project site located in protected areas	(a) N	(a) Project Site is not located within any protected area.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
Environment		designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?		
	(2) Ecosystem	(a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? (b) Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions? (c) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem? (d) Is there a possibility that the amount of water (e.g., surface water, groundwater) used by the project will adversely affect aquatic environments, such as rivers? Are adequate measures taken to reduce the impacts on aquatic environments, such as aquatic organisms?	(a) N (b) N (c) N (d) N	(a) No. (b) No. (c) No. (d) No.
	(3) Hydrology	(a) Is there any possibility that alteration of drainage system due to the constructions of airports and related facilities will adversely affect surface water and groundwater flows? (b) Do the facilities affect adversely flow regimes, waves, tides, currents of rivers and etc if the project facilities are constructed on/by the seas?	(a) N (b) N/A	(a) The airport construction will significantly increase the paved surface and reclaim large ponds that work as regulation ponds of storm water. The Project includes the construction of new regulation ponds to store increased run off from the paved area and to compensate the reclaimed regulation ponds. (b) Not applicable
	(4) Topography and Geology	(a) Does the project require the large scale change of topographic/geographic features? (b) Is there a possibility that civil works, such as cutting and filling will cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides? (c) Is there a possibility that soil runoff will result from cut and fill areas, waste soil disposal sites, and borrow sites? Are adequate measures taken to prevent soil runoff? (d) In the case of offshore projects, is there any possibility that the project will erode natural beaches?	(a) N (b) N (c) N (d) N/A	(a) No. (b) No. (c) Not likely during operation. During construction period, proper management is responsibility of contractor and that will be ensured by appropriate clauses in the bidding document, for example, protective measures for steep slope. (d) No.
4 Social Environment	(1) Resettlement	(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts	(a) N (b) N/A (c) N/A	(a) No. (b) Not applicable (c) Not applicable

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		caused by the resettlement? (b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement? (c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement? (d) Are the compensations going to be paid prior to the resettlement? (e) Are the compensation policies prepared in document? (f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, and the elderly people below the poverty line, ethnic minorities, and indigenous peoples? (g) Are agreements with the affected people obtained prior to resettlement? (h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan? (i) Are any plans developed to monitor the impacts of resettlement? (j) Is the grievance redress mechanism established?	(d)N/A (e) N/A (f) N/A (g) N/A (h) N/A (i) N/A (j) N/A	(d) Not applicable (e) Not applicable (f) Not applicable (g) Not applicable (h) Not applicable (i) Not applicable (j) Not applicable
	(2) Living and Livelihood	(a) Is there any possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if necessary? (b) Is there any possibility that the project causes the change of land uses in the neighboring areas to affect adversely livelihood of local people? (c) Is there any possibility that diseases, including infectious diseases, such as HIV will be brought due to immigration of workers associated with the project? Are adequate considerations given to public health, if necessary? (d) Is sufficient infrastructure (e.g., roads) available for the project implementation? If the existing infrastructure is insufficient, is a plan developed to construct new infrastructure or improve the existing infrastructure? (e) Is there any possibility that the airports and other	(a) N/A (b) N (c) Y (d) Y (e) N	(a), (b) Basically this project will be executed in airport area without land acquisition. Therefore, there are no impacts on the living conditions of inhabitants. (c) Workers will increase during construction. When the detailed plan is considered, adequate mitigation measures should be prepared for the risk of diseases. There will be a clause on HIV/AIDS prevention measures. (d) New access road is included in this project. Also, hauling road to construction site will be secured. (e) The projects have no impacts on sun shading and radio interference.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		project structures will cause a sun shading and radio interference?		
	(3) Heritage	(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?	(a) N	(a) No
	(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	(a) N	(a) No
	(5) Ethnic Minorities and Indigenous Peoples	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples? (b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources respected?	(a) N/A (b) N/A	(a), (b) Basically this project will be executed in airport area without land acquisition. Therefore, the projects have no impacts on the culture and lifestyle of ethnic minorities and indigenous peoples.
	(6) Working Conditions	(a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project? (b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials? (c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.? (d) Are appropriate measures taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents?	(a) N (b) Y (c) Y (d) Y	(a) No (b) Included in EIA (e.g. Using Personal Protective Equipment (PPE), hearing protection for workers on demolition of concrete). Also, JICA construction safety guidelines will be included in the Contractor's bid document. (c) Mentioned in EIA; will be included in contractor's bid document as Environmental Construction Specification (ECS) and Occupational Health and Safety (OHS) Manual. Also, JICA construction safety guidelines will be included in the Contractor's bid document. (d) Will be included in contractor's bid document as Contractor's responsibility.
5 Others	(1) Impacts during Construction	(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)? (b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts? (c) If construction activities adversely affect the social environment, are adequate measures considered to	(a) Y (b) Y (c) Y	(a) Environmental mitigation measures during construction were studied and draft EMP has already prepared. After this, these measures and plan will be modified corresponding with final EIA study. (b) Not likely to have such impact (c) Not likely to have such impact

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		reduce impacts?		
	(2) Monitoring	(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts? (b) What are the items, methods and frequencies of the monitoring program? (c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)? (d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	(a) Y (b) Y (c) Y (d) Y	Draft environmental monitoring plan has already prepared. After this these measures and plan will be modified corresponding with final EIA study. The items, methods, frequency and framework of monitoring are described in draft EMoF.
6 Note	Reference to Checklist of Other Sectors	(a) Where necessary, pertinent items described in the Roads, Railways, and Bridges checklist should also be checked (e.g., projects including large areas of deforestation). (b) If the airport is constructed on the sea, pertinent items described in the Ports and Harbors checklist should also be checked (e.g., projects including installation of power transmission lines and/or electric distribution facilities). (c) Where necessary, pertinent items described in the Forestry Projects checklist should also be checked (e.g., projects including large areas of deforestation).	(a) N/A (b) N/A (c) N/A	Not applicable
	Note on Using Environmental Checklist	(a) If necessary, the impacts to trans-boundary or global issues should be confirmed, if necessary (e.g., the project includes factors that may cause problems, such as trans-boundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	(a) N	(a)It is expected that the impact of these issues is small.

Annex-2: Environmental Monitoring Format

a. Construction Phase

Monitoring Item: Occupational health and safety

Company:	Monitoring period
Monitoring area/ Point:	
Project activity: Demolition of the existing apron/ Others (please mention)	
Monitoring method: Collecting implementation data	
Equipment used: -	
All workers using PPE: YES NO	

Date	Time	Parameter1	Parameter2	Parameter3	Remark
		W=The number of workers on demolition site	I=The number of installation of hearing protections on demolition site	Ratio=I/W	

I certify that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based upon my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature	Date

Monitoring Item: Dust, Air pollution

Company:	Monitoring period
Monitoring area/ Point:	
Project activity: Carrying construction materials	
Monitoring method: Collecting implementation data	
Equipment used: -	

Date	Time	Parameter1	Parameter2	Parameter3	Remark
		Sprinkling	Cleaning		
		□	□		
		□	□		
		□	□		
		□	□		
		□	□		
		□	□		
		□	□		
		□	□		
		□	□		
		□	□		
		□	□		
		□	□		
		□	□		
		□	□		
		□	□		
		□	□		
		□	□		
		□	□		
Total					

I certify that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based upon my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature	Date

Monitoring Item: Construction Noise

Company:	Monitoring Date
Monitoring area/ Point: As shown below figure	
Project activity:	
Monitoring method: Construction noise survey	
Equipment used: - Sound level meter Type ****	

Survey point	Time	Parameter1		Criteria	Remark
		Measured value L_{Aeq}(dB)	Baseline value L_{Aeq}(dB)	L_{Aeq}(dB)	
No.1	A.M.			70 (Commercial zone at daytime) 60 (Commercial zone at night time)	
	P.M.				
No.2	A.M.				
	P.M.				
No.3	A.M.				
	P.M.				
No.4	A.M.				
	P.M.				

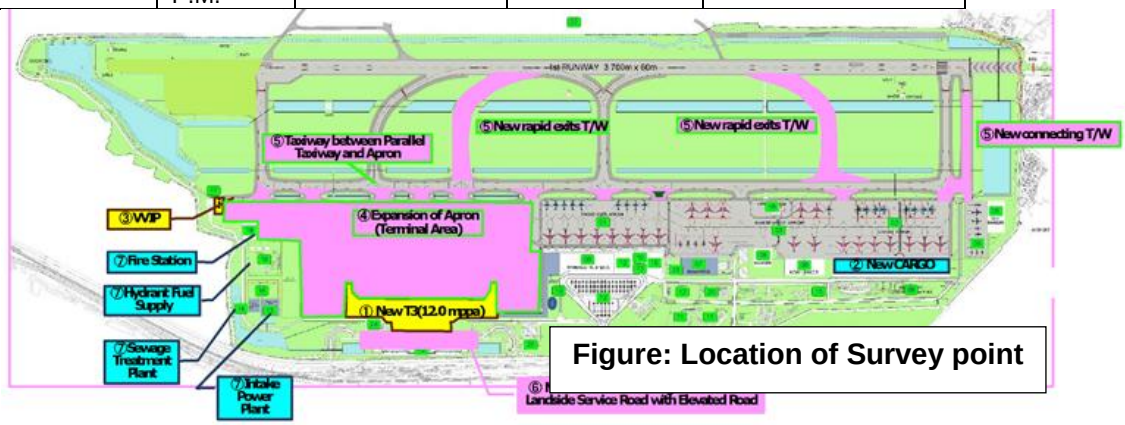


Figure: Location of Survey point

I certify that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based upon my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature	Date

Monitoring Item: Water quality

Company:		Monitoring Date
Monitoring area/ Point: As shown below figure		
Project activity:		
Monitoring method: Onsite water quality survey		
Equipment used: Multi-parameter water quality meter		

Survey point	Time	Parameters	Measured Value	Baseline value	Criteria	Remark
		pH				
		Temp				
		Turbidity(NTU)				
		EC(μS/cm)				
		pH				
		Temp				
		Turbidity(NTU)				
		EC(μS/cm)				
		pH				
		Temp				
		Turbidity(NTU)				
		EC(μS/cm)				

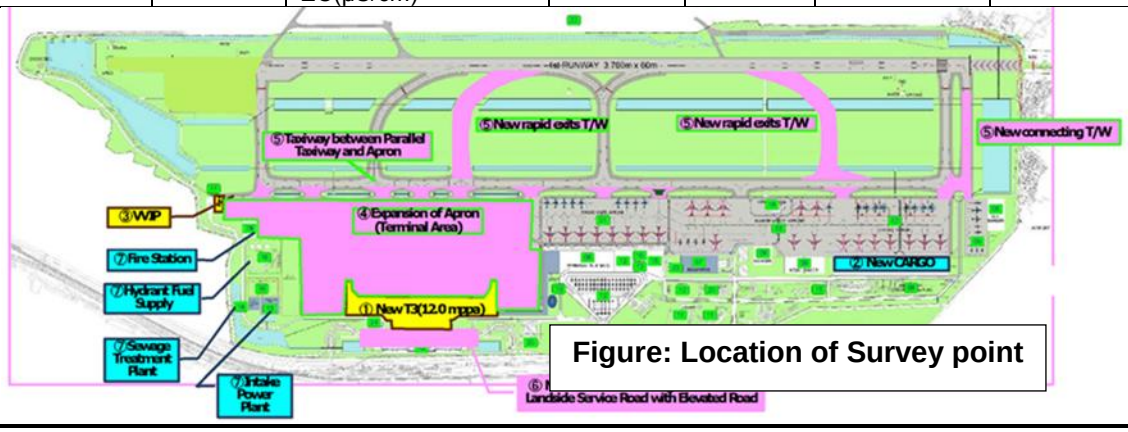


Figure: Location of Survey point

I certify that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based upon my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature	Date

Monitoring Item: Solid waste

Company:	Monitoring period
Monitoring area/ Point:	
Project activity:	
Monitoring method: Data collecting	
Equipment used: -	

Types of the waste	Category (Hazardous/Non-Hazardous)	Parameter1 Monthly quantity	unit	Remark

I certify that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based upon my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature	Date

Monitoring Natural environment

Company:	Monitoring period
Monitoring area/ Point:	
Project activity:	
Monitoring method: Inventory survey	
Equipment used: -	

Types of the tree	Parameter1 Number of tree	Remark
Total		

I certify that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based upon my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature	Date

b. Operation and Maintenance phase

Monitoring Item: Land (Soil) contamination

Company:	Monitoring Date
Monitoring area/ Point: As shown below figure	
Project activity: Storing and managing contaminated soil	
Monitoring method: Data collecting	
Equipment used: -	

Storing area	Storing quantity	Contained chemical substances	Method of management

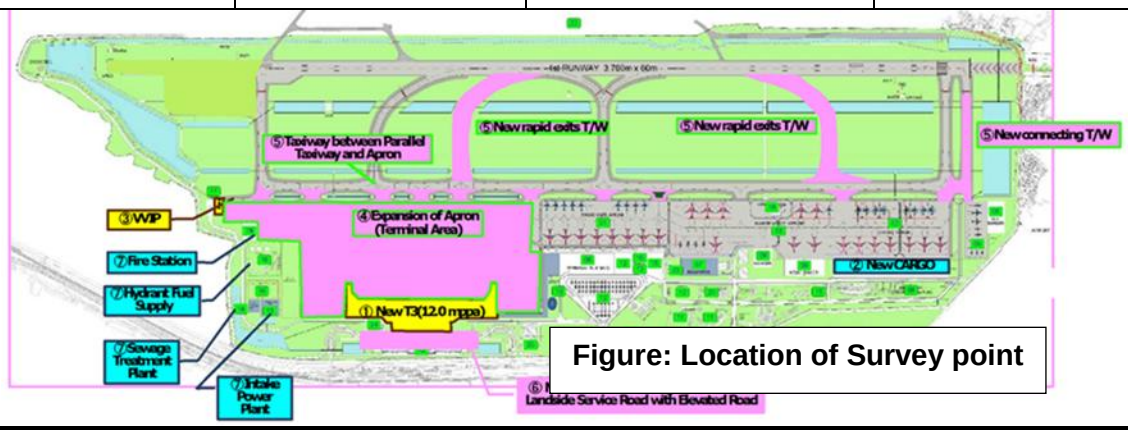


Figure: Location of Survey point

I certify that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based upon my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature	Date

Monitoring Item: Waste water quality

Company:	Monitoring Date
Monitoring area/ Point: As shown below figure	
Project activity:	
Monitoring method:Laboratory analysis	
Equipment used:	

Survey point	Parameters	Measured Value	Baseline value	Criteria	Remark
	pH				
	Temp				
	TSS(㎎/L)				
	EC(μS/cm)				
	TDS(㎎/L)				
	NH3(㎎/L)				
	COD(㎎/L)				
	BOD(㎎/L)				
	Coli(MPN)				
	Oil&Grease(㎎/L)				

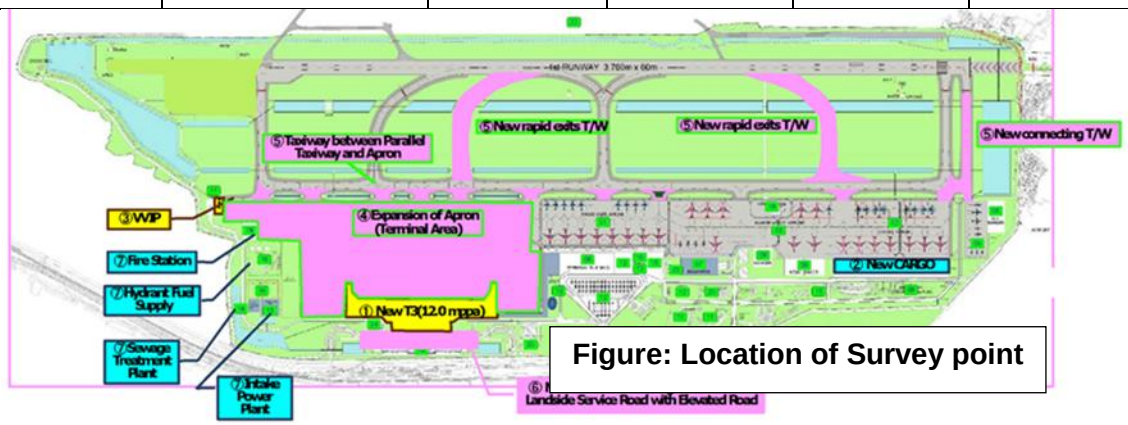


Figure: Location of Survey point

I certify that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based upon my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature	Date

Monitoring Item: Ambient noise level

Company:	Monitoring Date
Monitoring area/ Point: As shown below figure	
Project activity:	
Monitoring method: Construction noise survey	
Equipment used: - Sound level meter Type ****	

Survey point	Time	Parameter1		Criteria	Remark
		Measured value L_{Aeq}(dB)	Baseline value L_{Aeq}(dB)	L_{Aeq}(dB)	
No.1	A.M.			70 (Commercial zone at daytime) 60 (Commercial zone at night time)	
	P.M.				
No.2	A.M.				
	P.M.				
No.3	A.M.				
	P.M.				
No.4	A.M.				
	P.M.				

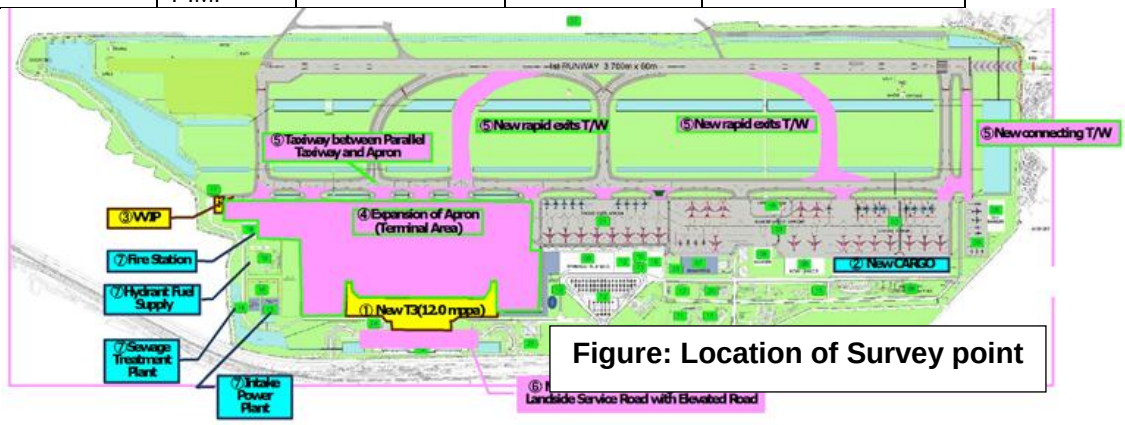


Figure: Location of Survey point

I certify that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based upon my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature	Date

Monitoring Item: Aircraft Noise

Company:	Monitoring Date
Monitoring area/ Point: As shown below figure	
Project activity:	
Monitoring method: Ambient noise survey	
Equipment used: - Sound level meter Type ****	

Survey point	Parameter1		Criteria	Remark
	Measured value L_{den}(dB)	Baseline value L_{Aeq}(dB)	(dB)	
No.1				
No.2				

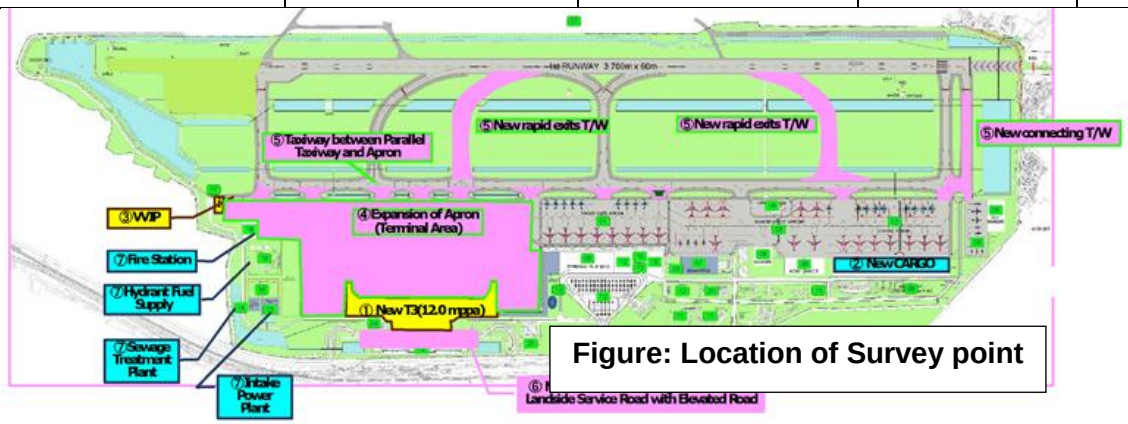


Figure: Location of Survey point

Description of complaints received and its actions		
Date	Complaints (Who and What)	Actions by CAAB

Operations of low-noise aircraft from/to HSIA (per year)							
Aircraft Type	A380	B747-8	B747-400	B777-300 ER	B777-300	B777-200	B777-200 ER
Number/year							
Aircraft Type	A350	A340	A330	B787	B767	B757	A321
Number/year							
Aircraft Type	A320	B737	A310	A300	ATR-42/72	ERJ145	Others
Number/year							

I certify that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based upon my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature	Date

Annex-3: Photographs of the Proposed Site in North Side Areas

North-East Side View

North-East Side View

North-East Side View

North-West Side View

North-West Side View

North-West Side View

Land Use Features in North Side of Airport

Annex-4: Photographs of the Proposed Site in South Side Areas

South-East Side View

South-East Side View

South-East Side View

South-West Side View

South-West Side View

South-West Side View

Land Use Features in South Side of Airport

Annex-5: Photographs of the Major Existing Infrastructures inside the Airport Areas

Access Road

Passenger Terminal 1 & 2

Domestic Terminal Building

VVIP Terminal Building

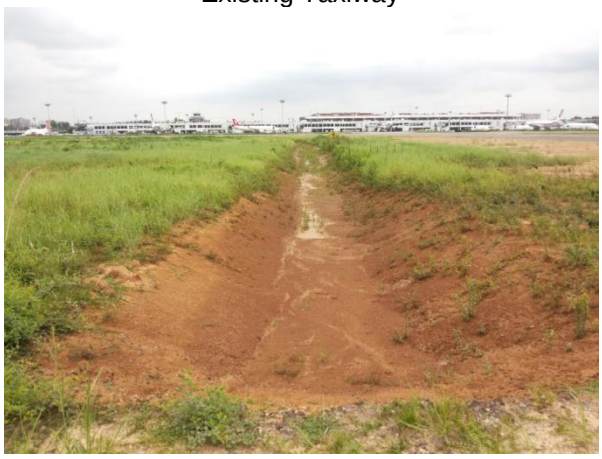
VIP Terminal Building

Fuel Power House

Major Existing Infrastructures Inside the Airport Areas

Existing Taxiway

Existing Runway



Terminal Building

Navaid Facility

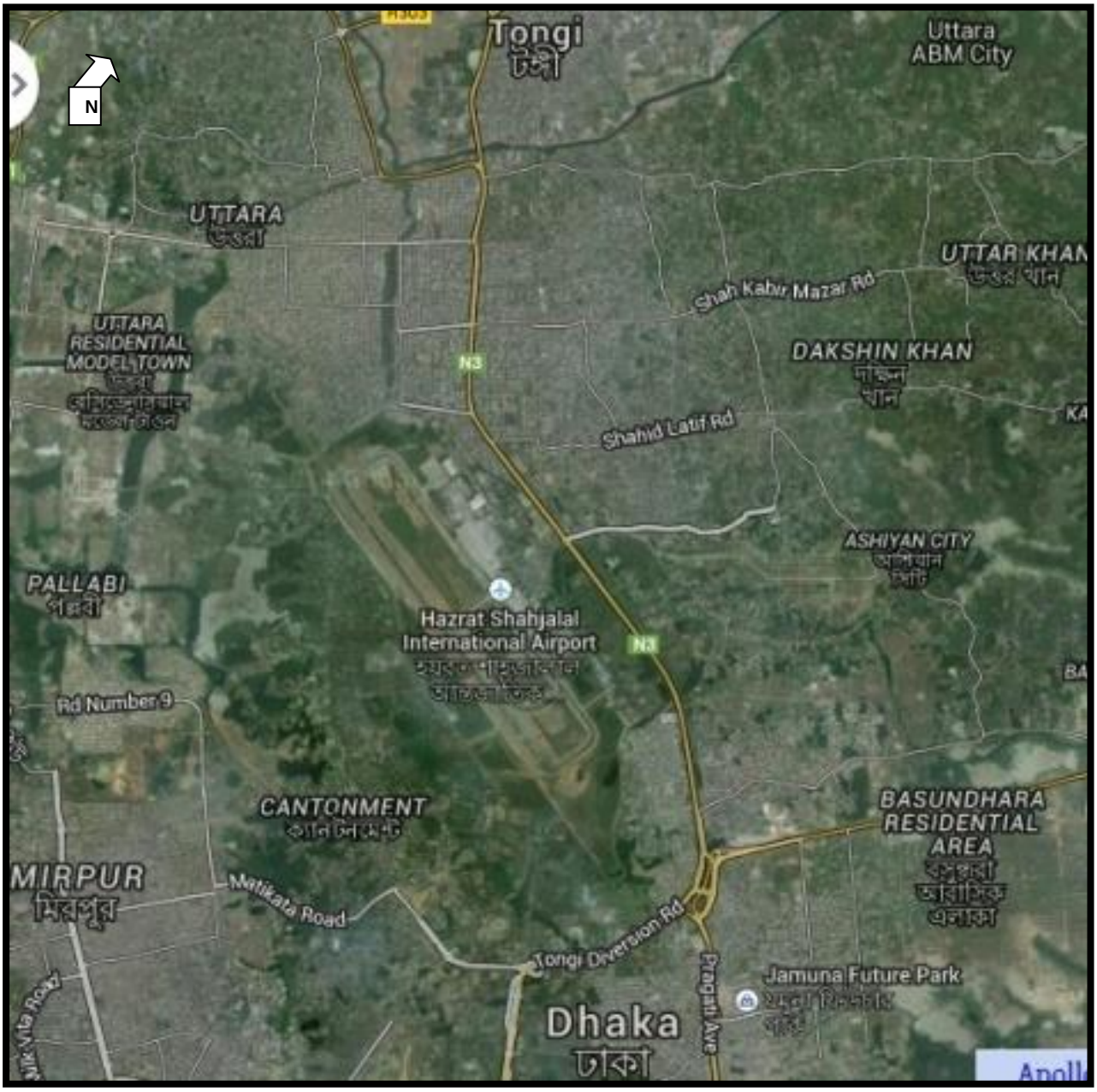
Aircraft

Drainage Outlet

Major Existing Infrastructures Inside the Airport Areas

Annex-6: Photographs of the Proposed Site and the Surrounding Areas

Uttara Residential Model Town on North-West side of airport; Cantonment on South-West side of airport; Mirpur on South side of airport; Bashundhara Residential Area &Jamuna Future Park on Eastern side of airport



Annex-7: Photographs of the Existing Soil Features inside the Airport Area

Annex-8: Drainage Ponds and Drainage Canal of Rainwater Discharge

South-West Canal

South-East Pond

North-West Canal

South-West Canal

Annex-9: Photographs of the Existing Flora inside the Airport Area

North-East: Hyacinth

North-East: Lantana (Lantana Camera)

North-West: Tall Trees

Grasses-(Durba-ghas): CynadonDactylon

Bushes

Lajjabati (Mimosa pudica)

Annex-10: Records of Public Consultations Conducted

A Public Consultation (PC) meeting was arranged regarding this project (**Figure A10-1**) at 21st November, 2016. Venue was Room of the Superintending Engineer, P&D/ QA Circle, CAAB, Dhaka. Two days before the meeting, banner for public consultation was made and invitation letters were sent to stakeholders to join this public consultation meeting on Hazrat Shahjalal (Dhaka) International Airport Expansion Project. About forty-three participants of different occupations were present on the meeting. Public Consultation Attendance List is given in **Figure A10-2** of this report.

Figure A10-1: Public Consultation Meeting Photographs

From 10:00 AM, registration session was started. All the participants wrote their name, occupation, contact number and signature. Registration was completed within ten minutes.

At 10.10 AM Superintending Engineer Mr. Md. Abdul Maleq, Deputy Project Director introduced himself and started the public consultation meeting. He informed about the expansion project and the past and present condition of the Hazrat Shahjalal International Airport (HSIA). He said that it is a big project which is in coordination with Japan International Cooperation Agency (JICA) and Government of Bangladesh for coping with the other international airports around the world. He quoted the capacity of present terminal buildings as 8 million per year. Already running capacity has reached to 7 million per year. Every year the number of passengers is increasing. For expansion, a third terminal building will be constructed. He informed about the high facilities to be provided in that new terminal and also about the old terminal updating in the next phase to increase more capacity. For third terminal building a huge space will be needed and Mr. Md. Abdul Maleq informed all the participants about the location of the place.

At 10:15 AM Senior Engineer, DDCL, Mr. Mustafizur Rahman (Team Leader) introduced himself and welcomed everyone for participating in the consultation meeting. He informed about the expansion project and environmental impact assessment. He said that about five environmental experts are working on this project. Then he talked about the design document and other facilities which will be included in the third terminal building. At the end, he thanked everyone for participating in the consultation meeting.

At 10:18 AM Senior Environmental Expert, Mr. Zainul Abedin introduced himself and welcomed everyone for participating in the meeting. Then he informed about the program summary and asked everyone to introduce oneself. After the introduction part, he again thanked everyone and asked Project Senior Environmental Expert, Mr. Golam Mustafa to start the project presentation.

At 10:25 AM Project Senior Environmental Expert, Mr. Golam Mustafa introduced himself and mentioned that every huge project need a public consultation meeting regarding project environment and that is why they were there that day. Then he started the project presentation. In the presentation, he showed the project background of HSIA, HSIA existing facilities, proposed works of construction of 2nd Runway and connecting Taxiways/Aprons (under consideration), construction of 3rd Terminal Building including landscaping, lightening, approach road, parking, connecting shed between existing and proposed terminal, connecting roads with the elevated expressway etc., construction of new Domestic Terminal Building including parking apron, construction of water supply, sanitary, drainage & sewerage network including Sewerage Treatment Plant. He also showed locations of project components, project location map, plan layout in brief (see photograph 3.2), concept of new drainage system for solving the water logging problem in the new area. As this is a huge project he informed that it is categorized as "Red" according to the Rule 7(2)(d) in schedule 1 of ECR, 1997. He also showed relevant guidelines and policies relevant to this project.

Then he informed about major environmental impacts mentioning both positive and negative impacts (minor negative impacts due to project activities for this green belt development with large growing trees). He also showed the mitigation measures to be adopted for the adverse impacts on air, noise occupational health and safety (OHS), water quality, solid waste management, aquatic and terrestrial ecology. Then he showed a comprehensive Environmental Management Plan (EMP) and capacity building and training program regarding the Hazrat Shahjalal (Dhaka) Int. Airport Expansion project. Then, he gave some recommendations for the implementation of this project. At the end he thanked everyone for their kind attention to his presentation.

At 10:56 AM Director DDCL, Mr. Mahbubur Rahman introduced himself. He said that everyone's valuable feedback will help environmental impact assessment reporting and thanked all for participating in the consultation meeting.

At 10:58 AM Mr. Zainul Abedin asked the participants if they had any questions and asked them to share their opinion regarding this project presentation and further project implementation. Superintending Engineer Mr. Md. Abdul Maleq addressed to a participant's question answering that the starting point of the 3rd terminal building is present Domestic terminal to Padma Oil Company to Le- Meridian canal. He also added that there will be a nice and hassle free environment for the international passengers' luggage. Then he said that this airport was established during Pakistan era when handling of aircraft was only three to four. After that it was expanded many times and now its handling capacity is 300 to 400 aircraft. So third terminal building will be well facilitated and will be like a modern terminal.

At 11:05 AM President of Nikunjo-2 Kollan Somity, Mr. Samsujjaman asked for the details of water management plan for the embankment of the south side (beside Le-Meridian). He informed about the devastating flood of 1988 and its consequences. He also mentioned about their concern about water logging problem on both Nikunja-1 and Nikunja-2 due to the implementation of this project. Answering to this raised question, Mr. Md. Abdul Maleq said that, Airport drainage system will be upgraded and the logged water will be pumped out. Mr. Zainul Abedin added that, the problem will be re-examined and he also mentioned about the importance of their opinions and concerns. Then he asked the participants again if they had any further questions.

At 11:16 AM Senior Vice-President of Nikunja-1 Kollan Somity, Mr. M.A. Aziz informed that pumping the logged water will never be a permanent solution. He asked if it is possible to bypass the logged water of Nikunja-1 and Nikunja-2 via the 300ft canal. He informed that there was a

connection of Balu River with Bonorupa, Nikunja portion once, but day by day the increasing number of low land filling, urbanization and after the construction of Bishwa Road Flyovers, all connections were lost. So, the water logging problem is serious in both Nikunja-1 and Nikunja-2 portion. Again a question was raised from one of the Nikunja-2 participants about the heights or elevation problem for the nearest buildings.

Regarding these questions Superintending Engineer Mr. Md. Abdul Maleq said that, the Civil Aviation treat logged water in airport area and that the Airport drainage system will be upgraded, even they are planning to harvest rain water, which will be cross-examined again. Answering the other question, he said that, every building should follow the civil aviation heights permission and Rajuk building permission.

A question was raised from one of the participants, that if all trees will be cut, how can be that environment regenerated. Regarding this question Mr. Zainul Abedin said that, five trees will be planted in the airport area for each 1 of trees to be cut as compensation. Mr. Md. Abdul Maleq added that, those will be taken care of by the airport authorities.

At 11:25 AM Teacher, Mr. Saikat Ali, welcomed everyone and suggested to find out greater benefit from this project. He referred that any foreigner will judge our country landing in this airport, so we have to sacrifice less impacts regarding bigger improvement this project. Assistant Hajj Officer Mr. Md. Abdul Maleq added that if the project is implemented it will be very good for Bangladesh.

At 11:30 AM the Imam of Sector-1 Jame Mosque, Alhaz Abdus Sakur asked about the noise pollution due to aircraft and hanger activities. Regarding this question Mr. Md. Abdul Maleq said that the hanger activities do not make noise, the main noise is the aircraft take-off and landing noise. This taking off and landing will be always noisy. So, it is not possible to take any action for this purpose, but during construction of 3rd terminal building they will take proper steps for reducing the noise.

At 11:40 AM Finance Secretary, Sector-1 Kollan Somity, Mr. Shorifur Rahman Khan said that it is easy to say but difficult to plant and even take care for a huge number of trees. If a huge amount of trees is cut, it will be never got back. He referred Uttara tree beautification plan and informed that, the 1:5 tree plantation program should be fully taken care of at Airport. Both Mr. Md. Abdul Maleq and Mr. Zainul Abedin agreed with him and committed about taking care of that matter.

At 11:45 AM HOD, Dhaka Regency, Mr. Faisal Aziz asked about 0 heights and if there is permission for their hotel and even Le-Meridien. Mr. Md. Abdul Maleq informed that, it was not done yet, but if needed they will be informed first.

At 11:55AM after public consultation Mr. Md. Abdul Maleq Thanked everyone for participating in the meeting. Mr. ZainulAbedin and Mr. Mustafizur Rahman also thanked everyone for participating.

All the environmental parameters such as air, noise, solid & liquid wastes management, water management etc. are briefly discussed during the public consultation meeting. A positive approach with different stakeholders regarding this project was established. Public Consultation meeting was closed with distributing refreshments to everyone.

PUBLIC CONSULTATION

Address: P&D/QS Circle, CAAB Kurmitola , Dhaka

Date: 21 November 2016

Time: 10:00 AM

List of Participants

SL	Participant's Name	Occupation/Address	Telephone No.	Signature
1	Kushal Roy	Teacher / Khulna University	01783264521	[signature]
2	Md. Shafiqur Rahman	Environmental Specialist (International)	01716009161	[signature]
3	MD. Showkat Ali	Writer, Researcher	01819-088128	[signature]
4	Md. Yunus Hossain	Estimator Civil	01711203657	[signature]
5	Biplab Narayan Choudhury	Vice-principal Residential Laboratory College	01715424656	[signature] 21.11.2016
6	MD ABDUL MALEK	HAJJ OFFICE ASHKONA DHAKA	01720017377	[signature] 21/11/16
7	S.M.H. Amin	Dhaka Regency H & R.	01713332540	[signature]
8	FAISAL AZIZ	DHAKA REGENCY HOTEL & RESORT LTD.	01713332515	[signature]
9	[signature]	" "	01713332622	[signature]
10	Md. Abdul Awal	Hajj office	018184158[illegible]	[signature]
11	MD. OBAYEDUR RAHMAN	Teacher.	01711067877	[signature]
12	Goutam Kumar Sarker	Engineer	01973027091	[signature]
13	Mohd. Rezaul Karim	Airport Manager, Le Meridien Dhaka	01966660024	[signature]
14	Shah Zaman Chowdhury	Ex-President, Uttara Sector-1 & Ex-President, Uttara Association	58591958	[signature]
15				

SL	Participant's Name	Occupation/Address	Telephone No.	Signature
16	Faisal Abu Md Zahangir	Nikunja model college	01953975123	[signature] 21-11-16
17	Md. Babul Hossain	Do	01915600152	[signature] 21.11.16
18	MD. ABDUS SHAKUR	BUSINESS	01715 438826	[signature]
19	Md. Abdul Malek	Supt. Engineer, CAAB	01741234956	[signature]
20	Shuvasheesh Barua	Executive Engineer (E/M) CAAB	01711-025821	[signature]
21	A.K.M. Kafil uddin	Vice president Nikunja Mosque	01720039694	[signature]
22	Md. Abu Saleh Sardar	Mentor Nikunja Mosque	01712 201373	[signature]
23	[illegible]	[illegible]	01726559000	[signature]
24	M. G. Haider	[illegible]	01711-525721	[signature]
25	Wg. Cdr Mahmudur Rah (Retd)	DFO, South Asian Airlines Ltd	01711-404759	[signature]
26	Mr. Masum	Aero Technologies GM	01712031613	[signature]
27	Swapan kumar Deb.	Asst Prof (JJBSMGC)	01767486705	[signature]
28	ABUSADAT MAHFUZUR RAHMAN	AIRPORT REPRESENTATIVE LE MERIDIEN DHAKA	01718-188855	[signature]
29	Abu Sahid	Kha 72 Khan ... Tan Pastin	01742240736	[signature]
30	Shamsuzzaman	Nayze -	01673333731	[signature]
31	SHARIFUR RAHMAN KHAN	SECTOR 1 KALLAYAN SAMITY UTTARA	01716226916	[signature]
32	Md. Sajjad Zahir	Sector # 01. Kallayn Samity, Uttara.	01716808504	[signature]
33	Md. Moniruzzaman Miah	Jatir Janak Banga bandhu Sheik M. Govt. College	01716580095	[signature]
34	Md. Sultan Ali	House No.→74/1, Road No.-01. Rajabari, Turag, uttara, Dhaka.	01712-182914	[signature]

Hazrat Shahjalal International (Dhaka) Airport Expansion Project

SL	Participant's Name	Occupation/Address	Telephone No.	Signature
35	Md. Shariful Islam	Services Mirpur, Dhaka.	01933323097	
36	Afroza Khanam	Services, Gawair, Dakkin Khan Uttara, Dhaka	01716224947	22/11/2016
37	Md. Abdul Kaddus	Mirpur-1 Dhaka-17	01537048390	21/11/16
38	MD! Jahangir Alam	Torgi, Gazipur	01718649380	21/11/16
39	MAHBUBUR RAHMAN	Director, DDC	0189 242378	
40	Md. Mustajizur Rahman	Sr. Engineer/DDC	01755618840	
41	MD. YOUNUS BHUIYAN	ASSISTANT ENGINEER (CIVIL), CAAB	01713007574	
42	Md. Tofael Ahmed	Env. Expert-DDC	01712034609	
43	Md. Atiqur Rahman	Jr. Env. Specialist DSCL	01722013701	
44	Mashiq Bashir	Jr. Environmental Specialist DSCL	01731237299	
45				

Figure A10-2 Participants' List of Public Consultation Meeting

Annex-11: Site Clearance from DOE

Government of the People's Republic of Bangladesh
Department of Environment
Head Office, E-16 Agargaon
Dhaka-1207
www.doe.gov.bd

Memo No: 30.26.95.4.252.27.08.15- 382 Date: 08/09/2016

Subject: Site Clearance for Construction of 2nd Runway and other Infrastructure Development Works at Hazrat Shahjalal International Airport, Kurmitola, Dhaka.

Ref: Your Application dated 27/08/2015 & 24/08/2016.

With reference to the above mentioned subject, the Department of Environment (DOE) hereby accords the Site Clearance to the Construction of 2nd Runway and other Infrastructure Development Works at Hazrat Shahjalal International Airport, Kurmitola, Dhaka Project with the following conditions:

I. The Project Authority shall submit a comprehensive Environmental Impact Assessment (EIA) considering the overall activity of the Construction of 2nd Runway and other Infrastructure Development Works Project in accordance with the TOR and time schedule indicated in the Initial Environmental Examination (IEE) Report.

II. The EIA shall incorporate the following components/items in addition to the issues mentioned in the proposed TOR for EIA.

1. Executive summary
2. Introduction: (Background, brief description, scope of study, methodology, limitation, EIA team, references)
3. Legislative, regulation and policy consideration (covering the potential legal, administrative, planning and policy framework within which the EIA will be prepared)
4. Environmental Baseline Data

4.1. Project Data Sheet

a. Project Location and Area
The location of the project and area involved

b Project Concept
An outline of description of the concept and objectives of the project, the types of activities expected, and the development plans for achieving the objectives.

c Project Components
Components of the project concerning the types of activities proposed to be located in the area, other infrastructure, utilities and service requirements.

d Project Activities
A list of the main project activities to be undertaken during: site clearing and construction, operation of activities and associated developments.

1

e **Resources and Utilities Demand**
Resources required to develop the project, such as soil and construction material and demand for utilities (water, electricity, sewerage, waste disposal and others), as well as infrastructure (road, drains, and others) to support the project.

4.2. Physical and Chemical Components

a **Map and Survey Information**
Location map.
Cadastral map showing land plots (project and adjacent area).
Topographic map for identifying catchment boundaries, general land use and terrain.
survey map showing contour information.
Aerial photograph.

b **Geology and Soil**
Geological map showing geological units, fault zone, and other natural features.
Soil map and soil profile analysis. This may only be established from soil survey and geotechnical investigation (important for analysis for soil stability, cut and fill).
Soil properties and composition.

c **Hydrology and Drainage**
Catchment boundaries of rivers/canals which drain the project.
Hydrological characteristics of rivers in and around the project area including flow and sediment load for varies return period.
Flood characteristics and historical records of flood events covering areas affected, height of flood and frequency.
Ground water potential and aspects of aquifer, such as recharge zones, ground water abstraction etc.
Drainage system and drainage characteristics in the project area.

d **Water Quality and Use**
Water quality of the receiving water bodies likely to be affected by the project.
Sources of pollutants from existing and known future activities within the catchment of the rivers

e **Air Quality and Noise**
Baseline data of the project site with respect to air quality and noise level.
Air pollutant and noise sources from existing and known sources.

4.3. Ecological Components

a **Habitats**
Aquatic habitat likely to be impacted by the project
Terrestrial habitat likely to be impacted by the project

b **Species and Population**
Identification of population of flora and fauna to assess their conservation status of being rare, endemic and endangered.
Biodiversity of the project site.

4.4. Social and Economic Factors

a **Population.**
Population within and around the project area.
Organizational structure of communities and the degree of public awareness and response to the proposed project.

b **Human Settlement.**

Size and distribution of human settlement.
Community infrastructure, utilities and services available.
Housing and future requirements within the impacted area.
Historical/archaeological features of significance.

c Economic activities.
Economic activities of population in and around the project area. Activities should include those that are dependent on resources which may be impacted by project.
Income dependence on economic activities impacted directly or indirectly by the project.
Employment and economic returns to the population by the project.

5.5. Infrastructure and Utilities

a Availability of infrastructure to support the proposed project. Attention should focus on different transportation requirements due to project increase in traffic to and from the project area.

b Availability of utilities and services, especially water, gas and electricity supply, sewerage and waste disposal facilities to cater to the projected demand for such utilities and services.

5. Prediction of Impacts

5.1 Soil erosion and sedimentation.
5.2 Floods and Cyclones/Tornados.
5.3 Water quality.
5.4 Air quality.
5.5 Noise.
5.6 Solid, Toxic and Hazardous waste.
5.7 Ecology.
5.8 Traffic.
5.9 Socio-Economy.

6. Evaluation of Impacts

The judgment of significance of impacts can be based on one or more of the following, depending on the environmental factor being evaluated. These are -

i. impact identification and scoping matrix.
ii. possible impacts in planning, construction and operation stage.
iii. comparison with laws, regulation or accepted national or international standards.
iv. reference to pre-set criteria such as conservation or protected status of a site, feature or species.
v. consistency with pre-set policy objectives.
vi. consultation and acceptability with the relevant decision makers, local community or the general public.

7. Mitigation of Impacts

Mitigation measures which may be considered including -

i. mitigation measures for planning, construction and operation stage.
ii. changing project layout, transport routes, disposal routes or locations, timing or engineering design.

iii. introducing pollution controls, waste treatment, phased implementation and construction, engineering measures, monitoring, landscaping, social services or public education.

iv. compensation to restore, relocate or provision of concession for damage.

Sl.	ITEM	REQUIREMENT
a	Soil erosion prevention	An outline of measures to control soil erosion.
b	water pollution	Measures to treat sewage water.
c	Air pollution	During construction: measures to minimize fugitive dust from exposed soil surface and those caused by motor vehicles. During operations: measures to minimize air pollution through selection of types of industries allowed in the area.
d	Noise	During construction: measures to minimize noise from traffic and construction activities During operation: application of buffer zones to minimize noise as well as that due to traffic.
e	Solid and hazardous waste	Management options need to be identified. The need for centralized waste collection, treatment and disposal facilities need to be given due consideration.
f	Flood/Cyclones/ Tornados	An outline of measures to minimize flooding/cyclones/ tornados. A diagram to show likely drainage system and flood retention sites, diversion channels, etc.
g	Land use	The project area should be effectively zoned for different categories of activities and types of recommendation should be outlined. A diagram showing land use distribution for the project area.
h	Habitat and species	Measures to protect or conserve habitat and species with recommended buffer zones. A diagram showing conservation areas.
i	Socio-economic issues	Outline of steps or measures to be taken to resolve social conflicts and related socio-economic issues.
j	Utilities and services	A diagram to show additional utilities and services required to satisfy projected demands of the project area.
k	Road and traffic	Road access and improvements required to meet projected traffic densities.

8. **Environmental Management Plan**

For each significant major impact, proposed mitigation measures will be set out for incorporation into project design or pro cedures, impacts, which are not capable of mitigation, will be identified as residual impacts Both technical and financial plans shall be incorporated for proposed mitigation measures..

An outline of the Environmental Management Plan shall be developed for the project.

In Environmental Monitoring Plan, a detail technical and financial proposal shall be included for developing an in-house environmental monitoring system to be operated by the proponent's own resources (equipments and expertise).

9. Consultation with Stakeholders/Public Consultation (ensures that consultation with interested parties and the general public will take place and their views taken into account in the planning and execution of the project)
Beneficial Impacts (summarize the benefits of the project to the Bangladesh nation, people and local community and the enhancement potentials)
10. Conclusion and Recommendations

III. Without approval of EIA report by the Department of Environment, the Project Authority shall not be able to open L/C in favor of importable machineries.
IV. The Project Authority shall submit the EIA along with a filled-in application for Environmental Clearance in prescribed form, the no objection certificates (NOCs) from the local authority, NOCs from forest department (if it is required in case of cutting any forested plant, private or public) and NOC from other relevant agencies for operational activity etc. to the Dhaka District Office with a copy to the Head Office of DOE in Dhaka.
V. This clearance is valid for one year from the date of issuance and the project authority shall apply for renewal to the Dhaka District Office of DoE with a copy the Head Office of DOE at least 30 days ahead of expiry.

This Clearance Certificate has been issued with the approval of the appropriate authority.

08.09.2016

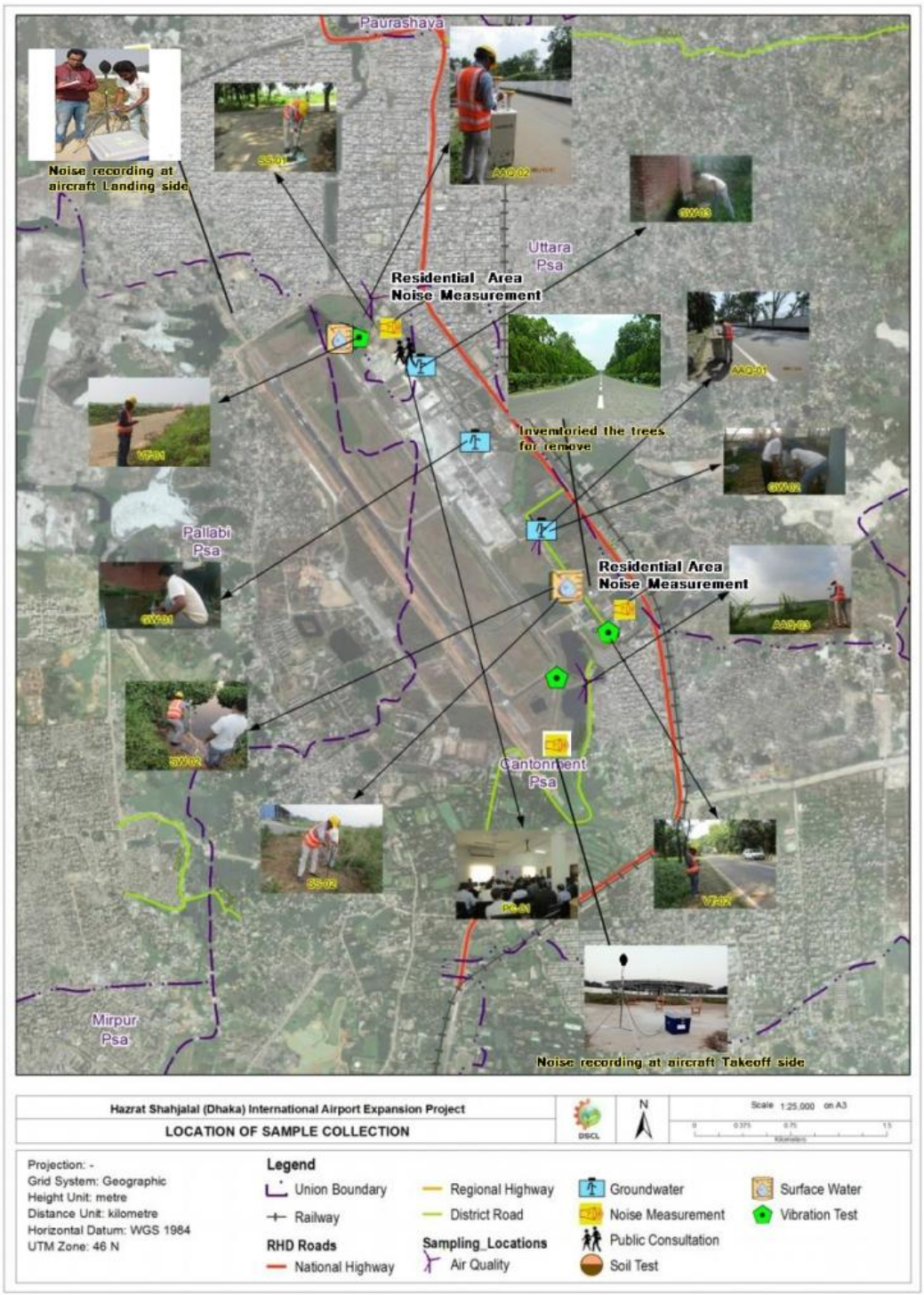
(Syed Nazmul Ahsan)
Director (Environmental Clearance, c.c)
Phone # 8181673

Chief Engineer
Civil Circle
Civil Aviation Authority of Bangladesh.
Kurmitola, Dhaka-1229.

Copy Forwarded to :

1) PS to the Secretary, Ministry of Environment and Forests, Bangladesh Secretariat, Dhaka.
2) Director, Department of Environment, Dhaka Regional Office, Dhaka.
3) Deputy Director/Officer in Charge, Department of Environment, Dhaka District Office, Dhaka.
4) Assistant Director, Office of the Director General, Department of Environment, Head Office, Dhaka.

Annex-12: Sampling and Testing at Project Influenced Area



Annex-13: Surface Water Quality Test Results

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY (BUET)

DEPARTMENT OF CIVIL ENGINEERING

Mobile: 01819 557 964; PABX: 966 5650-80 Ext. 7226; www.buet.ac.bd/ce/

ENVIRONMENTAL ENGINEERING LABORATORY

BRTC
Bureau of Research, Testing & Consultation

Ref. No. : Letter; Dt: 30/10/2016

BRTC No. : **1101-21615 /16-17/CE; Dt: 30/10/2016**

Sent by : Md. Atiqur Rahman, Junior Environmental Specialist

Project : Dhaka Airport Expansion Project

Company : Development Solutions Consultant Limited

Address :

Sample Id : SW-1 Location : Wetland near Radar building (N23.85782 E90.39384) Source : Surface water

Date of Test : 30/10/2016 - 23/11/2016

TEST REPORT (PHYSICAL/ CHEMICAL/ BACTERIOLOGICAL ANALYSIS OF WATER SAMPLE)

Sl. No.	Water Quality Parameters	Unit	Concentration Present	Method of analysis	Minimum Detection Limit (MDL)
1	pH	—	7.47	USEPA 150.1; SM 4500-H+ B	0
2	Turbidity	NTU	8.77	USEPA 180.1 Rev 2; SM 2130 B	0.01
3	Electrical Conductivity (EC) at 25°	µS/cm	229	USEPA 120.1; SM 2510 B	0.1
4	Dissolved Oxygen (DO)	mg/l	5.02	USEPA 360.3, 360.2; SM 4500- O B,G	0.1
5	Total Dissolved Solids (TDS)	mg/l	150	USEPA 160.2; SM 2540 B - D	5
6	Total Suspended Solids (TSS)	mg/l	16	USEPA 160.2; SM 2540 B - D	5
7	Iron (Fe)	mg/l	0.8	USEPA 200.9 ; SM 3111 B	0.02
8	Ammonia-Nitrogen (NH3 - N)	mg/l	6.5	USEPA 350.1; SM 4500 – NH3 B	0.017
9	Orthophosphate (PO4) or Reactive Phosphate	mg/l	0.580	USEPA 365.1; SM 4500-PO4	0.04
10	Sulphate (SO4)	mg/l	<1	USEPA 375.4; SM 4500-SO4	7
11	Arsenic (As)	mg/l	0.001	USEPA 206.2; SM 3113 B	0.001

Comments : 1. Sample was collected by BUET representatives.

Important Notes: Samples as supplied to us have been tested in our laboratory. BRTC does not have any responsibility as to the representative character of the samples required to be tested. It is recommended that samples are sent in a secure and sealed cover/pack

Countersigned by:

Dr. Abu Siddique
Professor, Dept. of Civil Engg.

Department of Civil Engineering * BUET, Dhaka-1000, Bangladesh

Test Performed by:

Dr. Tanvir Ahmed 23.11.16
Associate Professor, Dept. of Civil Engineering, BUET

Page 1

BUETCE 0005416

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY (BUET)

DEPARTMENT OF CIVIL ENGINEERING

Mobile: 01819 557 964; PABX: 966 5650-80 Ext. 7226; www.buet.ac.bd/ce/

ENVIRONMENTAL ENGINEERING LABORATORY

BRTC Bureau of Research, Testing & Consultation

BRTC No. : **1101-21615 /16-17/CE; Dt: 30/10/2016**

Ref. No. : Letter; Dt: 30/10/2016

Sent by : Md. Atiqur Rahman, Junior Environmental Specialist

Project : Dhaka Airport Expansion Project

Company Address : Development Solutions Consultant Limited

Sample Id : SW-1 Location : Wetland near Radar building (N23.85782 E90.39384) Source : Surface water

Date of Test : 30/10/2016 - 23/11/2016

TEST REPORT (PHYSICAL/ CHEMICAL/ BACTERIOLOGICAL ANALYSIS OF WATER SAMPLE)

Sl. No.	Water Quality Parameters	Unit	Concentration Present	Method of analysis	Minimum Detection Limit (MDL)
11	Chemical Oxygen Demand (COD) : Dichromate	mg/l	**31**	USEPA 410.4; SM 5220 D	0.2
12	Biochemical oxygen Demand (BOD5)	mg/l	**7.2**	USEPA 405.1; SM 5210 B; SM 5210 D	0.2
13	Lead (Pb)	mg/l	**0.028**	USEPA 200.9 Rev 2.2; SM 3111 B	0.01
14	Zinc (Zn)	mg/l	**0.032**	USEPA 200.9 ; SM 3111 B	0.02
15	---	---	---	---	---
16	---	---	---	---	---
17	---	---	---	---	---
18	---	---	---	---	---
19	---	---	---	---	---
20	---	---	---	---	---

a. Health based guideline, b. Guideline based on other considerations

Comments : 1. Sample was collected by BUET representatives.

Important Notes: Samples as supplied to us have been tested in our laboratory. BRTC does not have any responsibility as to the representative character of the samples required to be tested. It is recommended that samples are sent in a secure and sealed cover/pack

Countersigned *by*:

Dr. Abu Siddique
Professor, Dept. of Civil Engg.

Department of Civil Engineering BUET, Dhaka-1000, Bangladesh

Test Performed *by*:

T. Ahmed 23.11.16

Dr. Tanvir Ahmed
Associate Professor, Dept. of Civil Engineering, BUET

BUETCE 0005417

BUETCE 0005423

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY (BUET)

DEPARTMENT OF CIVIL ENGINEERING

Mobile: 01819 557 964; PABX: 966 5650-80 Ext. 7226; www.buet.ac.bd/ce/

ENVIRONMENTAL ENGINEERING LABORATORY

BRTC
Bureau of Research, Testing & Consultation

BRTC No. : 1101-21615 /16-17/CE; Dt: 30/10/2016 Ref. No. : Letter; Dt: 30/10/2016

Sent by : Md. Atiqur Rahman, Junior Environmental Specialist

Project : Dhaka Airport Expansion Project

Company : Development Solutions Consultant Limited

Address :

Sample Id : SW-2 Location : Wetland near R&R Aviation (N23.84031 E90.41119) Source : Surface water

Date of Test : 30/10/2016 - 23/11/2016

TEST REPORT (PHYSICAL/ CHEMICAL/ BACTERIOLOGICAL ANALYSIS OF WATER SAMPLE)

Sl. No.	Water Quality Parameters	Unit	Concentration Present	Method of analysis	Minimum Detection Limit (MDL)
1	pH	---	7.08	USEPA 150.1; SM 4500-H+ B	0
2	Turbidity	NTU	69.4	USEPA 180.1 Rev 2; SM 2130 B	0.01
3	Electrical Conductivity (EC) at 25°	µS/cm	209	USEPA 120.1; SM 2510 B	0.1
4	Dissolved Oxygen (DO)	mg/l	2.92	USEPA 360.3; 360.2; SM 4500- O B,G	0.1
5	Total Dissolved Solids (TDS)	mg/l	165	USEPA 160.2; SM 2540 B - D	5
6	Total Suspended Solids (TSS)	mg/l	155	USEPA 160.2; SM 2540 B - D	5
7	Iron (Fe)	mg/l	2	USEPA 200.9 ; SM 3111 B	0.02
8	Ammonia-Nitrogen (NH3 - N)	mg/l	3.65	USEPA 350.1; SM 4500 – NH3 B	0.017
9	Orthophosphate (PO4) or Reactive Phosphate	mg/l	0.500	USEPA 365.1; SM 4500-PO4	0.04
10	Sulphate (SO4)	mg/l	<1	USEPA 375.4; SM 4500-SO4	7
11	Arsenic (As)	mg/l	0.001	USEPA 206.2; SM 3113 B	0.001

Comments : 1. Sample was collected by BUET representatives.

Important Notes: Samples as supplied to us have been tested in our laboratory. BRTC does not have any responsibility as to the representative character of the samples required to be tested. It is recommended that samples are sent in a secure and sealed cover/pack.

Countersigned by:

Dr. Abu Siddique
Professor, Dept. of Civil Engg.

Department of Civil Engineering * BUET, Dhaka-1000 * Bangladesh

Test Performed by:

Dr. Tanvir Ahmed
Associate Professor, Dept. of Civil Engineering, BUET

Page 1

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY (BUET)

DEPARTMENT OF CIVIL ENGINEERING

Mobile: 01819 557 964; PABX: 966 5650-80 Ext. 7226; www.buet.ac.bd/ce/

ENVIRONMENTAL ENGINEERING LABORATORY

BRTC Bureau of Research, Testing & Consultation

BRTC No. : **1101-21615 /16-17/CE; Dt: 30/10/2016**

Ref. No. : Letter; Dt: 30/10/2016

Sent by : Md. Atiqur Rahman, Junior Environmental Specialist

Project : Dhaka Airport Expansion Project

Company Address : Development Solutions Consultant Limited

Sample Id : SW-2 Location : Wetland near R&R Aviation (N23.84031 E90.41119) Source : Surface water

Date of Test : 30/10/2016 - 23/11/2016

TEST REPORT (PHYSICAL/ CHEMICAL/ BACTERIOLOGICAL ANALYSIS OF WATER SAMPLE)

Sl. No.	Water Quality Parameters	Unit	Concentration Present	Method of analysis	Minimum Detection Limit (MDL)
11	Chemical Oxygen Demand (COD) : Dichromate	mg/l	40	USEPA 410.4; SM 5220 D	0.2
12	Biochemical oxygen Demand (BOD5)	mg/l	9	USEPA 405.1; SM 5210 B; SM 5210 D	0.2
13	Lead (Pb)	mg/l	0.031	USEPA 200.9 Rev 2.2; SM 3111 B	0.01
14	Zinc (Zn)	mg/l	0.057	USEPA 200.9 ; SM 3111 B	0.02
15	---	---	---	---	---
16	---	---	---	---	---
17	---	---	---	---	---
18	---	---	---	---	---
19	---	---	---	---	---
20	---	---	---	---	---

a. Health based guideline, b. Guideline based on other considerations

Comments : 1. Sample was collected by BUET representatives.

Important Notes: Samples as supplied to us have been tested in our laboratory. BRTC does not have any responsibility as to the representative character of the samples required to be tested. It is recommended that samples are sent in a secure and sealed cover/pack

Countersigned *by*:

Dr. Abu Siddique
Professor, Dept. of Civil Engg.

Department of Civil Engineering BUET, Dhaka-1000, Bangladesh

Test Performed *by*:

Dr. Tanvir Ahmed 23.11.16
Associate Professor, Dept. of Civil Engineering, BUET

Page 2

BUETCE 0005420

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY (BUET)
DEPARTMENT OF CIVIL ENGINEERING
Mobile: 01819 557 964; PABX: 966 5650-80 Ext. 7226; www.buet.ac.bd/ce/
ENVIRONMENTAL ENGINEERING LABORATORY

BRTC

Bureau of Research, Testing & Consultation

Ref. No. : Letter; Dt: 30/10/2016

BRTC No. : **1101-21615 /16-17/CE; Dt: 30/10/2016**
Sent by : Md. Atiqur Rahman, Junior Environmental Specialist
Project : Dhaka Airport Expansion Project
Company : Development Solutions Consultant Limited
Address Location : Drainage canal outside CAAB Boundary wall near residential area (N23.83608 E90.41453) Source : Surface water
Sample Id : SW-3
Date of Test : 30/10/2016.- 23/11/2016

TEST REPORT (PHYSICAL/ CHEMICAL/ BACTERIOLOGICAL ANALYSIS OF WATER SAMPLE)

Sl. No.	Water Quality Parameters	Unit	Concentration Present	Method of analysis	Minimum Detection Limit (MDL)
1	pH	—	6.99	USEPA 150.1; SM 4500-H+ B	0
2	Turbidity	NTU	45.4	USEPA 180.1 Rev 2; SM 2130 B	0.01
3	Electrical Conductivity (EC) at 25°	µS/cm	279	USEPA 120.1; SM 2510 B	0.1
4	Dissolved Oxygen (DO)	mg/l	0.4	USEPA 360.3, 360.2; SM 4500- O B,G	0.1
5	Total Dissolved Solids (TDS)	mg/l	176	USEPA 160.2; SM 2540 B - D	5
6	Total Suspended Solids (TSS)	mg/l	112	USEPA 160.2; SM 2540 B - D	5
7	Iron (Fe)	mg/l	2.2	USEPA 200.9 ; SM 3111 B	0.02
8	Ammonia-Nitrogen (NH3 - N)	mg/l	7.8	USEPA 350.1; SM 4500 – NH3 B	0.017
9	Orthophosphate (PO4) or Reactive Phosphate	mg/l	0.910	USEPA 365.1; SM 4500-PO4	0.04
10	Sulphate (SO4)	mg/l	<MDL	USEPA 375.4; SM 4500-SO4	7
11	Arsenic (As)	mg/l	0.001	USEPA 206.2; SM 3113 B	0.001

Comments : 1. Sample was collected by BUET representatives.

Important Notes: Samples as supplied to us have been tested in our laboratory. BRTC does not have any responsibility as to the representative character of the samples required to be tested. It is recommended that samples are sent in a secure and sealed cover/pack

Countersigned by:

Dr. Abu Siddique
Professor, Dept. of Civil Engg.

Test Performed by:

Dr. Tanvir Ahmed 23.11.16
Associate Professor, Dept. of Civil Engineering, BUET

BUETCE 0005421

Page 1

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY (BUET)

DEPARTMENT OF CIVIL ENGINEERING

Mobile: 01819 557 964; PABX: 966 5650-80 Ext. 7226; www.buet.ac.bd/ce/

ENVIRONMENTAL ENGINEERING LABORATORY

BRTC Bureau of Research, Testing & Consultation

Ref. No. : Letter; Dt: 30/10/2016

BRTC No. : **1101-21615 /16-17/CE; Dt: 30/10/2016**
Sent by : Md. Atiqur Rahman, Junior Environmental Specialist
Project : Dhaka Airport Expansion Project
Company Address : Development Solutions Consultant Limited
Sample Id : SW-3
Location : Drainage canal outside CAAB Boundary wall near residential area (N23.83608 E90.41453)
Source : Surface water
Date of Test : 30/10/2016 - 23/11/2016

TEST REPORT (PHYSICAL/ CHEMICAL/ BACTERIOLOGICAL ANALYSIS OF WATER SAMPLE)

Sl. No.	Water Quality Parameters	Unit	Concentration Present	Method of analysis	Minimum Detection Limit (MDL)
11	Chemical Oxygen Demand (COD) : Dichromate	mg/l	**54**	USEPA 410.4; SM 5220 D	0.2
12	Biochemical oxygen Demand (BOD5)	mg/l	**19.2**	USEPA 405.1; SM 5210 B; SM 5210 D	0.2
13	Lead (Pb)	mg/l	**0.027**	USEPA 200.9 Rev 2.2; SM 3111 B	0.01
14	Zinc (Zn)	mg/l	**0.052**	USEPA 200.9 ; SM 3111 B	0.02
15	---	---	---	---	---
16	---	---	---	---	---
17	---	---	---	---	---
18	---	---	---	---	---
19	---	---	---	---	---
20	---	---	---	---	---

a. Health based guideline, b. Guideline based on other considerations

Comments : 1. Sample was collected by BUET representatives.

Important Notes: Samples as supplied to us have been tested in our laboratory. BRTC does not have any responsibility as to the representative character of the samples required to be tested. It is recommended that samples are sent in a secure and sealed cover/pack

Countersigned *by*:

Dr. Abu Siddique
Professor, Dept. of Civil Engg.

Department of Civil Engineering BUET, Dhaka-1000, Bangladesh

Test Performed *by*:

Dr. Tanvir Ahmed 23.11.16
Associate Professor, Dept. of Civil Engineering, BUET

BUETCE 0005422

Page 2

মৃত্তিকা, পানি ও পরিবেশ বিভাগ
ঢাকা বিশ্ববিদ্যালয়
ঢাকা-১০০০
বাংলাদেশ

Department of Soil, Water and Environment
University of Dhaka
Dhaka 1000
Bangladesh

Date: 27. 11. 2016

Report of Analysis

Sample supplied by
Mr. Raisin Akhter Feroz
Environmental Specialist
Development Solutions Consultant Ltd.
House-734 (5-B), Road-10, Avenue-04
DOHS Mirpur, Dhaka-1216, Bangladesh

Project Name: Dhaka Hazrat Shahjalal International Airport Expansion project

Sample Title: Surface water sample analysis for oil and grease

Analytical Results:

Serial No.	Sample ID	Test Parameters	Test Method (APHA)
		Oil and Grease (mg/L)	
1	SWAP-01	Less than 5.0	5520.B
2	SWAP-02	Less than 5.0	5520.B
3	SWAP-03	5.40	5520.B

(Professor Dr. Sirajul Hoque)
Chairman

Dr. Sirajul Hoque
Professor & Chairman
Department of Soil, Water & Environment
University of Dhaka, Dhaka-1000

Telephone: 9661920-73/7470, Fax:(880-2) 8615583, e-mail: swed @du.ac.bd

Annex-14: Ground Water Quality Test Reports

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY (BUET)

DEPARTMENT OF CIVIL ENGINEERING

Mobile: 01819 557 964; PABX: 966 5650-80 Ext. 7226; www.buet.ac.bd/ce/

ENVIRONMENTAL ENGINEERING LABORATORY

BRTC
Bureau of Research, Testing & Consultation

BRTC No. : **110121615 /16-17/CE; Dt: 30/10/2016** Ref. No. : Letter; Dt: 30/10/2016

Sent by : Md. Atiqur Rahman, Junior Environmental Specialist

Project : Dhaka Airport Expansion Project

Company : Development Solutions Consultant Limited

Address :

Sample Id : GW-1 Location : BFCC Pump (N23.85068 E90.40423) Source : Groundwater

Date of Test : 30/10/2016 - 23/11/2016

TEST REPORT (PHYSICAL/ CHEMICAL/ BACTERIOLOGICAL ANALYSIS OF DRINKING WATER SAMPLE)

Sl. No.	Water Quality Parameters	Unit	Concentration Present	Bangladesh Standard for Drinking Water (ECR'97)	WHO Guideline Values, 2004	Method of analysis	Minimum Detection Limit (MDL)
1	pH	---	**6.77**	6.5-8.5	6.5-8.5	USEPA 150.1; SM 4500-H+ B	0
2	Turbidity	NTU	**0.33**	10	5	USEPA 180.1 Rev 2; SM 2130 B	0.01
3	Total Coliform(TC)	CFU/100ml	**0**	0	0	USEPA 9132; SM 9221 E	0
4	Fecal Coliform (FC)	CFU/100ml	**0**	0	0	SM 9222 G	0
5	Total Alkalinity (as CaCO3)	mg/l	**84**	---	---	USEPA 310.1; SM 2320B	1
6	Chloride (Cl-)	mg/l	**8**	150-600	250	USEPA 325.6; SM 4500-Cl-	1
7	Iron (Fe)	mg/l	**<0.02**	0.3-1.0	0.3	Phenonthrolin Method, SM 3500-Fe B	0.02
8	Total Dissolved Solids (TDS)	mg/l	**137**	1000	1000	USEPA 160.2; SM 2540 B - D	5
9	Color	Pt-Co	**1**	15	15	USEPA 110.2; SM 2120 C	0.01
10	Manganese (Mn)	mg/l	**0.007**	0.1	0.4	PAN Method	0.005
11	Arsenic (As)	mg/l	**0.001**	0.05	0.01	USEPA 206.2; SM 3113 B	0.001
12	---	---	**---**	---	---	---	---

a. Health based guideline, b. Guideline based on other considerations

Comments : 1. Sample was collected by BUET representatives.
2. Sample was received in sealed condition.

Important Notes: Samples as supplied to us have been tested in our laboratory. BRTC does not have any responsibility as to the representative character of the samples required to be tested. It is recommended that samples are sent in a secure and sealed cover/pack

Countersigned by:

Dr. Abu Siddique
Professor, Dept. of Civil Engg.

Test Performed by:

Dr. Tanvir Ahmed 23.11.16
Associate Professor, Dept. of Civil Engineering

Department of Civil Engineering * BUET, Dhaka-1000 * Bangladesh

BUETCE 0005410

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY (BUET)

DEPARTMENT OF CIVIL ENGINEERING

Mobile: 01819 557 964; PABX: 966 5650-80 Ext. 7226; www.buet.ac.bd/ce/

ENVIRONMENTAL ENGINEERING LABORATORY

BRTC Bureau of Research, Testing & Consultation

BRTC No. : **110121615 /16-17/CE; Dt: 30/10/2016**

Ref. No. : Letter; Dt: 30/10/2016

Sent by : Md. Atiqur Rahman, Junior Environmental Specialist

Project : Dhaka Airport Expansion Project

Company Address : Development Solutions Consultant Limited

Sample Id : GW-2 Location : VIP Pump (N23.84437 E90.40941) Source : Groundwater

Date of Test : 30/10/2016 - 23/11/2016

TEST REPORT (PHYSICAL/ CHEMICAL/ BACTERIOLOGICAL ANALYSIS OF DRINKING WATER SAMPLE)

Sl. No.	Water Quality Parameters	Unit	Concentration Present	Bangladesh Standard for Drinking Water (ECR'97)	WHO Guideline Values, 2004	Method of analysis	Minimum Detection Limit (MDL)
1	pH	---	6.62	6.5-8.5	6.5-8.5	USEPA 150.1; SM 4500-H+ B	0
2	Turbidity	NTU	0.31	10	5	USEPA 180.1 Rev 2; SM 2130 B	0.01
3	Total Coliform(TC)	CFU/100ml	0	0	0	USEPA 9132; SM 9221 E	0
4	Fecal Coliform (FC)	CFU/100ml	0	0	0	SM 9222 G	0
5	Total Alkalinity (as CaCO3)	mg/l	83	---	---	USEPA 310.1; SM 2320B	1
6	Chloride (Cl-)	mg/l	9	150-600	250	USEPA 325.6; SM 4500-Cl-	1
7	Iron (Fe)	mg/l	0.04	0.3-1.0	0.3	Phenonthrolin Method, SM 3500-Fe B	0.02
8	Total Dissolved Solids (TDS)	mg/l	133	1000	1000	USEPA 160.2; SM 2540 B - D	5
9	Color	Pt-Co	2	15	15	USEPA 110.2; SM 2120 C	0.01
10	Manganese (Mn)	mg/l	0.036	0.1	0.4	PAN Method	0.005
11	Arsenic (As)	mg/l	0.002	0.05	0.01	USEPA 206.2; SM 3113 B	0.001
12	---	---	---	---	---	---	---

a. Health based guideline, b. Guideline based on other considerations

Comments : 1. Sample was collected by BUET representatives.
2. Sample was received in sealed condition.

Important Notes: Samples as supplied to us have been tested in our laboratory. BRTC does not have any responsibility as to the representative character of the samples required to be tested. It is recommended that samples are sent in a secure and sealed cover/pack

Countersigned *by*:

Dr. Abu Siddique
Professor, Dept. of Civil Engg.

Department of Civil Engineering * BUET, Dhaka-1000, Bangladesh *

Test Performed *by*:

T. Ahmed 23.11.16

Dr. Tanvir Ahmed
Associate Professor, Dept. of Civil Engineering

BUETCE 0005111

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY (BUET)

DEPARTMENT OF CIVIL ENGINEERING

Mobile: 01819 557 964; PABX: 966 5650-80 Ext. 7226; www.buet.ac.bd/ce/

ENVIRONMENTAL ENGINEERING LABORATORY

BRTC Bureau of Research, Testing & Consultation

BRTC No. : **110121615 /16-17/CE; Dt: 30/10/2016** Ref. No. : Letter; Dt: 30/10/2016

Sent by : Md. Atiqur Rahman, Junior Environmental Specialist

Project : Dhaka Airport Expansion Project

Company Address : Development Solutions Consultant Limited

Sample Id : GW-3 Location : RAB Pump (N23.85606 E90.39993) Source : Groundwater

Date of Test : 30/10/2016 - 23/11/2016

TEST REPORT (PHYSICAL/ CHEMICAL/ BACTERIOLOGICAL ANALYSIS OF DRINKING WATER SAMPLE)

Sl. No.	Water Quality Parameters	Unit	Concentration Present	Bangladesh Standard for Drinking Water (ECR'97)	WHO Guideline Values, 2004	Method of analysis	Minimum Detection Limit (MDL)
1	pH	---	**6.68**	6.5-8.5	6.5-8.5	USEPA 150.1; SM 4500-H+ B	0
2	Turbidity	NTU	**0.37**	10	5	USEPA 180.1 Rev 2; SM 2130 B	0.01
3	Total Coliform(TC)	CFU/100ml	**0**	0	0	USEPA 9132; SM 9221 E	0
4	Fecal Coliform (FC)	CFU/100ml	**0**	0	0	SM 9222 G	0
5	Total Alkalinity (as CaCO3)	mg/l	**110**	---	---	USEPA 310.1; SM 2320B	1
6	Chloride (Cl-)	mg/l	**7**	150-600	250	USEPA 325.6; SM 4500-Cl-	1
7	Iron (Fe)	mg/l	**0.02**	0.3-1.0	0.3	Phenonthrolin Method, SM 3500-Fe B	0.02
8	Total Dissolved Solids (TDS)	mg/l	**142**	1000	1000	USEPA 160.2; SM 2540 B - D	5
9	Color	Pt-Co	**1**	15	15	USEPA 110.2; SM 2120 C	0.01
10	Manganese (Mn)	mg/l	**0.012**	0.1	0.4	PAN Method	0.005
11	Arsenic (As)	mg/l	**<0.001**	0.05	0.01	USEPA 206.2; SM 3113 B	0.001
12	---	---	---	---	---	---	---

a. Health based guideline, b. Guideline based on other considerations

Comments : 1. Sample was collected by BUET representatives.
2. Sample was received in sealed condition.

Important Notes: Samples as supplied to us have been tested in our laboratory. BRTC does not have any responsibility as to the representative character of the samples required to be tested. It is recommended that samples are sent in a secure and sealed cover/pack

Countersigned *by*:

Dr. Abu Siddique
Professor, Dept. of Civil Engg.

Department of Civil Engineering * BUET, Dhaka-1000, Bangladesh *

Test Performed *by*:

Dr. Tanvir Ahmed 23.11.16
Associate Professor, Dept. of Civil Engineering

BUET/CE 000542

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY (BUET)

DEPARTMENT OF CIVIL ENGINEERING

Mobile: 01819 557 964; PABX: 966 5650-80 Ext. 7226; www.buet.ac.bd/ce/

ENVIRONMENTAL ENGINEERING LABORATORY

BRTC Bureau of Research, Testing & Consultation

BRTC No. : **21615 /16-17/CE; Dt: 30/10/2016**

Ref. No. : Letter; Dt: 30/10/2016

Sent by : Md. Atiqur Rahman, Junior Environmental Specialist

Project : Dhaka Airport Expansion Project

Company Address : Development Solutions Consultant Limited

Sample Id : Soil-1 Source : Excavated soil Location : Near Radar Area (N23.8583 E90.39621)

Date of Test : 31/10/2016 - 22/11/2016

TEST REPORT (TOTAL EXTRACTION OF SOIL SAMPLES : TOTAL EXTRACTION DONE BY AQUA-REGIA)

Sl. No.	Parameter	Unit	Concentration Present	EU Directive 86/278/EEC for Land Application	Method of analysis	Minimum Detection Limit (MDL)
1	Iron (Fe)	mg/kg	238	---	USEPA 200.9 ; SM 3111 B	---
2	Lead (Pb)	mg/kg	4479	1200	USEPA 200.9 Rev 2.2; SM 3111 B	---
3	Cadmium (Cd)	mg/kg	0.9	40	USEPA 213.2 ; SM 3113 B	---
4	Zinc (Zn)	mg/kg	34.5	4000	USEPA 200.9 ; SM 3111 B	---
5	Organic Matter	%	1.9	---	ASTM D2974	---
6	---	---	---	---	---	---
7	---	---	---	---	---	---
8	---	---	---	---	---	---
9	---	---	---	---	---	---
10	---	---	---	---	---	---

Comments : 1. Sample was collected by BUET representatives.
2. Sample was received in sealed condition.

Note : Above is a partial analysis performed at our laboratory as per client's request. It should be noted that in order to certify a SOIL sample according to EU Directive 86/278/EEC a number of additional tests have to be performed

Important Notes: Samples as supplied to us have been tested in our laboratory. BRTC does not have any responsibility as to the representative character of the samples required to be tested. It is recommended that samples are sent in a secure and sealed cover/pack

Countersigned *by*:

Dr. Abu Siddique
Professor, Dept. of Civil Engg.

Page 1

Department of Civil Engineering * BUET, Dhaka-1000, Bangladesh *

Test Performed *by*:

Dr. Tanvir Ahmed 23·11·16
Associate Professor, Dept. of Civil Engineering

BUETCE 0005413

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY (BUET)

DEPARTMENT OF CIVIL ENGINEERING

Mobile: 01819 557 964; PABX: 966 5650-80 Ext. 7226; www.buet.ac.bd/ce/

ENVIRONMENTAL ENGINEERING LABORATORY

BRTC
Bureau of Research, Testing & Consultation

BRTC No. : **21615 /16-17/CE; Dt: 30/10/2016**

Ref. No. : Letter; Dt: 30/10/2016

Sent by : Md. Atiqur Rahman, Junior Environmental Specialist

Project : Dhaka Airport Expansion Project

Company Address : Development Solutions Consultant Limited

Sample Id : Soil-2 Source : Excavated soil Location : Near R&R Aviation (N23.84016 E90.41137)

Date of Test : 31/10/2016 - 22/11/2016

TEST REPORT (TOTAL EXTRACTION OF SOIL SAMPLES : TOTAL EXTRACTION DONE BY AQUA-REGIA)

Sl. No.	Parameter	Unit	Concentration Present	EU Directive 86/278/EEC for Land Application	Method of analysis	Minimum Detection Limit (MDL)
1	Iron (Fe)	mg/kg	238	---	USEPA 200.9 ; SM 3111 B	---
2	Lead (Pb)	mg/kg	4479	1200	USEPA 200.9 Rev 2.2; SM 3111 B	---
3	Cadmium (Cd)	mg/kg	0.8	40	USEPA 213.2 ; SM 3113 B	---
4	Zinc (Zn)	mg/kg	27.7	4000	USEPA 200.9 ; SM 3111 B	---
5	Organic Matter	%	2.2	---	ASTM D2974	---
6	---	---	---	---	---	---
7	---	---	---	---	---	---
8	---	---	---	---	---	---
9	---	---	---	---	---	---
10	---	---	---	---	---	---

Comments : 1. Sample was collected by BUET representatives.
2. Sample was received in sealed condition.

Note : Above is a partial analysis performed at our laboratory as per client's request. It should be noted that in order to certify a SOIL sample according to EU Directive 86/278/EEC a number of additional tests have to be performed

Important Notes: Samples as supplied to us have been tested in our laboratory. BRTC does not have any responsibility as to the representative character of the samples required to be tested. It is recommended that samples are sent in a secure and sealed cover/pack

Countersigned *by*:

Dr. Abu Siddique
Professor, Dept. of Civil Engg.

Page 1

Department of Civil Engineering * BUET, Dhaka-1000, Bangladesh *

Test Performed *by*:

Dr. Tanvir Ahmed 23.11.16
Associate Professor, Dept. of Civil Engineering

BUETCE 000544

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY (BUET)

DEPARTMENT OF CIVIL ENGINEERING

Mobile: 01819 557 964; PABX: 966 5650-80 Ext. 7226; www.buet.ac.bd/ce/

ENVIRONMENTAL ENGINEERING LABORATORY

BRTC Bureau of Research, Testing & Consultation

BRTC No. : **21615 /16-17/CE; Dt: 30/10/2016** Ref. No. : Letter; Dt: 30/10/2016

Sent by : Md. Atiqur Rahman, Junior Environmental Specialist

Project : Dhaka Airport Expansion Project

Company Address : Development Solutions Consultant Limited

Sample Id : Soil-3 Source : Excavated soil Location : Near Residential Area outside CAAB Boundary (N23.83608 E90.41453)

Date of Test : 31/10/2016 - 22/11/2016

TEST REPORT (TOTAL EXTRACTION OF SOIL SAMPLES : TOTAL EXTRACTION DONE BY AQUA-REGIA)

Sl. No.	Parameter	Unit	Concentration Present	EU Directive 86/278/EEC for Land Application	Method of analysis	Minimum Detection Limit (MDL)
1	Iron (Fe)	mg/kg	238	---	USEPA 200.9 ; SM 3111 B	---
2	Lead (Pb)	mg/kg	4479	1200	USEPA 200.9 Rev 2.2; SM 3111 B	---
3	Cadmium (Cd)	mg/kg	0.8	40	USEPA 213.2 ; SM 3113 B	---
4	Zinc (Zn)	mg/kg	36.7	4000	USEPA 200.9 ; SM 3111 B	---
5	Organic Matter	%	1.5	---	ASTM D2974	---
6	---	---	---	---	---	---
7	---	---	---	---	---	---
8	---	---	---	---	---	---
9	---	---	---	---	---	---
10	---	---	---	---	---	---

Comments : 1. Sample was collected by BUET representatives.
2. Sample was received in sealed condition.

Note : Above is a partial analysis performed at our laboratory as per client's request. It should be noted that in order to certify a SOIL sample according to EU Directive 86/278/EEC a number of additional tests have to be performed

Important Notes: Samples as supplied to us have been tested in our laboratory. BRTC does not have any responsibility as to the representative character of the samples required to be tested. It is recommended that samples are sent in a secure and sealed cover/pack

Countersigned *by* :

Dr. Abu Siddique
Professor, Dept. of Civil Engg.

Page 1

Department of Civil Engineering BUET, Dhaka-1000, Bangladesh

Test Performed *by* :

Dr. Tanvir Ahmed 23.11.16
Associate Professor, Dept. of Civil Engineering

BUETCE 0005115

মৃত্তিকা, পানি ও পরিবেশ বিভাগ
ঢাকা বিশ্ববিদ্যালয়
ঢাকা-১০০০

Department of Soil, Water and Environment
University of Dhaka
Dhaka 1000
Bangladesh

Date: 27. 11. 2016

Report of Analysis

Sample supplied by
Mr. Raisin Akhter Feroz
Environmental Specialist
Development Solutions Consultant Ltd.
House-734 (5-B), Road-10, Avenue-04
DOHS Mirpur, Dhaka-1216, Bangladesh

Project Name: Dhaka Hazrat Shahjalal International Airport Expansion project

Sample Title: Soil sample analysis for oil and grease

Analytical Results:

Serial No.	Sample ID	Test Parameters	Test Method
		Oil and Grease (mg/kg)	
1	SSAP-01	84.8	EPA 9071 B {Oil & Grease (O&G) in soil}
2	SSAP-02	29.9	
3	SSAP-03	858.1	

(Professor Dr. Sirajul Hoque)
Chairman

Dr. Sirajul Hoque
Professor & Chairman
Department of Soil, Water & Environment
University of Dhaka, Dhaka-1000

Telephone: 9661920-73/7470, Fax:(880-2) 8615583, e-mail: swed @du.ac.bd

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY (BUET)

DEPARTMENT OF CIVIL ENGINEERING

Mobile: 01819 557 964; PABX: 966 5650-80 Ext. 7226; www.buet.ac.bd/ce/

ENVIRONMENTAL ENGINEERING LABORATORY

BRTC Bureau of Research, Testing & Consultation

BRTC No. : **21615 /16-17/CE; Dt: 30/10/2016** Ref. No. : Letter; Dt: 30/10/2016

Sent by : Md. Atiqur Rahman, Junior Environmental Specialist

Project : Dhaka Airport Expansion Project

Company Address : Development Solutions Consultant Limited

Sample Id : Soil-1 Source : Excavated soil Location : Near Radar Area (N23.8583 E90.39621)

Date of Test : 31/10/2016 - 22/11/2016

TEST REPORT (TOTAL EXTRACTION OF SOIL SAMPLES : TOTAL EXTRACTION DONE BY AQUA-REGIA)

Sl. No.	Parameter	Unit	Concentration Present	EU Directive 86/278/EEC for Land Application	Method of analysis	Minimum Detection Limit (MDL)
1	Iron (Fe)	mg/kg	238	---	USEPA 200.9 ; SM 3111 B	---
2	Lead (Pb)	mg/kg	4479	1200	USEPA 200.9 Rev 2.2; SM 3111 B	---
3	Cadmium (Cd)	mg/kg	0.9	40	USEPA 213.2 ; SM 3113 B	---
4	Zinc (Zn)	mg/kg	34.5	4000	USEPA 200.9 ; SM 3111 B	---
5	Organic Matter	%	1.9	---	ASTM D2974	---
6	---	---	---	---	---	---
7	---	---	---	---	---	---
8	---	---	---	---	---	---
9	---	---	---	---	---	---
10	---	---	---	---	---	---

Comments : 1. Sample was collected by BUET representatives.
2. Sample was received in sealed condition.

Note : Above is a partial analysis performed at our laboratory as per client's request. It should be noted that in order to certify a SOIL sample according to EU Directive 86/278/EEC a number of additional tests have to be performed

Important Notes: Samples as supplied to us have been tested in our laboratory. BRTC does not have any responsibility as to the representative character of the samples required to be tested. It is recommended that samples are sent in a secure and sealed cover/pack

Countersigned by:

Dr. Abu Siddique
Professor, Dept. of Civil Engg.

Page 1

Department of Civil Engineering * BUET, Dhaka-1000, Bangladesh *

Test Performed by:

Dr. Tanvir Ahmed 23.11.16
Associate Professor, Dept. of Civil Engineering

BUETCE 0005413

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY (BUET)

DEPARTMENT OF CIVIL ENGINEERING

Mobile: 01819 557 964; PABX: 966 5650-80 Ext. 7226; www.buet.ac.bd/ce/

ENVIRONMENTAL ENGINEERING LABORATORY

BRTC Bureau of Research, Testing & Consultation

BRTC No. : **21615 /16-17/CE; Dt: 30/10/2016**

Ref. No. : Letter; Dt: 30/10/2016

Sent by : Md. Atiqur Rahman, Junior Environmental Specialist

Project : Dhaka Airport Expansion Project

Company Address : Development Solutions Consultant Limited

Sample Id : Soil-2 Source : Excavated soil Location : Near R&R Aviation (N23.84016 E90.41137)

Date of Test : 31/10/2016 - 22/11/2016

TEST REPORT (TOTAL EXTRACTION OF SOIL SAMPLES : TOTAL EXTRACTION DONE BY AQUA-REGIA)

Sl. No.	Parameter	Unit	Concentration Present	EU Directive 86/278/EEC for Land Application	Method of analysis	Minimum Detection Limit (MDL)
1	Iron (Fe)	mg/kg	238	---	USEPA 200.9 ; SM 3111 B	---
2	Lead (Pb)	mg/kg	4479	1200	USEPA 200.9 Rev 2.2; SM 3111 B	---
3	Cadmium (Cd)	mg/kg	0.8	40	USEPA 213.2 ; SM 3113 B	---
4	Zinc (Zn)	mg/kg	27.7	4000	USEPA 200.9 ; SM 3111 B	---
5	Organic Matter	%	2.2	---	ASTM D2974	---
6	---	---	---	---	---	---
7	---	---	---	---	---	---
8	---	---	---	---	---	---
9	---	---	---	---	---	---
10	---	---	---	---	---	---

Comments : 1. Sample was collected by BUET representatives.
2. Sample was received in sealed condition.

Note : Above is a partial analysis performed at our laboratory as per client's request. It should be noted that in order to certify a SOIL sample according to EU Directive 86/278/EEC a number of additional tests have to be performed

Important Notes: Samples as supplied to us have been tested in our laboratory. BRTC does not have any responsibility as to the representative character of the samples required to be tested. It is recommended that samples are sent in a secure and sealed cover/pack

Countersigned *by*:

Dr. Abu Siddique
Professor, Dept. of Civil Engg.

Page 1

Department of Civil Engineering * BUET, Dhaka-1000, Bangladesh *

Test Performed *by*:

Dr. Tanvir Ahmed 23.11.16
Associate Professor, Dept. of Civil Engineering

BUETCE 0005 4.4

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY (BUET)

DEPARTMENT OF CIVIL ENGINEERING

Mobile: 01819 557 964; PABX: 966 5650-80 Ext. 7226; www.buet.ac.bd/ce/

ENVIRONMENTAL ENGINEERING LABORATORY

BRTC Bureau of Research, Testing & Consultation

BRTC No. : **21615 /16-17/CE; Dt: 30/10/2016** Ref. No. : Letter; Dt: 30/10/2016

Sent by : Md. Atiqur Rahman, Junior Environmental Specialist

Project : Dhaka Airport Expansion Project

Company Address : Development Solutions Consultant Limited

Sample Id : Soil-3 Source : Excavated soil Location : Near Residential Area outside CAAB Boundary (N23.83608 E90.41453)

Date of Test : 31/10/2016 - 22/11/2016

TEST REPORT (TOTAL EXTRACTION OF SOIL SAMPLES : TOTAL EXTRACTION DONE BY AQUA-REGIA)

Sl. No.	Parameter	Unit	Concentration Present	EU Directive 86/278/EEC for Land Application	Method of analysis	Minimum Detection Limit (MDL)
1	Iron (Fe)	mg/kg	238	---	USEPA 200.9 ; SM 3111 B	---
2	Lead (Pb)	mg/kg	4479	1200	USEPA 200.9 Rev 2.2; SM 3111 B	---
3	Cadmium (Cd)	mg/kg	0.8	40	USEPA 213.2 ; SM 3113 B	---
4	Zinc (Zn)	mg/kg	36.7	4000	USEPA 200.9 ; SM 3111 B	---
5	Organic Matter	%	1.5	---	ASTM D2974	---
6	---	---	---	---	---	---
7	---	---	---	---	---	---
8	---	---	---	---	---	---
9	---	---	---	---	---	---
10	---	---	---	---	---	---

Comments : 1. Sample was collected by BUET representatives.
2. Sample was received in sealed condition.

Note : Above is a partial analysis performed at our laboratory as per client's request. It should be noted that in order to certify a SOIL sample according to EU Directive 86/278/EEC a number of additional tests have to be performed

Important Notes: Samples as supplied to us have been tested in our laboratory. BRTC does not have any responsibility as to the representative character of the samples required to be tested. It is recommended that samples are sent in a secure and sealed cover/pack

Countersigned *by* :

Dr. Abu Siddique
Professor, Dept. of Civil Engg.

Page 1

Department of Civil Engineering BUET, Dhaka-1000, Bangladesh

Test Performed *by* :

Dr. Tanvir Ahmed 23.11.16
Associate Professor, Dept. of Civil Engineering

BUETCE 0005115

মৃত্তিকা, পানি ও পরিবেশ বিভাগ
ঢাকা বিশ্ববিদ্যালয়
ঢাকা-১০০০

Department of Soil, Water and Environment
University of Dhaka
Dhaka 1000
Bangladesh

Date: 27. 11. 2016

Report of Analysis

Sample supplied by
Mr. Raisin Akhter Feroz
Environmental Specialist
Development Solutions Consultant Ltd.
House-734 (5-B), Road-10, Avenue-04
DOHS Mirpur, Dhaka-1216, Bangladesh

Project Name: Dhaka Hazrat Shahjalal International Airport Expansion project

Sample Title: Soil sample analysis for oil and grease

Analytical Results:

Serial No.	Sample ID	Test Parameters	Test Method
		Oil and Grease (mg/kg)	
1	SSAP-01	84.8	EPA 9071 B {Oil & Grease (O&G) in soil}
2	SSAP-02	29.9	
3	SSAP-03	858.1	

(Professor Dr. Sirajul Hoque)
Chairman

Dr. Sirajul Hoque
Professor & Chairman
Department of Soil, Water & Environment
University of Dhaka, Dhaka-1000

Telephone: 9661920-73/7470, Fax:(880-2) 8615583, e-mail: swed @du.ac.bd

Annex-16: Ambient Air Quality Monitoring Results

DSCL

Multidisciplinary Development Consultants

DSCL Environmental Laboratory

Name of the Project	Hazrat Shahjalal (Dhaka) International Airport Expansion Project	
Project Location	VIP Road near VIP pump	
GPS Coordination	Longitude- 23.84419° N	Latitude- 90.40918° E
Description of sample	Ambient Air Quality Test Result	
Sample Collector	Collected by DSCL Monitoring Team	
Sampling ID	AAQ-01	
Sampling Date	30th October, 2016	

Test Result of Ambient Air Quality Analysis

Parameter	Unit	Project Site	Bangladesh (DoE) Standard**	WHO AQGs***	Duration (hours)	Weather Condition	Method of Analysis
PM_{10}	µg/m³	145.45	150	50	24	Sunny	Gravimetric
$PM_{2.5}$	µg/m³	74.66	65	25	24		Gravimetric
SO_2	µg/m³	8.62	365	20	24		West- Geake
NOx	µg/m³	57.20	100	40	24		Jacob and Hochheiser
O_3	µg/m³	23.10	235	100	24		Spectophotometric Method
Pb	µg/m³	0.18	0.5	0.5	24		AAS Method
CO*	ppm	2	10	10	8		CO-Meter

Note:

** CO concentrations and standards are 8-hourly only.*

***The Bangladesh National Ambient Air Quality Standards have been taken from the Environmental Conservation Rules, 1997 which was amended on 19th July 2005 vide S.R.O. No. 220-Law/2005.*

****WHO AQGs have been taken from WHO Air Quality Guideline Standards (AQGs), Global Update, 2006.*

Abbreviation:

PM_{10} - Respirable Dust Content, $PM_{2.5}$ - Fine Particulate Matter, SO_2 - Sulphur Di-oxide, NO_X - Oxides of Nitrogen, O_3 - Ozone, Pb - Lead, CO - Carbon Monoxide, AAS - Atomic Absorption Spectroscopy, µg/m³ - microgram/cubic meter, ppm - parts per million.

Test Performed By:	Approved By:
1.) **Masfiq Bashir** Jr. Environmental Specialist	**Israt Jahan Sumi** Director
2.) **Md. Atiqur Rahman** Jr. Environmental Specialist	

Development Solutions Consultant Limited * DSCL *

Development Solutions Consultant Ltd.
House-734 (5-B), Road-10, Avenue-04, DOHS Mirpur, Dhaka -1216,
Bangladesh. Tel: +8804478035444
Email: dscl@dsclbd.com Web: www.dsclbd.com

DSCL Environmental Laboratory

Name of the Project	Hazrat Shahjalal (Dhaka) International Airport Expansion Project	
Project Location	Near Abdul Momen Ltd.	
GPS Coordination	Longitude- 23.86087° N	Latitude- 90.39598° E
Description of sample	Ambient Air Quality Test Result	
Sample Collector	Collected by DSCL Monitoring Team	
Sampling ID	AAQ-02	
Sampling Date	31st October, 2016	

Test Result of Ambient Air Quality Analysis

Parameter	Unit	Project Site	Bangladesh (DoE) Standard**	WHO AQGs***	Duration (hours)	Weather Condition	Method of Analysis
PM_{10}	µg/m³	142.50	150	50	24	Sunny	Gravimetric
$PM_{2.5}$	µg/m³	71.54	65	25	24		Gravimetric
SO_2	µg/m³	8.12	365	20	24		West- Geake
NOx	µg/m³	55.10	100	40	24		Jacob and Hochheiser
O_3	µg/m³	22.85	235	100	24		Spectophotometric Method
Pb	µg/m³	0.16	0.5	0.5	24		AAS Method
CO*	ppm	3	10	10	8		CO-Meter

Note:

** CO concentrations and standards are 8-hourly only.*

***The Bangladesh National Ambient Air Quality Standards have been taken from the Environmental Conservation Rules, 1997 which was amended on 19th July 2005 vide S.R.O. No. 220-Law/2005.*

****WHO AQGs have been taken from WHO Air Quality Guideline Standards (AQGs), Global Update, 2006.*

Abbreviation:

PM_{10} - Respirable Dust Content, $PM_{2.5}$ - Fine Particulate Matter, SO_2 - Sulphur Di-oxide, NO_X - Oxides of Nitrogen, O_3 - Ozone, Pb - Lead, CO - Carbon Monoxide, AAS - Atomic Absorption Spectroscopy, µg/m³ - microgram/cubic meter, ppm - parts per million.

Test Performed By:	Approved By:
1.) **Masfiq Bashir** Jr. Environmental Specialist	**Israt Jahan Sumi** Director
2.) **Md. Atiqur Rahman** Jr. Environmental Specialist	

Development Solutions Consultant Ltd.
House-734 (5-B), Road-10, Avenue-04, DOHS Mirpur, Dhaka -1216,
Bangladesh. Tel: +8804478035444
Email: dscl@dsclbd.com Web: www.dsclbd.com

DSCL Environmental Laboratory

Name of the Project	Hazrat Shahjalal (Dhaka) International Airport Expansion Project	
Project Location	Near last Gate of VIP Road (Inside)	
GPS Coordination	Longitude- 23.83352° N	Latitude- 90.41299° E
Description of sample	Ambient Air Quality Test Result	
Sample Collector	Collected by DSCL Monitoring Team	
Sampling ID	AAQ-03	
Sampling Date	8th November, 2016	

Test Result of Ambient Air Quality Analysis

Parameter	Unit	Project Site	Bangladesh (DoE) Standard**	WHO AQGs***	Duration (hours)	Weather Condition	Method of Analysis
PM_{10}	µg/m³	148.52	150	50	24	Sunny	Gravimetric
$PM_{2.5}$	µg/m³	76.68	65	25	24		Gravimetric
SO_2	µg/m³	9.01	365	20	24		West- Geake
NOx	µg/m³	58.12	100	40	24		Jacob and Hochheiser
O_3	µg/m³	23.31	235	100	24		Spectophotometric Method
Pb	µg/m³	0.23	0.5	0.5	24		AAS Method
CO*	ppm	2	10	10	8		CO-Meter

Note:

** CO concentrations and standards are 8-hourly only.*

***The Bangladesh National Ambient Air Quality Standards have been taken from the Environmental Conservation Rules, 1997 which was amended on 19th July 2005 vide S.R.O. No. 220-Law/2005.*

****WHO AQGs have been taken from WHO Air Quality Guideline Standards (AQGs), Global Update, 2006.*

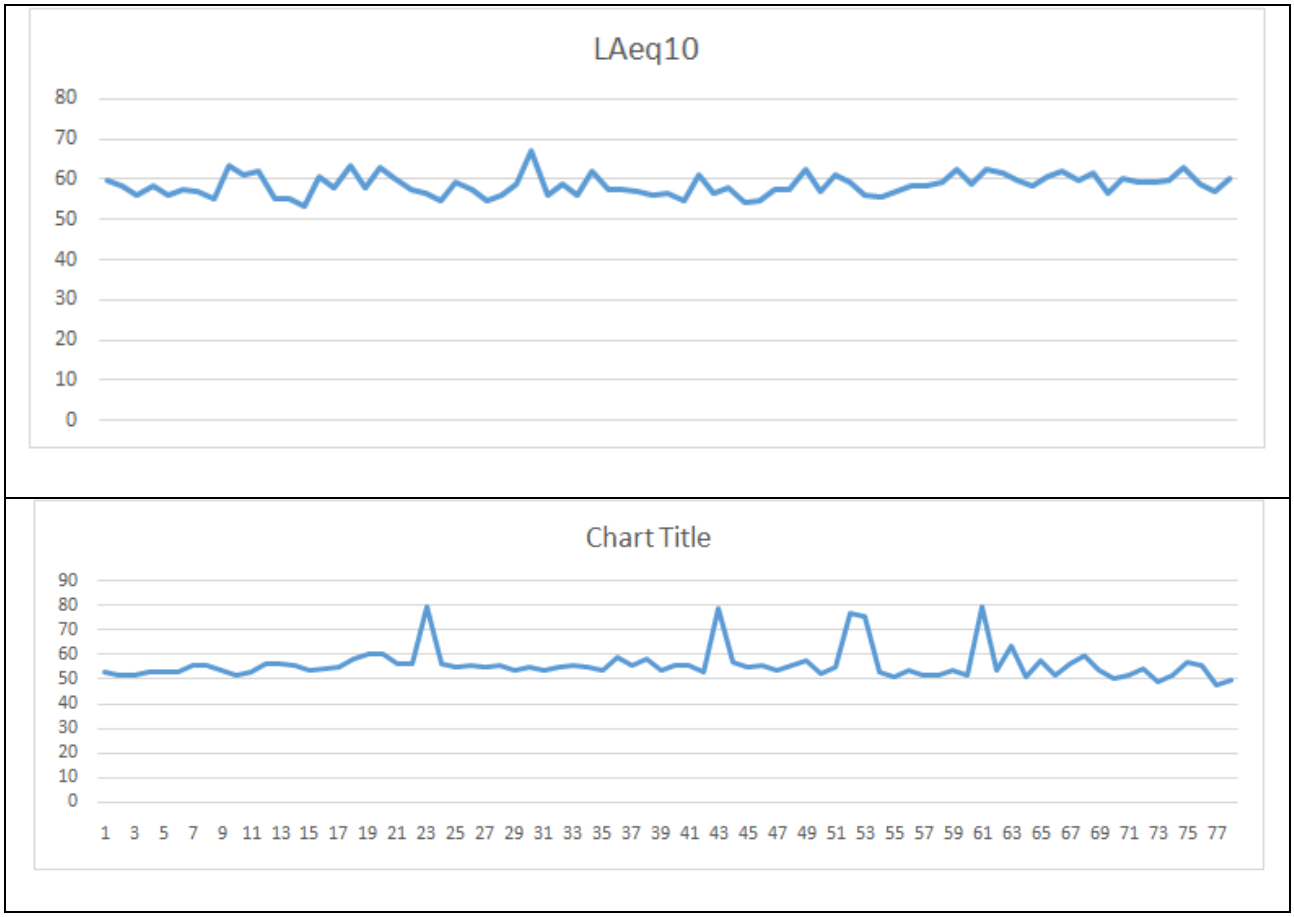
Abbreviation:

PM_{10} - Respirable Dust Content, $PM_{2.5}$ - Fine Particulate Matter, SO_2 - Sulphur Di-oxide, NO_X - Oxides of Nitrogen, O_3 - Ozone, Pb - Lead, CO - Carbon Monoxide, AAS - Atomic Absorption Spectroscopy, µg/m³ - microgram/cubic meter, ppm - parts per million.

Test Performed By:	Approved By:
1.) **Masfiq Bashir** Jr. Environmental Specialist	**Israt Jahan Sumi** Director
2.) **Md. Atiqur Rahman** Jr. Environmental Specialist	

Development Solutions Consultant Ltd.
House-734 (5-B), Road-10, Avenue-04, DOHS Mirpur, Dhaka -1216,
Bangladesh. Tel: +8804478035444
Email: dscl@dsclbd.com Web: www.dsclbd.com

Annex-17: Noise Level Measurement Test Results in Location 3 and 4



Annex-18: Analysis of Social Environment

18.1 Introduction

For social Environment describes the existing conditions of socio-economic components (e.g. population, and housing, traffic and transport, economy and employment, cultural, archaeological and historical resources, etc.) in the project area.The primary objectives are to provide a baseline data that helps to identify important social components (ISCs) and to assess the potential impacts on the ISCs which may be caused by the project activities during pre-construction, construction and operation and maintenance (O&M) stages. The baseline data includes an inventory of economic development and socio-cultural resources.

HazratShahjalal International Airport expansion project is under the jurisdiction of Biman Bandar Thana. It is bounded by pallabi, uttara and dakshinkhanthanas on the north, khilkhet and cantonmentthanas on the south, Khilkhet and Dakshinkhanthanas on the east, Cantonment and Pallabithanas on the west under Dhaka North City Corporation(DNCC).

The information to establish the baseline of the project area was collected from different secondary (e.g. government and private sector agencies) and primary (e.g. field survey, site visits, public consultation, professional judgment etc.) sources.

In order to assess the impacts of the proposed Project on people living in the vicinity of the project area, detailed survey was conducted and existing socio-economic conditions and salient

features of the area were duly observed. Secondary data on demographic and socioeconomic issues of the study area have been collected from various sources including the population census of Bangladesh Bureau of Statistics (BBS-2012) and Harirampur union perished, ward council office, Dhaka North City Corporation (DNCC). During the detailed site visit, relevant government agencies/departments were also consulted for the collection of the relevant data. Information on socio-cultural resources and economic development were collected through interview with different occupations, in spot field visit, Focus group discussion, individual consultation, public consultation, Key informant interview, secondary sources and also by the social study team of the project.

18.2 Project area

The socio-economic conditions of the communities near the runway ends were assessed because they are affected by aircraft noise.HSIA project area bounded by pallabi, uttara and dakshinkhan thanas on the north, khilkhet and cantonment thanas on the south, Khilkhet and Dakshinkhanthanas on the east, Cantonment and Pallabi thanas on the west under Dhaka North City Corporation.

The HSIA expansion project area is completely premises of Civil Aviation area. In that case, there is no provision of resettlement and land acquisition. Project area is under jurisdiction of Bimanbandarthana. BimanbandarThanaarea 8.02 sq. km, located between 23°49' and 23°51' north latitudes and between 90°23' and 90°25' east longitudes.Aircraft landing is mostly north to south and in times of winter season aircraft landing from south to north.Dolipara and Ahalia villages are located north site of aircraft landing also known as focus light area. Pakuria village is in north site and Baunia village in the West site of aircraft landing site. Doipara, Ahalia, Pakuria and Baunia villages are under Harirampur union of TuragThana. Aircraft take-off site is Nikunja.

18.3 Study Methodology

The following were the main highlights of the methodology:

- Collection of Secondary data through literature survey.
- Conducted consultation with different professionals near the runway ends area likeshopkeeper, teacher of school, college, madrasa (religious school), land owner, service holder, business man, taxi driver, rickshaw driver, van puller, Moszid Imam (religious leader), word councilor (elected representative), women leader, house wife etc.

18.4 Thana wise area, population, population density, literacy rate

Biman Bandar Thana total Population 5079; male 3016, female 2063, which includes Muslim 4921, Hindu 137 and others 21. The highest area is under Pallabi 25.28 sq.km and lowest Utara 7.0 sq.km. Population is highest in the Dakshinkhan 2, 55,931 (male-136572, female-119359) and lowest Bimanbandarthana (male-3016 and female 2063). Population density highest DakshinkhanThana 31,911 (per sq. km) and lowest Biman Bandar thana 1323 (per sq. km). Literacy rate highest Biman Bandar Thana male 82.50% and female 70.01% and lowest KhilkhetThana male 63.32% and female 52.52%. Thana wise area, population, population density, literacy rate are in **Table A18-1**.

Table A18-1: Thana wise area, population, population density, literacy rate

Name of Thana	Area (sq. km)	Population			Density (per sq. km)	Literacy rate (%)		
		Average	male	Female		Average	male	female
Bimanbandar	8.02	5,079	3,016	2,063	1,323.3	79.13	82.50	70.01
Pallabi	25.28	4,12,217	2,21,411	1,90,806	21,412	64.10	69.22	58.98
Uttara	7.0	1,79,907	1,01,349	78,558	25,701	65.67	71.26	58.42
Dakshinkhan	8.02	2,55,931	1,36,572	1,19,359	31,911.6	68.87	73.57	63.06
Khikhet	15.65	1,30,053	73,271	56,782	8,310.1	58.32	63.32	52.52
Cantonment	8.6	1,31,864	75,201	56,663	15,333	70.3	74.4	65.70
Turag	25.09	1,57,316	86,428	70,888	6,270.1	60.54	65.62	54.72

References: Bangladesh Population Census 2011, Bangladesh Bureau of Statistics

Figure A18-1: Map showing Biman Bandar Thana and its surroundings

18.5 Land Use

Land use Planning

Dhaka Metropolitan Development Plan (DMDP) was prepared in 1995 with support from UNDP under RajdhaniUnnayanKartripakkha (RAJUK) (Capital Development Authority). The plan covers the Dhaka Metropolitan development area, an area of over 1,500 km2. Height restrictions are enforced by RAJUK for the airport overlay zone. The usual practice is that RAJUK consults with CAAB in connection with high rise constructions within the airport surroundings, and particularly along the runway approach.It may be mentioned that RAJUK recently updated the 1995 Land Use Plan in 2015 for next 20 years' period of 2016 to 2035. However, the plan has not been approved yet.

Existing Land Use

The existing land use in the airport environment is illustrated in **Figure A18-2** which describes Airport, Residential Areas, Wetland-Swamp, Restricted Military Zone, Army Golf Club, Government Offices, Trees, etc.)

Figure A18-2: Spatial View of Existing Land Use Features

There are some wetland areas in north-west side of the runway. Residential area in the north-northeast side is mostly single story buildings, and some are semi-permanent buildings. Military area is located in south-southwest of the runway. All the infrastructures under the proposed Project will be located inside the airport boundary.

Land Use Pattern

Land use categories in the Dhaka Metropolitan Region (DMR) are illustrated in the following table. Analysis of land use pattern are observed that the highest land use in agriculture purposes followed by residential area, water bodies, restricted area, industrial area, public facilities, road/railways, commercial, mixed use area and recreational area are in **Table A18-2**.

Table A18-2: Current Distribution of Detailed Land Uses in Dhaka Metropolitan Region

Land use category	Area in acres	Area in hectares	%
Agriculture	145670.85	58976.05	38.49
Residential Area	138013.93	55852.51	36.47
Water bodies	47641.60	19288.10	12.59
Restricted Area	11971.73	4844.81	3.16
Industrial Area	9873.09	3995.50	2.61
Public Facilities	9560.75	3869.12	2.53
Road/Railways	8705.54	3523.04	2.30
Commercial	3781.55	1530.37	1.00
Mixed Use area	2247.29	909.44	0.59
Recreational Area (Park/Playground/Urban Green Area)	996.29	403.19	0.26
Total	378462.63	153192.12	100.0

Source: RDP Survey, RAJUK, 2013

Region wise percentage of different land use is given in the Table below. From analysis, the data shown that land use category are Dhaka central region, north, east, west, south region and south west region. Land use categories are residential area, followed by agriculture, water body, restricted area, road/railways, public facilities, commercial and mixed use are in **Table A18-3**.

Table A18-3: Region wise Share (%) of Different Land Uses

Land use category	DCR	NR	ER	WR	SR	SWR
Residential Area	41.45	38.54	40.24	33.46	37.19	23.20
Agriculture	21.42	44.32	41.89	39.10	34.18	57.26
water-body	13.03	38.54	40.24	33.46	37.19	23.20
Restricted Area	6.51	2.78	0.37	4.26	1.78	1.90
Road/Railways	6.06	1.51	0.88	1.59	1.79	0.98
Public Facilities	4.38	1.99	0.39	5.17	1.27	0.92
Commercial	2.32	0.76	0.51	0.60	1.04	0.40
Mixed Use area	2.05	0.23	0.02	0.27	0.57	0.10
Industrial Area	1.83	2.79	2.49	3.19	4.27	0.91
Recreational Area	0.95	0.01	0.07	0.32	0.07	0.00

Source: RDP Survey, RAJUK, 2013

Housing Structures and occupation

Housing structures in the run way ends site area are different types like tin shed, pucca, semi-pucca and multistoried. They don't know the height restriction of building If they have knownthe height restriction make building accordingly.Resident of Dolipara villages are affected by aircraft noise because they are living adjacent to aircraft landing side and also boundary wall. The airport is virtually surrounded by permanent and semi-permanent dwelling, commercial areas, and housing areas for over 1 million people within a perimeter of 2 km.

People in the study area are engaged in different types of primary and secondary occupations such as farming, wage labor, business, services (govt. & non-govt.), unemployed, household work, overseas employment, carpenter, black smith,rickshaw/ van puller, student, small enterprises, mobile shop, handicraft, etc. Aside from primary occupation, a significant proportion of the population also adopts a secondary occupation to enhance the household income. Consequently, wage labor and business are found to be the dominant secondary occupation in the study area.

Household Income and economic status

The households derive their income from multiple sources including service, wage, business, poultry rearing, remittance, hotel business, driving of vehicle, rickshaw /van puller, etc.Main sources of income the communities near the runway ends are service 49.62%, commerce 21.46%, renting out 5.39%, non-agricultural laborer 3.88%, construction 3.45%, industry 2.04%, Agriculture 2.04%, transport 1.29%, religious service 0.10%, and other 10.73% (Census-2011).

Literacy rate and educational institutions

In the Biman Bandar Thana there are many educational institutions are existing like school, college, Madrasa, moktob. Average literacy rate is 67.70%; male 71, 41%, female 60.42% in the project including other thanas. Some prominent educational institutions like Scholastica School and College, Civil Aviation Staff School (Kawla), Mahila Medical College, Babussalam Madrasa and Civil Aviation Madrasa.

Employment and distribution of services

The CAAB has employed close to 2,000 people in HazratShahjalal Airport. The Airport further provides direct employment to around 1,500 people in customs services, immigration, postal services and airlines. Indirectly between 5,000 and 7,000 people are employed with transport services, customs clearance services, and contractors for works and services in the airport. Roughly 10 % of the CAAB employees are women, mainly occupied as security personnel, office clerks, and cleaning personnel. Other people or community involved different occupation like service, business, rickshaw/van puller,wages, labour, remittance or service in abroad etc.

Natural Protected Areas near Airport Boundary/ Cultural Heritage

There are no internationally or nationally protected nature reserves, or nature parks within the close vicinity of the airport. Nearest one is Bhawal National Park at a distance of about 25 km from the airport. There is no cultural heritage within the airport area or its immediate vicinity.

Community Attitudes and Opinions Surrounding the Airport

The airport is believed to be well accepted in community. Residential areas have developed extensively in the airport surroundings, and it is expected that the airport will be completely blocked by residential areas. The residential areas are nearly beginning on the airport boundary and they are over-flown at very low height, which obviously has a considerable noise impact. While grievance about the airport have not been reported, the residents in these areas, southeast of the airport, occasionally attempt to block the drainage outlets to avoid flooding of their areas.

Public Utilities

Biman Bandar thana including surrounding thana`s households have access to electricity, use of drinking water and sanitation are remarkable.

Access to electricity

Households have access to electricity around 90% in all thanas. Run way both ends area`speople under electrification net-work; however, 95.57% dwelling households have access to electricity (BBS-2011).

Water Supply

Households in the run way both ends area are using tap, tube-well, pond for drinking and other purpose. About 70% of the households are dependent tap water (supply water) for drink and domestic use. People those are depending on pond water are affected by many waters borne diseases.Sources of drinking water in the area aretap 91.26%, tube-well 3.99%, ponds 0.10% and others 4.65%(BBS-2011).

Sanitation

The sanitation facilities in the proposed area are not poor compared to other parts of the country. In case of sanitation mostly use sanitary latrine but some family have no latrine and they are about 3%. Sanitation in the proposed area are 94.49% of dwelling households of the area use sanitary latrines and 3.03% of dwelling households use non-sanitary latrines; 2.48% of households do not have latrine facilities(BBS-2011). Comparative status of facilities like electricity, drinking water and sanitation in the Biman Bandar thana and surrounding other thana`s are in **Table 18-4.**

Table A18-4: Thana wise status of facilities for residents

Name of Thana	Households having access to electricity (%)	Sources of drinking water				Sanitation		
		Tube-well(%)	Tap (%)	Pond (%)	Others (%)	Sanitary latrine (%)	Non-sanitarylatrine (%)	No latrine (%)
Bimanbandar	95.57	3.99	91.26	0.10	4.65	94.49	3.03	2.48
Pallabi	97.77	15.01	82.08	0.11	2.80	84.28	14.07	1.65
Uttara	67.28	27.28	8.32	0.48	66.35	66.35	27.90	5.75
Dakshinkhan	92.30	53.46	44.73	0.10	1.71	87.23	11.80	0.97
Khikhet	93.50	39.24	57.99	0.09	2.68	78.54	17.83	3.63
Cantonment	96.43	9.15	88.50	0.04	2.31	96.18	2.03	1.79
Turag	89.02	92.06	3.61	0.36	3.97	82.50	13.37	4.13

References: *Bangladesh Population Census 2011(BBS)*

Solid Waste

Solid waste includes kitchen waste, used or damaged/ broken household goods and agriculture and domestic animal waste. Traditional households in most sub-project areas use kitchen and animal waste for composing in pits. Agriculture and organic/wood waste is uses for fuel in cooking stoves. Plastic and metal are commonly sold for recycling. There is no proper solid

waste dumping site in the run way ends site specially Dolipara, Ahalia, Pakuria and Baunia villages. Solid waste including kitchen and industrial waste is being dumped in different locations.

Potential Environmental Problems

Noise, water, air, industrial pollution, burning fuel, trees and over population, deforestation, land erosion, health and sanitation problem. Environmental problems in the both ends of runway are noise, water pollution, drainage congestion and solid waste etc. There is no management system of solid waste. Other problems are overcrowded area; population density is high and also made building without height restriction. Population density is high in the Dolipara village is high because of cheap house rent and having all facilities like gas, electricity, tap water, sewerage line etc. Inside of village road communication is not good enough. Developments are mostly unplanned.

Annex-19: Air Craft Noise Measurement
Introduction

"Aircraft noise measurement was one of the tasks under JICA study Team`s Supplementary EIA Works". The survey locations and methods were determined by JICA Survey team. Continuous measurements for 7 successive days (Including recording of airplane model during this noise measurement) were made.

Noise recording has been done in north end and south end or run way 14 and 32. Enumerators from DDC and associates were initially given an orientation on noise measurement instruments, recording modes, and procedures by ShinjiTanaka of Nipon Koei Co. Consultants of DDC monitored continuously for the entire 7-day duration.

Methodology

The 24-hour day was divided into three (3) 8-hour shifts for measurements. Two enumerators team were engaged foreach 8-hour shift. Total 6 teams worked for noise measurements.Noise recording started at landing site on 6th January 20017 at 3pm and takeoff site at 3.45 pm on the same day. Recording completed on 13th January 2017 at 3pm and at 3.45 pm at landing and takeoff sitesrespectively. 12 enumerators with one coordinator and 3 consultants from DDCwere engaged in this survey. Each team also recorded in the form other noise eventslikeAjan.

Of the two (2) sites, north end site is located near Dolipara, and south end site near Nikunja Housing estate. Both sites were located within the Civil Aviation periphery.Sound meter auto-recorded the measurements. Surveyorsrecorded every sound event (aircraft, Ajan and other sound). of the Noise Survey Point.

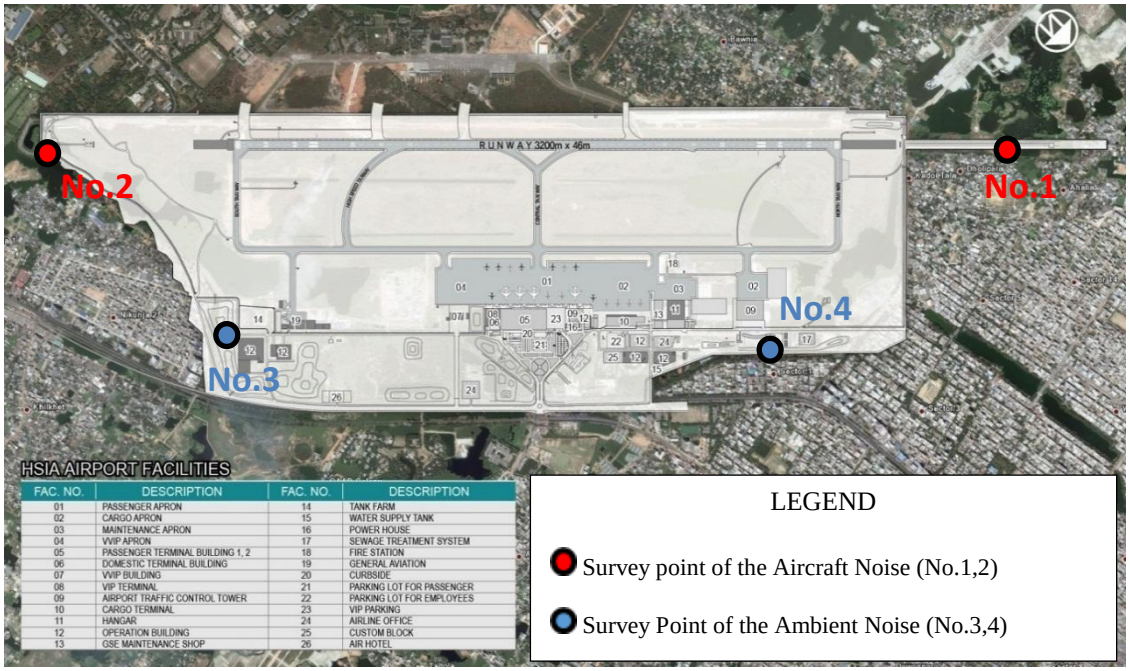


Figure A19-1: The Location of the Noise Survey Point

Lden Calculating method

Previously,WECPNL (Weighted Equivalent Continuous Perceived Noise Level) was used as an index of aircraft noise. Recently, Lden(day/evening/night weighted average sound pressure level) is becoming a common aircraft index in the world.

The day-evening-night index Lden indicates the noise level over an entire day, with different weightings given to the individual time periods: The time between 7 a.m. and 7 p.m. is considered daytime, between 7 p.m. and 10 p.m. is considered evening time, and between 10 p.m. and 7 a.m. is considered nighttime. Noise in the evening and at night is weighted more heavily than noise during the day. (These time zones are the stipulated in Japanese regulation).

Lden (Day-Evening-Night Average Sound Level)

Lden is one of the indexes for aircraft noise. Lden is calculated from LAE (Single event Exposure Sound Level) for each aircraft. The target of Lden is flying, landing, takeoff, taxing, and reverses noise of the aircraft. Lden is using for assessment of aircraft noise in many countries such as EU countries and Japan. Lden is defined by the following formula:

Calculating daily Lden

The daily Lden calculated from below formula.

$$L_{den} = 10log_{10}\left\{\frac{T_0}{T}\left(\sum_i 10^{\frac{L_{AE,i}}{10}} + \sum_j 10^{\frac{L_{AE,j}+5}{10}} + \sum_k 10^{\frac{L_{AE,k}+10}{10}}\right)\right\}$$

Where,
Lden is Daily day/evening/night weighted average sound pressure level,
i is The i-th event during day time,
j is The j-th event during evening,
k is The k-th event during night time
L_{AE} is Single event exposure sound level (dB),
T_0 is 1(s), and
T is 86,400(second, =60 x 60 x 24)

Result

In the aircraft landing site-1 total 874 aircrafts landing during recorded time. The highest numbers of aircrafts landing during day time and the lowest in night time.Maximum LAE was 119.03 and minimum LAE was 58.35. Average value of Lden was 74.9 during measuring period are **Table A19-1**(Summary of day wise LAE (Max& Min), day time-evening time and night time LAE, number of aircrafts landing site-1 andAverage value of Lden.

Table A19-1: Summary of day wise LAE (Max&, Min – aircrafts landing site-1)

Site-1(air craft landing)												
Day	ID	No.of Aircraft at day time	No. of Aircraft at evening time	No. of Aircraft at night time	Total no. of (Aircraft full day)	Total day time LAE	Total Evening LAE	Total Night LAE	Total Day LAE	Day Max. LAE	Day Min .LAE	Day Lden
1	**1001**	81	21	12	114	115.78	109.46	106.65	117.10	107.42	59.84	74.54
2	**1002**	89	25	11	125	115.74	112.32	108.86	117.94	109.22	58.63	72.90
3	**1003**	105	22	16	143	116.59	109.82	108.17	117.91	103.21	58.35	72.15
4	**1004**	90	22	11	123	115.88	112.77	108.52	118.11	109.73	60.83	69.16
5	**1005**	80	29	15	124	119.19	121.96	108.21	123.92	119.03	63.30	78.74
6	**1006**	74	31	10	115	113.90	120.17	106.98	121.26	115.10	58.64	76.70
7	**1007**	78	24	28	130	117.45	110.78	110.49	118.96	113.17	60.47	73.77
		597	174	103	874					Max .LAE	Min. LAE	Average value of Ldenduring measuring period
										119.03	**58.35**	**74.9**

Note: This formula is for calculating decibel -average value of 7days Lden data.

In the aircraft takeoff site-2 in total 773 aircrafts during recorded time. The highest numbers of aircraftstakeoff during day time and the lowest in night time. Maximum LAE was 119.25 and minimum LAE was 53.60. Average value of Lden was 75.20 during measuring period in **Table A19-2** (Summary of day wise LAE (Max&, Min), day time, evening time and night time LAE, number of aircrafts takeoff site-2 and Average value of Lden)

Table A19-2:Summary of day wise LAE (Max& Min - takeoff site-2)

Site-2 (aircraft takeoff site)												
Day	ID	Total no.of Aircraft day time	No. of Aircraft at evening time	No. of Aircraft at night time	Total no. of Aircraft (full day)	Total day Time LAE	Total Evening Time LAE	Total Night Time LAE	Total Day LAE	Day Max LAE	Day Min LAE	Day Lden
1	**2001**	77	15	17	109	110.50	108.88	113.58	116.20	108.90	75.23	72.66
2	**2002**	76	15	17	108	121.28	113.28	110.14	122.19	116.53	53.60	75.48
3	**2003**	77	22	18	117	123.93	107.36	109.50	124.17	119.25	60.90	76.12
4	**2004**	75	18	19	112	119.81	106.41	111.22	120.54	116.55	67.81	74.48
5	**2005**	80	19	18	117	116.67	115.36	110.54	119.65	113.84	73.38	74.93
6	**2006**	78	22	17	117	119.64	116.11	111.02	121.63	118.08	54.56	76.05
7	**2007**	65	14	14	93	113.60	107.53	114.57	117.57	113.21	71.63	75.79
		528	125	120	773							Average value of Lden during measuring period
										Max LAE	Min LAE	
										119.25	53.60	75.2

Comparative study

The current aircraft noise level with using Lden value around the airport is excessing the aircraft noise standard in Japan for category II area are in **Table A19-3.**

Table A19-3: The result of aircraft noise measuring

Location		Measuring Period	Average value of Lden during measuring period	Environmental quality standard of Japan
No.1	Northwest of the airport area/ On the extension line of runway	3pm 6th January 2017 - 3pm 13th January 2017	74.9dB	62dB (Category II)
No.2	Southeast of the airport area/ On the extension line of runway	3pm 6th January 2017 - 3pm 13th January 2017	75.2dB	62dB (Category II)

Note: Category II refers to other areas where the normal living conditions shall be preserved

Orientation on noisesapling

Noise recording orientation

Aircraft landing

Noise recording machine, recorded the noise

Recorded noise during aircraft takeoff

Recorded noise during aircraft landing

Figure A19-2: Some figure on noise sapling and orientation

Impact of noise pollution

Noise pollution affects both health and behavior. Unwanted sound (noise) can damage psychological health. Noise pollution can cause hypertension, high stress levels, tinnitus, hearing loss, sleep disturbances, and other harmful effects. Excessive *noise pollution* in working areas such as offices, construction sites, bars and even in our homes can influence psychological health. Studies show that the occurrence of aggressive behavior, disturbance of sleep, constant stress, fatigue and hypertension can be linked to excessive *noise* levels. Changes in the immune system and birth defects have been also attributed to noise exposure.

Noise recording sheet

Table A19-4: Noise recording sheet for aircraft Noise Survey

Measuring point: No Sheet used for recording all noise events

Sound Level meter type: NL-42

S/N.	Date	Time	Noise source, A(aircraft), O(other)	Take off/Landing	Aircraft type	Propeller/Jet	Weather	Remarks
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								

Annex-20: Tree Inventory and Classification

20.1 Introduction

Tree inventory and classification was the requirement of Department of Environment as DOE asked an NOC from Department of Forest (DOF) in their Site Clearance. Due to implementation of the project, trees to be removed and same number of saplings to be replanted in other locations. This study was conducted along the proposed HSIA expansion project area. Most of the trees inventoried from Balaka Airlines office to Hotel La Meridians and V.V.I. P complex to fuel power house. This area has been selected for Terminal Building-3. May be removed the most of the trees from this location before implementation the project.

Figure A20-1: Trees of VVIP Road included in Inventory

20.2 Methodology for Tree Inventory

The tree inventory started with in-situ field training. Tree census data appraiser during survey, the experts from DDC were present. The help of the officials from the Bangladesh Forest Department and Consultant of Nippon Koei Co. were also taken as and when needed.

Three field inventory groups were made and each group (one enumerator for remove bark, one painting and one measure/ recorded) supervised by one Environmentalist from DDC, each group was assigned the paint, brush, tap, stick, 20ft height bamboo, recording form, pencil, eraser, and sharpener etc. According to the suggestion from the Department of Forest, trees inventory was done. Enumeration & Counting Lasted 13 Days (December 28, 2016 to January 9, 2017). Tree inventoried 1.3-meter height and above 6 inches' girth/ circumference. Below 6 inches' girth of trees only counts the number. DDC provided the PPE for all enumerator.

The Environmentalist has worked mostly as supervise and reviewers of data. A botanical inventory survey has been conducted in the proposed tree plantation site covering local name of the species, girth/circumference, entire height, bole height and amount of fuel. Following form have been used during inventory of the trees.

Table A20-1: Format used for Tree Inventory

S/N	Local Name	Girth(ft)	Dbh (feet)	Height (feet)	Bole Height, (feet)	CFT	Amount of Fuel, Kg)	Remarks

Following formula was used for calculated the CFT.

$$CFT = \frac{\text{Bole height X } (dbh)^2}{16}$$

20.3 Data and Sample Management

Field data were entered into computerized spread sheets periodically and backed up electronically in multiple physical locations. Strict precautionary measures were taken in the process of data collection and data entry to minimize error. Completed data forms were checked and reviewed in the field and data entry was also reviewed.

20.4 Data Analysis

Dominant species of trees are – Akashmoni followed by Mahogoni, Debdaru, Kathal, Rain tree, Arjun. Aam, Koroi etc. Out of 7007 number of trees Akashmoni 2061 (29.54%), Mahogani 1240 (17.81%), Debdaru 587 (8.48%), Kathal 410 (5.98%), Rain tree 330 (4.71%), Arjun 321(4.58%); Aam 281 (2.95%), and Koroi 207 (2.95%).

Akashmoni and Eucalyptus are alien invasive species. Out of 7007 numbers of trees 2082 (29.74%) are Alien invasive species which are not environment friendly; 92 number of trees were dead. Total inventoried 66 species of trees among them CFT calculated 15 species of trees (Akshmoni, Mahogani, Debdaru, Kathal, Raintree, Aam, Koroi, Shisoo, silkoroi, Chambul, Jam, jaw, Minjium, Gajari, and Segun) which will be used for commercial purposes.

Note: *Bengal group did not give permission for counting and marking trees in the premises of their lease area because they claimed that they are the owner of these trees. Around 80 species of different type's trees like Mahogani, Narikel, Raintree, debdaru, katbadam, supari, sonalu, Jhau etc. existed there.*

Each tree height (feet), bole height (feet), girth (feet), diameter (feet), amount of fuel (kg) and numbers. Identify Native, Alien Invasive Species were recorded. Fruit bearing- 28, Timber-21, fuel-8, ornament-5 and Herbal-4 were categorized. Volume in CFT was calculated for above 0.63 feet diameter according to direction of Forest Department (Ref. Mr. Moniruzzaman, Range Officer, Social Forest division, under Dhaka Division).

Volume of **3429** number of trees is **4594 CFT**. Total amount of fuel for 7007 number of trees is 7, 25,988Kg or 725.98 Metric Ton(MT). Inventoried trees wise local name, number, percentage and use are given in the Table A20-2.

Table A20-2: Inventory of Identified Trees with Local Name, Number, % and Use

S/N	Local name	Number of species	Percentage (%)	Use
1.	Akashmoni	2061	29.54	Timber
2.	Mahogani	1240	17.81	Timber
3.	Debdaru	587	8.48	Timber
4.	Kathal	419	5.98	Fruit bearing
5.	Raintree	330	4.71	Timber
6.	Arjun	321	4.58	Herbal
7.	Am	281	4.01	Fruit bearing
8.	Koroi	207	2.95	Timber
9.	Jalani/ Bonno	133	1.75	Fuel
10.	Jhau	98	1.4	Timber
11.	Others	98	1.4	Fuel
12.	Shisoo	96	1.37	Timber
13.	Kadam	87	1.24	Fuel
14.	Palm	80	1.14	Ornament
15.	Shilkori	75	1.07	Timber
16.	Sonalu	74	1.05	Timber
17.	Bottlebrass	67	0.95	Ornament
18.	Narikel	67	0.95	Fruit bearing
19.	Chambul	62	0.88	Timber
20.	Jam	46	0.65	Fruit bearing
21.	Shajna	43	0.61	Fruit bearing
22.	Peyara	41	0.58	Fruit bearing
23.	Mendapata	40	0.57	Fruit bearing
24.	Tal	36	0.51	Fruit bearing
25.	Nim	34	0.48	Herbal
26.	Minjium	27	0.38	Timber
27.	Boroi	25	0.35	Fruit bearing
28.	Bella	23	0.32	Fuel
29.	Bokul	22	0.31	Ornament
30.	Jambura	22	0.31	Fruit bearing
31.	Katbadam	22	0.31	Fruit bearing
32.	Bel	21	0.30	Fruit bearing
33.	Eucalyptus	21	0.30	Fuel
34.	Pai	19	0.27	Fuel
35.	Bot	18	0.25	Timber
36.	Kamranga	18	0.25	Fruit bearing
37.	Pain	14	0.20	Fuel

S/N	Local name	Number of species	Percentage (%)	Use
38.	Jamrul	13	0.18	Fruit bearing
39.	Jiga	11	0.15	Timber
40.	Amra	8	0.11	Fruit bearing
41.	Gajari	8	0.11	Timber
42.	Tetul	8	0.11	Timber
43.	Bahera	7	0.10	Herbal
44.	Krishnachura	7	0.10	Timber
45.	Paban	7	0.10	Fuel
46.	Pitraj	7	0.10	Timber
47.	Khajur	6	0.08	Fruit bearing
48.	Segun	6	0.08	Timber
49.	Tejpata	6	0.08	Herbal
50.	Supari	5	0.07	Fruit bearing
51.	Belombi	4	0.05	Fruit bearing
52.	Shimul	4	0.05	Ornament
53.	Shundari	4	0.05	Timber
54.	Atafal	3	0.04	Fruit bearing
55.	Dumur	3	0.04	Fruit bearing
56.	Hijal	3	0.04	Fruit bearing
57.	Jalpai	3	0.04	Fruit bearing
58.	Chalta	2	0.02	Fruit bearing
59.	Litchu	2	0.02	Fruit bearing
60.	Amloki	1	0.01	Fruit bearing
61.	Belati gab	1	0.01	Fruit bearing
62.	Chandan	1	0.01	Ornament
63.	Kotbel	1	0.01	Fruit bearing
64.	Lombu	1	0.01	Timber
65.	Safeda	1	0.01	Fruit bearing
66.	Telikadam	1	0.01	Timber
Total		**6999**	**100**	

Species wise total numbers of trees with CFT measured are given below Table A20-3.

Table A20-3: Species Wise Number of Trees and Volume in CFT

S/N	Local name	Number of trees	Volume of trees having above 0.63 ft diameter, CFT
1	Akashmoni	1586	1841
2	Mahogani	615	541
3	Debdaru	137	74
4	Kathal	218	163
5	Raintree	288	938

S/N	Local name	Number of trees	Volume of trees having above 0.63 ft diameter, CFT
6	Aam	141	145
7	Koroi	180	501
8	Shisoo	14	28
9	Shilkoroi	63	115
10	Chambul	40	29
11	Jam	25	37
12	Jaw	93	148
13	Minjium	20	24
14	Gajari	4	4
15	Segun	5	6
Total		**3429**	**4594**

20.5 Categories of Trees

Inventoried trees have been categorized on the basis of diameter as below:

- A category trees those are >1.5 feet diameter and total number is 387
- B category 1 feet to 1.5 feet diameter and total number is 1315 and
- C category <1 feet diameter or rest other trees and total number is 4918

In total 391 numbers of trees < 6 inches' girths have been identified under 17 species.

20.6 Re-plantation and Selection of Species

Selection of plant species will be done carefully, as such they are of fast growing variety, perennial and evergreen with thick canopy cover, large leaf area index (LAI) and a high pollution attenuation factor (PAF) for effective dry deposition of particles and fibers. On the same time, the species selection must take into consideration those trees, which do not attract the birds in order to avoid the chances of bird hitting with aircraft. To be considered the local species because of having well adaption mechanism.

20.7 Guidelines for Plantation and Landscaping

Selection of plant species is to be done on the basis of their adaptability to the existing geographical conditions and the vegetation composition of the topography of the region. As the area is an open area and open scrub, suitable native species of trees to be planted, those are found in that geographical region and locally well adaptive.During the operational phase of the proposed project, plantation shall be done for three specific reasons:

- Plantation in and around the airport to reduce noise impact
- Plantation to absorb air pollutant
- Re-plantation, pertaining to the cutting of trees

During the operational phase, air emissions will be from the vehicular traffic and operation. An adequate greenbelt development at and around the project site has been suggested to reduce the impact on the flora and fauna as the plant species will act as air and noise pollutants sink.

Based on the location, suitable type of trees and plants will be recommended as a part of the greenbelt development plan to mitigate the impact and to restore the damaged habitat of the region.

20.8 Green Belt Development Plan

In order to assure proper greenbelt development, following management plan will be adopted:

- Healthy and established sapling having 1m height should be selected for planting in greenbelt to avoid mortality of plants.
- Pit measurements of 0.6 m x 0.6 m x 0.6 m are to be dug up at desired point in triangular pattern.
- The tall shrubs and dwarf trees with 3 m spacing between plants and rows is sufficient while medium and tall trees in middle and rear rows are to be planted at a distance of 6-7 m and 8-10 m apart respectively depending upon the space available.
- Close plantation is recommended for accommodating more number of trees per unit area resulting in more leaf surface.
- The pit should be filled with mixture of cow dung manure and soil in ratio of 1:4. 10 gm BHC of 10% concentration should be properly mixed with the soil and manure to kill the termites and insect.
- Close plantation with three tiers system keeping dwarf trees with round canopy exposed to the source of emission followed by medium and tall trees with cylindrical canopy is ideal design for the polluted area, because all plants are exposed to the pollutants. This plantation shall be done inside the airport boundary lines and inside the airport residential area boundary lines nearby Dhaka Mymensingh highway. The minimum thickness of this proposed green belt is 100 meter as per recommendation of IATA. Plan detailing the location of Green Belt will be prepared and it will be followed during implementation.

Close plantation also result in tall trees with deeper roots and ultimately yield more bio-mass per unit area and more efficient absorption of pollutants. Plantation of trees in staging arrangement in multiple rows across the direction of the wind is recommended for better trapping and absorption of the pollutants.

20.9 Location of Re-plantation

Green belt will be developed in and around the airport area and along the road side. Already there are many spaces in the south, west and north site of the airport area for re-plantation. Civil Aviation has also its own land where re-plantation will be done. Existing and or future airport will also have scope and space for re-plantation of huge number of saplings. Heterogenic trees in green belts development will be provided.

Following species of trees have been selected for Green Belt that will help reducing the aircraft noise in the project area isgiven in **Table A20-4**.

Table A20-4:List of Plants Selected for Green Belt

Sl./No.	Local name	Scientific name	Family	Types	Use
1	Akonda (Sada)	*Calotropis procera*	Asclepiadaceae	D	Herbal
2	Ashwatha	*Ficus religiosa*	Moraceae	D	Herbal
3	Chalta	*Dillenia indica*	Dilleniaceae	D	Fruit

Sl./No.	Local name	Scientific name	Family	Types	Use
4	Chatim	*Alstonia scholaris*	Apocynaceae	D	Herbal
5	Debdaru	*Polyalthia longifolia*	Annonaceae	D	Timber
6	Deshi Neem	*Azadirachtaindica*	Meliaceae	D	Herbal
7	Gub	*Diospyros peregrina*	Ebenaceae	D	Herbal
8	Jarul	*Lagerstroemia speciosa*	Lythraceae	D	Ornament
9	Kaatbadam	*Terminalia catappa*	Combretaceae	D	Timber
10	Kathbel	*Feronia limonia*	Rutaceae	D	Fruit
11	Medda	*Trewia polycarpa*	Asteraceae	D	Timber
12	Mehogoni	*Swietenia mahagoni*	Meliaceae	D	Timber
13	Sheora	*Streblus asper*	Moraceae	D	Fuel
14	Varenda	*Ricinus communis*	Euphorbiaceae	D	Herbal
15	Hijal	*Barringtonia acutangula*	Lecythidaceae	D	Fuel
16	Koroch	*Pongamia pinnata*	Fabaceae	D	Fuel

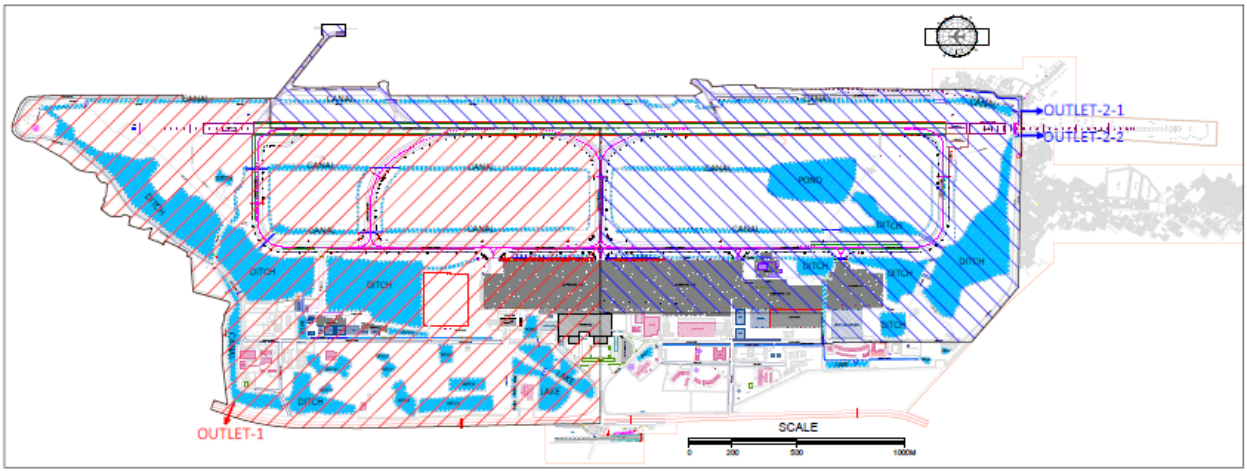
20.10 Conclusion for Tree Inventory

Data analysis of inventoried trees and observed that around 30% trees are Alien Invasive Species which are not environment friendly in our country. Same number of saplings in another location will be re-planted. Native and ecologically sensitive species will be selected for plantation. Airport should be kept free from birds. Presence of birds in the airport may cause of accident during aircraft landing. Many tall trees attract the birds which is dangerous to aircraft movement. Those trees should be removed. Fast growing variety, perennial and evergreen with thick canopy cover, large leaf area index (LAI) and a high pollution attenuation factor (PAF) for effective dry deposition of particles and fibers are to be selected. Species, which do not attract the birds,will be selected in order to avoid the chances of birds hitting with aircraft. Local species will be considered because of their high adaptive capability.

Annex-21: Analysis of Water Logging in Surrounding Area

Background: In the public consultation meeting held on 21st November 2016, the representatives of Nikunja Area and Uttara Sector 1 raised the issue of water logging in their respective areas. They assumed that this is caused by the water coming out of the Airport area. So they requested immediate solution of the problem. According investigations were conducted under this Supplementary Works.

Drainage Pattern of the Airport Area: During the devastating flood of 1988, the Airport was flooded and air traffic was seriously affected. After the flood, the Airport area was encircledwith a dyke to stop inflow of flood water from outside. For drainage of Airport area, provisions were made on the north and south side. On the north, water dischargesthrough 2 out lets to the Turag River viaacanal. On the south water,water discharges through a gate to a culvert located under the road and crossing the Airport road. The culvert was supposed to be linked with a canal along the Purbachal road. The drainage outlets are shown in the following figure. The internal surface water drainage system in the airport areas consists of interlinked canals and regulation/ retention ponds. After the construction of embankment, there is no other inlet/ outlet except those mentioned.



Source: JICA Data Collection Survey Report, 2016

Figure A21-1: Existing Drainage System

Field Investigation: A joint field visit was conducted dated on December 19, 2016 by JICA Preparatory Survey Team member, CAAB representative and DDC experts. They could not find any drainage link between airport area and Uttara Sec 1. But observed that local drainage situation of Uttara Sector 1 is poor and water logging at that area occurred due to local congestion.

It was also observed that the gate at outlet 1 was blocked by sand bags; it was done due to previous complains from the local area. However, it was found that there was leakage in the blocking; and water is entering from outside. It was also found that flow towards Purbachal is very slow.

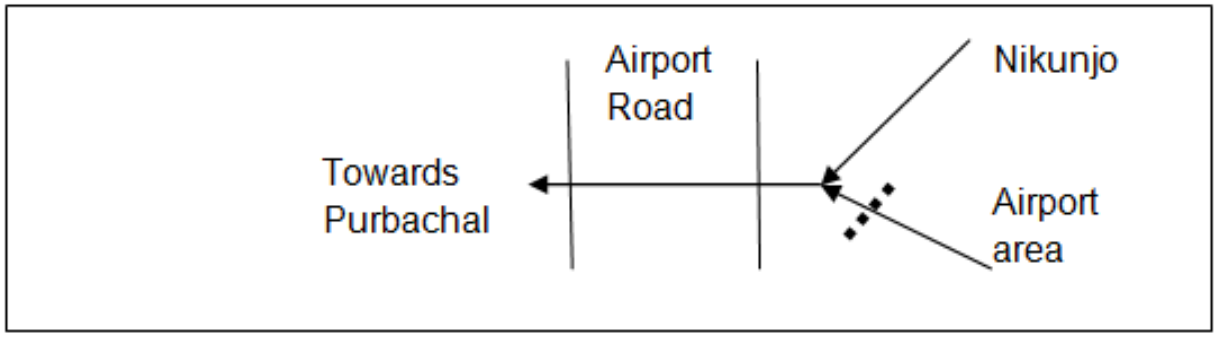


Figure A21-2: Sketch of drainage flow at outlet 1

As shown in the sketch above, as the flow towards pubachal is obstructed, water coming from Nikunjo cannot flow freely and there was a water backup at the gate area. Also, as the water level in airport area is low in the dry season, and there is a leak in the sand bag, water of Nikunjo is entering into airport.

So, it can be apprehended that during the rainy season, when the water level in the retention ponds of the airport are high, and as flow towards Pubachal is restricted, water from airport area will enter into Nikunjowithout going through the culvert.

Recommendations: During the implementation of HSIA Expansion Project, drainage of airport area will be studied comprehensively. Until that time, it is recommended that sand bag blocking should be fixed properly, so that there is no leakage. This measure will prevent water coming from or going to Nikunjo area. Pictures of the current situation at the airport area drainage outlets are given in the following.

Stagnant water at South eastern corner of airport

Gate at South eastern corner

Sluice gate, North western site of airport

Sand bag blocking at South eastern corner

Figure A21-3: Pictures of current situation at the airport area drainage outlets

Annex-22: Focus Group Discussion

22.1 Background

In connection with the Environmental Impact Assessment (EIA) of HazratShahjalal International Airport Expansion Project a Focus Group Discussion was organized with the participants of the representatives from different Stakeholders around the project location who are directly or indirectly benefited or affected by the project. People of various occupations including businessmen, social workers, UP Member, Retired Government Officer, and Superintendent Engineer were attended as participants of the program. The discussion program was arranged as a medium of expressing opinions of the local people about the project.

The Focus Group Discussion (FGD) was arranged at the Conference Room of the Superintending Engineer, P&D/QS Circle, CAAB Kurmitola, and Dhaka on 10th January, 2016. The discussion was started on 10:30 am.

22.2 Inaugurating Speech

Engr. Mahbubur Rahman, Director of Development Design Consultants Limited (DDC) inaugurated the program with an introductory speech. In his speech, he expressed his gratitude to all the participants and welcomed them in the discussion program. He said that the participants are invited in the discussion program to express their valuable opinions about the HazratShahjalal (Dhaka) International Airport (HSIA) Expansion Project. Then Dr. Zainul Abedin, Environmental Specialist, DDC requested the participants to give a short introduction about them before starting the discussion.

At the very beginning of his presentation, Dr.Zainul Abedin had given a brief idea about the topic of the FGD. He enlightened the participants about the funding agency (JICA) of the project as well as, he gave some general information about the project. Then he explained the reasons as well as its importance of implementation of the project.

Then he delivered some brief idea about the importance of airport in international communication. He said that, primarily this airport was constructed as a domestic airport and later, it was developed continuously to make an international airport.Then Dr. Zainul Abedin requested Engr. Md. Golam Mustafa to present his core presentation on HSIA Expansion Project.

22.3 Core Presentation of FGD

Engr. Md. Golam Mustafa started the presentation with the main features/civil work of this project then he presented the main electrical work within the project activities. Finally, he mentioned about the communication & security improvement works.

After the briefing about the project, he also explained the location of the project and showed that the project location is within the airport boundary. He added that, IEE is completed for the project and the report is submitted to DoE and it was approved already. Now DoE asked for the EIA report of this project. The policy review, baseline study, noise measurement, stakeholder identification, social study, public consultation and alternative analysis are already completed for this project. After that, he showed some major positive and negative impacts of the project as well as the mitigation measures that will be taken to minimize the negative impacts. He also ensured of a compensatory tree plantation with a ratio of 1:5.

In conclusion, Engr. Golam Mustafa said that despite of having some minor negative impacts; this project will bring a lot of positive impacts to the local people as well as for the whole country. Lastly, he thanked all the participants for attending the discussion.

22.4 Questions and Discussion on FGD

After the closing of the core presentation of this FGD by Engr. Md. Golam Mustafa; Dr. Zainul Abedin requested the participants to express their valuable opinions and asked for the questions they have about the project. The participants asked various questions regarding the project. But the mostly discussed topics were about land acquisition and height fixation. Details of question and response are given in **Table A22-1**.

Table A22-1: Details of Questions and Discussion on FGD

Sl. No.	Name and Profession/Address	Question/Opinion	Response
01.	Salauddin Ahmed Badal, Businessman	He appreciated the modernization of the HSIA with the implementation of this project. He also appreciated the fire detection and fire hydrant related issues. Lastly, he thanked the project authority on behalf of the area and offered any kind of possible help they can.	Dr. Zainul Abedin thanked him for his kind participation.
02.	Md. Muslim Khan, Businessman and Social Worker	Firstly, he expressed his gratitude to the participants. He said that the previous no boundary wall in the airport and the later development of the airport. He concluded with a suggestion of working carefully, so that no harm occurs to the local people. Later he added that, RAJUK don't give permission for constructing new buildings. He asked for the permission from RAJUK for constructing new houses and he ensured that the local people will maintain the fixed height given by RAJUK after getting the permission.	Dr. Gainful Abedin thanked him for his kind participation. The Deputy Project Director responded in his concluding speech mentioning that after submitting the report to JICA, may be height fixation will be done by RAJUK.
03.	Farid Ahmed, Pakuria	He said that, they have no objection for the development. They were afraid of the land acquisition as they experienced before. He expressed his demand on behalf of the local people in a very important topic, and that is a clearance from RAJUK about the height of their future constructions.	Dr. Zainul Abedin said that, there will be no new land acquisition due to this project implementation as the works will be done within the airport boundaries. About the building height, he said that, the Deputy Director of the Project will answer this.
04.	AbulHossain,U.P. Member, ward-7	He expressed his gratitude to the participants. He firstly expressed his opinion about the previous land acquisition issues and appreciated the project authority as no land acquisition will be done for this project. Then he said that as there is already a security wall along the road thus the road extension under this project will not be sufficient. Lastly, he demanded for the assurance of no land acquisition.	Dr. Zainul Abedin again cleared that there will be no new land acquisitions. About the road insufficiency, he said, that will be a different project.
05.	Md. Abu Zafar, Retired Government Officer	He said that in these discussion participants from Dolipara, Ahalia, Pakuria, Bauniaare honored to be a part of this discussion as well as the project. He thanked DDC and JICA for implementing the project and offered any kind	Engr. Md. Mustafizur Rahman, DDC explained that, the elevated expressway works are not included in this project.

Sl. No.	Name and Profession/Address	Question/Opinion	Response
		of help possible. He also talked about the land acquisition issues. He asked three questions including knowing about the elevated expressway, knowing about the disturbance to flights by the 3 or 4 storied buildings and knowing if any new runway will be constructed.	Regarding the height problem, the Project Deputy Director responded as, after submitting the report to JICA, may be height fixation will be done by RAJUK.
06.	Momtaz Uddin Ahmed	He talked about the land acquisition problem. He also demanded for the written clearance from RAJUK about no land acquisition.	Dr. Zainul Abedin again assured about no land acquisition for this project.
07.	Md. Shahadat Hossain Chowdhury, Retired Superintendent Engineer, BWDB, Dolipara	He said that, this time Civil Aviation Authority ensured about no land acquisition.He demanded a guarantee from Civil Aviation Authority about no demolition of their houses. He said that, during 2007-2008 around 322 buildings near airport were detected as risky in Mohakhali, Nikunja and Old Airport, Tejgaon areas. The buildings were decided to break down.	Dr. Zainul Abedin thanked him for his kind participation and again assured about no land acquisition and house demolition for this project.
08.	Md. Ashraf Ali, Managing Director of Internal Transportation System	He expressed his gratitude to the participants. He suggested about establishing a parking facility for the internal transportation. He said that due to not having any parking facilities, the foreigners have to wait on the road which is very insecure for them.	Engr. Zainul Abedin answered that this project will improve the link road and as a whole, the project will improve all the facilities and make the HSIA a new modern airport.
09.	Ahanul Miah,	He expressed his worry on behalf of the local people about the height and land acquisition issues from RAJUK. He said that, this time the local people do not want to lose their land due to this project.	Dr. Zainul Abedin then ensured that, during this project no harassment will be occurred from RAJUK on the name of this project.
10.	Kadam Ali, Pakuria	He said that after the land acquisition harassment for three times, they do not want any new problems. He suggested for not expanding the HSIA and emphasizing in Bangabandhu Airport.	The Deputy Project Director said that a new airport construction will take around 18-20 years. During this period, HSIA should be functional.
11.	Hazi Md. Younus Ali Khan, Dolipara	He talked about the land acquisition problem. He said, now the local people are happy that this project will not acquire their land. He said that previously they faced many problems due to breaking down their houses and land acquisitions. But for the last 4-5 years they are living in peace and no problems occurred. But this group discussion ensured that, there will be no land acquisition. Recently they got a rough plan which shows that the design is within the Dolipara village.	The Project Deputy Director responded as, after submitting the report to JICA, may be height fixation will be done by RAJUK.

22.5 Concluding Speech

The Deputy Project Director started his speech with thanking the local people for being co-operative about the security issues for the last 24 years on behalf of CAAB. Then he said that, a

new airport construction will take around 25-30 years. During this period, HSIA should be functional. He added that, this project will be within the airport boundary and no land acquisition and resettlement will be done. The new airport will be constructed, but in between the HSIA should be functional as modern international airport. He told the local people if any kind of noise or dust pollution occurs, let the CAAB know about it so that they can take proper steps to mitigate. About the access road, he said, a new tunnel will be constructed with automatic horizontal walkway, so there will be no problem due to access road. About the height clearance, he said that RAJUK followed zero height restriction. He also added that, after submitting the report to JICA, a height fixation will be done by RAJUK. Lastly, he thanked the participants for attending the FGD and ensured no disturbance to local people in future.

Figure A22-1: Photographs of FGD

22.6 Closing Session

After finishing the concluding speech Dr.Zainul Abedin requested Engr. Mustafizur Rahman to close the discussion program with his final remarks.Engr. Mustafizur Rahman concluded and ended the program by thanking all the participants for coming to this session and to provide their valuable comments, experience and suggestions for this project. Mr. Mustafizur Rahman also thanked to the Deputy Project Director for his cooperation and response on some sensitive issues to the local people. Lastly all the participants were requested to receive light refreshment from DDC.

22.7 Participants concerns

Many participants inquired about land acquisition. It was replied that there would be no land acquisition as all the Project activities will be confined within the current airport premises.

Many participants also inquired about building height restriction. They were briefed that as there would be no new runway construction, there would be no change in zone wise building height restriction.

Figure A22-2: Scanned List of Participants for FGD

Hazrat Shahjalal International (Dhaka) Airport Expansion Project

FOCUS GROUP DISCUSSION (FGD)

Venue: P&D / QS Circle, CAAB Kurmitola, Dhaka

Date : 10 January 2017 Time : 10:30 AM

List of Participants

SL	Participant's Name	Occupation/Address	Telephone No.	Signature
1	Saiaoddin Badal	Business	01715135446	[signature]
2	Md. Muslim Khan	"	01711368223	[signature]
3	Ahmad Noman	"	01755528835	
4	Md Sharif Khan	"	01711249541	
5	Montazuddin	Senior (Rd)	01911305804	[signature] 10/1/017
6	Abdullah al Mamun	Sr SAE, CAAB	01911207471	[signature]
7	Md. Shah sultan shams	SAE, CAAB	01554646123	[signature]
8	Md. Nizam-Al-Hasib	Sr. SAE CAAB	01911423850	[signature]
9	Ayesha Haque	Asst Eng E/M CAAB	01712589263	[signature]
10	Md. Abdul Bared	Sub Asst Eng E/M CAAB	01916706897	[signature]
11	Md. Yunus Hossain	Engineer (civil) PBSL Sena Kalyan	01711203647	[signature]
12	Afroza Khanam	GM/DDC	01716271947	[signature] 10/01/2017
13	Md. Habibur Rahman	Pakuria	01711971256	[signature]
14	[illegible]	PAKURIA TALTEK	[illegible]	[signature]
15	[illegible]	[illegible]	0191280[illegible]	[signature]

SL	Participant's Name	Occupation/Address	Telephone No.	Signature
16	[illegible]	[illegible]	[illegible]	[illegible]
17	[illegible]	[illegible]	01987825379	[illegible]
18	[illegible]	[illegible]	01727531262	[illegible]
19	[illegible]	[illegible]	01924660814	[illegible]
20	[illegible]	[illegible]	01711432429	[illegible]
21	Md. [illegible]	Pakuria	01710005215	[illegible]
22	[illegible]	[illegible]	01811944154	[illegible]
23	[illegible]	[illegible]	01711197405	[illegible]
24	[illegible]	[illegible]	01822999129	[illegible]
25	[illegible]	[illegible]	01712650668	[illegible]
26	[illegible]	[illegible]	01818390905	[illegible]
27	[illegible]	[illegible]	[illegible]	[illegible]
28	[illegible]	[illegible]	01613018070	[illegible]
29	[illegible]	[illegible]	01712105680	[illegible]
30	[illegible]	[illegible]	01739497256	[illegible]
31	Sadia Sharyi	Design Engrr. DDC. Ltd.	01671506515	[illegible]
32	[illegible]	[illegible]	[illegible]	[illegible]
33	[illegible]	[illegible]	01720379511	[illegible]
34	[illegible]	[illegible]	01718-343264	[illegible]

SL	Participant's Name	Occupation/Address	Telephone No.	Signature
35	[illegible]	[illegible]	01726529196	
36	Mahbubur Rahman, P.Engg.	DDC Director	01819242378	
37	Engr. Md. Shahadat Hossain Chowdhury	Rtd. S/E, RWDB	01718588481	
38	Santosh Kumar Saha	Airport, Uttara	01689464214	
39	Asrab Ali (MD)	4 BM	01974[illegible]82199	
40	Alamgir Hossain	Dalipara	01716267615	
41	M Mosharraf Hossain	"	01719181426	
42	Abu Zafar Alam	"	01716744891	
43	Md. Sirajul Islam	Dalipara	01716-090763	
44	Zainul Abedin	Sulsha 2	01766707114	
45	MD YOUNUS BHUIYAN	CAAB	01713007574	
46	Md. Mostafizur Rahman	Sr. Engr. DDC	01755618840	
47	Prosanta Kumar Saha	SCE, CEMSU	01715296342	
48	ABUL HOSSAIN	UP MEMBER WARD. 7	01713023891	
49	Nasim-Al-Islam	Engineer, CAAB	01709086603	
50	Arafat Khan	Dalipara	01911659413	
51	Md. Siddique Miah (Freedom Fighter)	Pakuria.	01911200771	
52	[illegible]	Pakuria	01948633140	
53	MD. KASIM KHAN	Dalipara	01712168789	

SL	Participant's Name	Occupation/Address	Telephone No.	Signature
54	Tanzida Sharmin	Jr. Environmental Engr, DSCL	01787110007	Tanzida Sharmin
55	Yasushi INOUE	ATS Engineer. Nippon Koei	+81-3-6322-1543.	
56	Md. Aminul Islam	Transport Engineer Nippon koei	01716 777 856	
57	Jahir	চাকরি	01714699757	Jahir
58	[illegible]	[illegible]	01920203210	[illegible]
59	Md. A Kaddus	DDCL	01537048390	
60	Md. Abdur Rashid	Dalipara	01670925647	
61	MD. Tofael Ahmed	Env. Expt. DDC	01712034609	
62	Md. Aliqur Rahman	Jr. Env. Expert	01722013701	
63	TAREK ALAMGIR	MANAGER (CIVIL) BIMAN BANGLADESH	01819-492406	
64	Al-Hajj Md Zamir Hossain	Dolipara.	01711685512	Zamir
65	Dr. Tajul Islam	DDCL	01731-451470	
66	Md. Golam Mostafa	DDCL	01715370347	
48				
49				
50				
51				
52				
53				

Annex-23: Key Informants Interview (KII)

23.1 Introduction

KII under JICA Preparatory Survey: Key Informant Interview (KII) is a useful tool of PRA (Participatory Rapid Appraisal) that gives shared understanding of common concerns of a knowledgeable/ focal person. The KII usually takes place at a suitable place where the concerned person can discuss issues in details and express his views freely and independently. KII does not follow any fixed structured questions.

23.2 Methodology

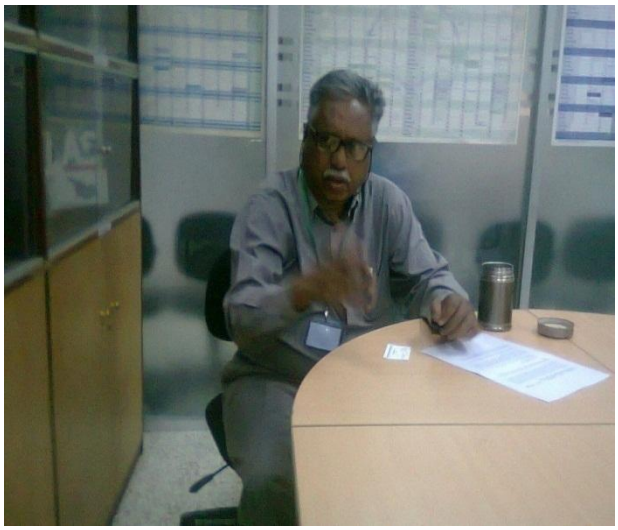
A JICA study team`s requirement is to interview5-7 key Informants for in-depth opinion, suggestion and recommendations for the proposed HSIA expansion project. A project briefwas made and sentwith the project master plan to the selected Key Informants toacquaint them with the project. A phone appointment was made with the information prior tothe interview. A diverse group of professionals on architecture, environment, journalism, sociology and waterresources were selected for this KII.The following six persons were interviewed as part of the KII for this Project as shown in **Table A23-1**.

Table A23-1: List of Key Informants with their expertise and identity

S/N	Name of Key Informant	Expertise on	Identity
1	Dr. AinunNishat	Water resources/ ecology	Prof Emeritus, VC (Former) BRAC University, Former Chairman, IUCN-Bangladesh Former Professor, BUET
2	Prof M. Feroze Ahmed	Environmental Expert	VC, Stamford University Former Professor, BUET
3	Prof A. I. Mabub Uddin Ahmed	Sociologist	Past Chair, Sociology,Dhaka University
4	Mr. Mahfuz Ullah	Environmental Journalist	Secretary General, Center For Sustainable Development (CFSD), Former Chairman IUCN-Bangladesh
5	Mr. Iqbal Habib	Architecture	Director, VittiSthapatiBrindo LTD Environmental Activist
6	Dr. Ashan Uddin Ahmed	Climate Change	Executive Director, Centre for Global Change

All these eminent scholars were highly supportive to the expansion project. Summary of KII is given below.

Professor AinunNishat- Water resources/ ecology



Dr. AinunNishat is presently a professor emeritus who served as a former Vice Chancellor at the BRAC University. A globally recognized environmental expert Prof Nishat, uniquely enjoys the reputations of a national water expert, ADB & World Bank expert, and membership in Indo-Bangla Joint River Commission. He was a former BUET Faculty member.

DDC Consultants Dr.Tajul Islam, Tofael Ahmed, Dr.Zainul Abedin and Engr. Mustafizur Rahman held the KII interview with Prof. AinunNishat on January 11, 2017 at 3pm at the BRAC University,Mohakhali. Dhaka.

Prof.Nishat opined of the inefficient space utilization, lack of appropriate signs and lounges inside the existing terminals at the HazratShahjalal International Airport presently. He stated that HSIA is an International Airport though; it is not good enough because of scarcity of physical facilities. In the terminal building 1st floor is used for arrival, 2nd floor for departure and third floor is not properly utilized for other purposes-he reacted. He observed that lack of enough Escalators has been causing passenger delay and the lack of enough luggage belts has been causing luggage delay.

The Guest Waiting Lounge for arrival and departure is closed presently and the guests suffer long waits in open areas. He suggests a pass system for reopening the Guest Waiting Lounge and expressed displeasure for lack of proper amenities at HSIA comparing with similar airports in nearby countries.

The populations close to aircraft landing area are exposed to excessive aircraft noiseover 95 db or even 100 db from supersonic fighter aircraft and he emphasized a remedy. He recommended a psycho-sociological study to observe the noise impact among the landing site populations. A green belt by native fruiting, timber, and herbal trees is suggested to combat such excessive noise. A large number of existing trees will be felled between Le Meridian and Balaka Office, so he suggested afforestation in the ratio of 1:3. He suggested to avoidingafforestation by Alien Invasive Species (AIS) like Eucalyptus and Akasia. He proposed some native species like Aam,

jam, kathal,litchi,haritaki, bahera, jalpai, amloki, hijal, koaroch, krishnachura, tetul, arjun, neem, etc. for their profusely branching pattern and bushy leaves.

According to Prof Nishat, there should be an emergency runwayadditional to the existing one at HSIA and the present runway should be expanded at landing and takeoffs. Earth/concrete walls should be built on both landing and take-off sites to reduce aircraft noise.He recommends the airport expansion to avoid future congestion and increase facilities for transit passengers.

Professor M. Feroze Ahmed-Environmental Expert, Vice Chancellor of Stamford University, Dhaka

Dr. Feroze Ahmed is presently a Vice Chancellor of Stamford University who served as a former Dean of BUET faculty. A Nationally recognized environmental expert Prof. Feroze Ahmed, uniquely enjoys the reputations of a national Environment expert.

DDC Consultants Dr. Tajul Islam, Tofael Ahmed, and Dr. Zainul Abedin held the KII interview with Prof. Feroze Ahmed on January 15, 2017 at 1.30 to 2.30 pm on January 15, 2017 during 1.30 to 2.30 pm at the Stamford University, Siddeshari campus, Dhaka

Prof. Feroze stated that Five-starhotel and shopping mall are going to established to the airport to exit and entrance way. Government has leased out the land for commercial purposes. In future, this location will be crowded place and make problem for passenger entrance and exit. Airport expansion is only possible in the southern site. Day by day number of passengers and also number of aircrafts increase.

He said that, primarily this airport was constructed as a domestic airport and later, it was developed continuously to make an international airport. He added that, a typical modern airport has5 level security system which is lacked in HSIA. With the increasing rate of population and development of country's economy, two problems are arising to smooth operation of this airport. These are, Passenger handling capacity, andSecurity issues.

From Environmental point of view,noise modeling, tree inventory, drainage system, retaining ponds are in consideration. Every day over 100 aircrafts landing and takeoff in HSIA, space is not enough for air bus besides number of aircrafts are increasing and also passengers. Dust and sound to be reduced by the establishment of green belt, dense forest to be established by

afforestation of saplings those have profusely branching pattern and thick leaves like as mehogani, kathal, assath, katbadam, etc.

HSIA is not well managed like other country. To be required rest room for guest those come from local area for receive and see of the guest. Neighborhood pressure Dolipara and Ahalia residents are in resettlement concern. More viable option is underground connectivity with airport.

ProfessorA.I.Mahbub Uddin Ahmed-Sociologist, Dhaka University

Dr. Mahbub Uddin Ahmed was Former Chair of Sociology Department, Dhaka University. He is also a National Socio-Economic Expert and National Educational Pioneer.

DDC Consultants Dr. TajulIslam and Eng. Mustafizur Rahman held the KII interview with Prof. Mahbub Uddin Ahmed dated on January 16, 2017 during 12.30 pm to 1.30 pm in the Sociology Department, Dhaka University.

His concerns on some issues like traffic congestion, security level, noise modeling and easy access to airport. Residents should be lived in long distance to airport because of noise.Otherwise in future they will suffer health problem, need to phyco-sociological study now. Residents of Dolipara people are very close to airport boundary wall need to relocate from this side for their health safety environment. Need to study on pregnant women and child for the negative impact aircraft noise. Their proper compensationis to be ensured if they will relocate from this site. To be concerned that during construction, inhabitants will not be affected.

Due to establishment of five-star hotel women business will increase because of people will not move long distance for traffic congestion, security and lack of vehicles. In future crime zone will be developed.

Compare to other countries airport like India, Thailand etc. andgather experience and apply in the HSIA. To be concerned the HES (health Environment safety), PPE (personal protective equipment) for workersand occupation hazard. To be identified hazardous and non-hazardous substances also.

Vibration occurred during aircraft landing as a result impact on pregnant women and child to be irritated. Waiting room for the people those come from remote area for see off and receive the passengers and waiting long time in the open space. It is necessary to make a waiting room for the guest in that case should be payment system for them including neat and clean washroom. To be identified the Occupational Health and Safety (OHS) during construction and have taken initiative for mitigation.

Mr. Mahfuz Ullah-Environmental Journalist

Environmental Journalist Mahfuz Ullah is the Secretary General of Centre for Sustainable Development (CFSD), Pioneer columnist and Journalist, Former Chairman of IUCN-Bangladesh and Councilor of South Asia.

Conducted Key Informants interview with Mahfuz Ullah dated on January 24, 2017 during 6.30 to 7.20 pm in his Office at Lalmatia, Mohammadpur, Dhaka

If the airport is not constructed there would be no effects on physical environmental factors. Besides, no adverse impact would be suffered by the adjoining city institutions. However, as the extension of the airport is under consideration, different environmental factors are to be studied during construction and operational phase. These include: the effects of aircraft noise on institutional and residential areas, particularly at night, increased traffic congestion in the airport approaches, fire hazards, ambient air quality, surface water quality, impact on flora and fauna, emergency preparedness and public perception.

Special attention needs to be taken about fuel storage and handling (delivery, storage and use of fuel for aircraft and other vehicles), maintenance of aircraft and vehicles, waste disposal, spillage, burning activities. To reduce some of the impact, there should be relocation of people living around the airport.

There should be green belt of about four to five deep of shorter height trees outside the security wall of the airport. Use of Water from STP and rainwater harvesting plant for would help development of the green belt. The tree plantation and cooling plants will further reduce the burden on fresh water. Reuse of the waste water from these is to be planned for refills in tanks meant for firefighting.

The already existing water bodies which become homes to the migratory birds during the winter season will have to be cleared for ensuring takeoff and landing of the aircraft. The swamps within the project area could be filled with earth available during construction of runways and terminal building.

The central cooling system of the terminal building should be free from CFC.People should be allowed entry into the concourse hall which bans smoking and helps in keeping the air clean.

There should be leak detection system while transferring fuels during refueling operations, and arrangement has to be in place to contain any surface spillage.Proper drainage systems, emergency containment in the event of a major spill during monsoon season etc. are to be provided for.

The main use of water includes aircraft and vehicle washing, aircraft potable water supply, catering facilities toilets/ laundries/ cleaning fluids/ and other domestic facilities. The conservation measures for drinking water and ground water resources will reduce the impact on water resources drastically. Detailed waste disposal is to be worked out following the principle of 3R.

Iqbal Habib, Architect Director, VITTI STHAPATI BRINDO LTD

He is a Secretary of Bangladesh PoribeshAndolon, Design Architect of Dhaka Hatirjheel Project and Dedicated Design Planner of Dhaka City Redesign & Improvement.

DDC Consultants Dr. Tajul Islam, Tofael Ahmed, andDr. Zainul Abedin held the KII interview with Iqbal Habibon January 15, 2017 during 11.30 am to 12.30 pm in his office at Monipuripara, Tejgaon, and Dhaka.

His opinion on HSIA expansion project is that one five start hotel and shopping mall are under construction that are located in front of the entrance and exit way to HSIA that will be overcrowded in future. Why Government lease out the land for five start hotel and shopping mall? Any development activities should be done by considering the future aspect.

Existing water bodies inside the airport are to be developed that help to increase the aesthetic value of airport and attraction to visitors. Bangladesh is the country of riverine. Water body

should be integrated. Existing airport needsupdated and redesign. Establishment of physical facilities and infrastructure development with modern design will be necessary.

This airport is the only gate way of Bangladesh and need to redecorate. Huge structure to be made volumetric is not justifying as an international airport, it'slook like as domestic airport and by 2021 we need volumetric change. Another run way or 2nd run way is needed which is very important in the HSIA because of passenger's movement increase and also aircrafts.

He states that Dhaka elevator express way and train lineto be linked with HSIA. Present HSIA is like domestic airportbecausean international airport there is no enough facilities. HSIA should be transit. There is lack of physical facilities in the HSIA. Developing activities are to be constructed by considering the future aspect. He concluded that Enhance Accessibility to Surrounding Infrastructures and a National Symbol Should Redecorate the HSIA Outlook.

Dr. Ashan Uddin Ahmed-Climate Change Expert

He is an Executive Director of Center for Global Climate Change and Advisory Panelist, Green Climate Fund, Korea.Conducted Key Informant Interview with Dr. Ashan Uddin Ahmed, dated on January 11, 2017 during 10 am to 11 am in his Shamoli Office.

He said that Save the airport from flash flood and inundation by over raining and its Hydro-ecological study to be required. As riverine country of Bangladesh,surrounding of airport should be kept water body. Water body important inside of airport because heat generated in the airport and fire related incident may occur that help to faced instantly and airport to be kept disaster free. Relocate the people those are living close to airport because they will suffer psychological problem in future and need to study on psycho-sociological study in the noise affected communities.

Drainage congestion to be improved in the airport and water will not allow to be deposited, if deposited drain out instantly.

Tree remove from CAAB area is great problem for Dhaka city because of comparatively less numbers of trees existing. At least 25% forest to be required for the environmental balance in our country. Although have some trees in different locations, but for the development activities it will be necessary to remove the trees. He suggested that two saplings to be planted instead of one

tree cutting. Saplings of trees are to be provided the vulnerable people for afforestation. Once these plants will grow up and mature and sell it for need basis that help to family support and livelihood develop.

Encourage to afforestation of shrub trees (fruit bearing, herbal and timber) thoseare fast growing variety, perennial and evergreen with thick canopy cover, large leaf area.Green belt to be made by shrub species likeDebdaru, mehogani, assath, mango, jackfruit, katbadam, deshi neem, gab, haritaki, bahera, jalpai, arjun, etc.

Birds in the airport are threat for aircraft any time incident may occur, especiallythreat for Jet aircraft. Anyhow to be concerned that birds will not gather in the airport and habitat for birds roosting and nesting sites including tall trees to be removed from airport area.

23.3 Summary of Key Informants Interview

All these eminent scholars were highly supportive to the expansion project. Summary of suggestions given in KII is given below:

- Expansion should be comprehensive & integrated
- Accessibility should be enhanced
- A National Symbol should decorate the HSIA outlook
- Interconnected water channel should surround the HSIA
- Entrance overcrowding by malls & hotels should be eliminated
- Lounge, escalator, and other internal facilities should be improved
- Promote greenbelt by native timber, fruits & herbal trees
- An emergency runway additional to the existing one is required
- Improved safety and security should be ensured
- Impact of noise pollution on the nearby residents should be minimized.
- Occupational Health and Safety (OHS) should be maintained during construction
- Special attention needs to be taken about fuel storage and handling
- Water reuse and use of rain water should be considered.
- Birds should be regulated for aircraft safety.
- Tree cuttings should be property compensated by re plantation.

Annex-24: Individual Consultation under JICA Preparatory Survey

Conducted interview with various local people dated on 27 to 30 December, 2016(four days) living close to the airport area for gathering their opinion on the Project and its impact. Interviewees included shopkeeper, teacher of school, college, madrasa (religious school), land owner, service holder, business man, taxi driver, rickshaw driver, van puller, Moszid Imam (religious leader), ward councilor (elected representative), women leader, house wife etc, these people are from the nearby four villages (Dolipara, Ahalia, Pakuria and Baunia) of Harirampur union under Turag Thana. Noise affected people and their opinions are in **Table A24-1**. Summary of their opinion are as follows:

- Aircraft noise is a problem especially for sick, pregnant, babies, and elderly persons, particularly at night.
- Drainage from airport creates a problem.
- Road communication is not good enough

Table A24-1: List of noise affected people identity and their opinions

Sl./No.	Name	Profession	Age	Address	Opinion
1	Mrs. Rahima Khatun	UP member	34	Baunia under union of Harirampur of Turag Thana	Four times informed us from RAJUK that relocate from here. Owing to noise we did get any complain on hearing problem.
2	Mr. Nobel Mia	Manager, Café runway	35	Baunia under union of Harirampur of Turag Thana	People live here with comport because of comparatively house rent is optimum and having facilities of gas, electricity and supply water.
3	Mr. Jony Ibrahim	Ashrisha Dairy farm owner/close to run way	33	Baunia under union of Harirampur of Turag Thana	We have a dairy firm of cattle here, we are in threat because of high noise may be abortion occur of our domestic animals
4	Md. Khalil Mia	Manager bashundhara paper agent, very close to run way or landing site	37	Baunia under union of Harirampur of Turag Thana	Aircraft noise is the major problem otherwise there is no another to survive here.
5	Md. AbulHossen	UP member, ward-7	45	Dolipara, under union of Harirampurunion of Turagthana	Always we are in doubt that what will happen if relocate from here. Generation to generation we are living here and also our grave yard here. We don't know what kind of decision Government will take for resettlement. Actually we will not relocate from here.
6	Md. Saidur Rahman	Piyanki Runway city Housing project	44	Baunia under union of Harirampur of Turag Thana	Piyanka Housing is ongoing project. Public have demand to take flat and plot from our housing.
7	Mr. Mohobbat Khan	Secretary doliparajame mosjid	48	Dolipara, under Harirampurunion of Turagthana	We are habituate to perform prayers in five times. During jamat they did not feel comport and actually nothing to do else.
8	Mr. Nurul Islam	Imam of Doliparajame mosjid	49	Dolipara, under Harirampur union of Turagthana	We did not feel uneasy during aircraft landing.
9	Mr. Asad	Shopkeeper Dolipara Bazar	50	Dolipara, under Harirampur union of Turagthana	Since January 01, 1994 continue their business at Doilipara and we are habituated to survive here.
10	Md. Shafiullah	Imam of Ahalia South jamemoszid	44	Ahalia village ,union of HarirampurofTuragthana	No problem during aircraft landing in the run way. We feel threat in case of high sound.
11	Md. Afjal Hossain	Teacher of Madrasa		Ahalia village ,uUnion of HarirampurofTuragthana	Development construction is ongoing even multistoried building also made by community. We are living very close to air port
12	Md. NazmulAlam	Hotel owner	35	Ahalia village,union of HarirampurofTuragthana	There is no impact occur by noise
13	Mr. Abdul Haque Mia	Ex AGM of Investment corporation	56	Ahalia village ,union of HarirampurofTuragthana	Still now there is no migration occurred from this location for the causes of noise. Rich people move high society but not for noise. In the evening public gather at

Sl./No.	Name	Profession	Age	Address	Opinion
					Bounia site because of they came to see the air craft landing. In future crime will increase.
14	Md. Abdul Motaleb	Private service	50	Ahalia village ,union of Harirampur of Turagthana	Comparatively land price is less and also house rent because of noise affected area
15	Md. Razzak	Carpenter	39	Ahalia village ,union of Harirampur of Turagthana	Those are rich purchase the flat and plot and move from here to accommodate in high society.
16	Md. Nazrul Islam	Driver of car	50	Ahalia village ,union of Harirampur of Turagthana	There is no pucca road inside the dolipara village. Mostly are semi- pacca. There is no facility from Government for road Construction.
17	Mr, Anowar Hossain	School teacher	48	Dolipara village, under union of Harirampurof Turag Thana	Drainage system is not good. All drainages are blocked by solid waste, if heavy raining water logged and inundated the area.
18	Mrs. Hosneara Begum	Owner of shop	45	Ahalia village ,union of Harirampur of Turagthana	Residents of ahalia village did not feel uneasy to live here. There is no incident occurred yet during landing the aircrafts.
19	Md. Rasul Mia	Hawker	44	Ahalia village ,union of Harirampur of Turagthana	He has no complain on it, they are habituated
20	Mr. Shopu Mia	Student	28	Dolipara village, under union of Harirampurof Turagthana	Road communication is not good enough because of there is no plan for road construction.
21	Mr. Sarowar Hossain	Teacher	48	Dolipara village, under union of Harirampurof Turagthana	There is no design and policy for make building from RAJUK. Community makes their building according their wishes.
22	Mrs. Muksuda Begum	House wife	43	Dolipara village, under union of Harirampurof Turagthana	Solid waste management society is existing at Dolipara. Limited number of waste collectors have been collected the solid waste from door to door and dumping in a site for recycles and reuse.
23	Md. Saidur Rahman	Van driver	56	Dolipara village, under union of Harirampurof Turagthana	They have no complain on noise pollution because of they habituated to live there
24	Md. Belal Hossain	Rickshaw puller	40	Dolipara village, under union of Harirampurof Turagthana	His income has increased but during aircraft landing their awake
25	Md. Jalal Uddin	Imam of DoliaparaJam eMoszid	45	Dolipara village, under union of Harirampurof Turagthana	We have to bound to survive here because of we have another option.
26	Mr. Shafiullah	Imam of Ahalia South jamemoszid	44	Dolipara village, under union of Harirampurof Turagthana	No problem during aircraft landing in the run way
27	Mr. Mostafa Kamal	Hotel owner	36	Dolipara village, under union of Harirampurof Turagthana	There is no effect on our business because of noise. Semi skilledpeople live here.
28	Mr. Afjal Hossain	Teacher of Madrasa	35	Dolipara village, under union of Harirampurof Turagthana	Development construction is ongoing even multistoried building also made in the locality. We are living very close to air port

Sl./No.	Name	Profession	Age	Address	Opinion
29	Mr. HaziBadsa Mia	Shopkeeper	49	Dolipara village, under union of Harirampurof Turagthana	Once three or four floor building demolish from RAJUK. But now no follow up even multistoried building construction ongoing process.
30	Mr. NazmulAla m	Hotel owner	41	Dolipara village, under union of Harirampurof Turagthana	High sound occurs during concord aircraft landing.
31	Mr. Join Uddin	Land owner	60	Pakuria village under union of Harirampur of Turagthana	There is no height limit for making building.
32	Md. Monir Hossain	Service	33	Ahalia village under union of Harirampur of TuragThjana	We are habituate about aircraft noise,
33	Mr. AnowarPar vez	Contractor	34	Ahalia village under union of Harirampur of TuragThana	There is no limitation for making multistoried building. Community make building of their wishes.
34	Mrs. Shapna Banu	Women shopkeeper	31	Ahalia village under union of Harirampur of TuragThana	Dense population because of this area house rent is comparative less and people did not feel uneasy to live here.
35	Md.Nazim Uddin	Taxi driver	36	Ahalia village under union of Harirampur of TuragThana	Road communication facilities is not good enough for the resident of Dolipara and Ahalia villages. All roads are narrow and congested.
36	Md. HabiburRa hman	CNG driver	38	Pakuria village under union of Harirampur of Turagthana	This area densely populated, communication facilities are not good enough.
37	Md. Hapez Golam Murtaza	Madrasa Teacher	40	Pakuria village under union of Harirampur of Turagthana	We habituate to hear the sound of craft but nothing to do because of we are living here generation to generation.
38	Md. Barkot Ullah	Social worker	42	Ahalia village under union of Harirampur of TuragThjana	Our village will develop immediately because of we are going to under pourasava.
39	Md. Jalil Mia	Businessman	37	Uttara sector-1	There is proper waste management. Residents are aware but they are not concern on waste management
40	Mr. Abdul Sahid	Student	42	Pakuria village under union of Harirampur of Turagthana	Our road communication is not good, In time we have to walk in long distance

Figure A24-1: Some Photographson consultation with community

Annex-25: Discussion with Former Lease Holders

Background: Within the proposed 3rd terminal building, there are some existing structures, which have to be removed for the Project. There are 2 former lease holders, who are still using the area and have their permanent structures. As the leases, have been expired in 2012, CAAB didn't renew the leases and asked them to evacuate. However, cases have been filed with the court of law and there is stay order. CAAB won the cases in the lower court in 2015 and now the litigation is pending with high court. Under this back drop, JICA Study Team wishes to listen to position/ views of the former lease holders and requested CAAB to arrange such meeting.

The Meeting: A meeting with the former lease holders of CAAB's property in HSIA was held on 20 February 2017 at 11 am atthe conference room ofCAAB. The meeting was presided over by Mr. A. K. M. Shahidur Rahman, Additional Secretary to the Government and Member Administration of CAAB.Representativesfrom CAAB, 2 lease holders (namely, Bangladesh

Flying Academy and M/S Builders and Design Ltd.), sublet consultants and JICA Study Team attendedthe meeting (list attached). The purpose of the meeting was to apprise the lease holders of CAAB's program for implementation of HSIA expansion project and sharing the views of the lease holders.

The meeting started with greeting to the participantsfrom the chair and self-introduction by the participants. Then the Chair requested Dr. Nurul Islam, member of the JICA Preparatory Survey Team to briefly explain the objectiveof HSIA Expansion project. Dr.Islam briefly explained the scope of the Project and the conflict with the structures currently used by former lease holders.He also explained that since JICA is considering financing the implementation, this meeting was arranged for consultation with the former lease holders as per JICA guideline for environmental and social consideration of 2010.

Then the Chairman requested the representative of Bangladesh Flying Academyto express their opinion. Mr.A.F.M NurulAlam,Chief Ground Instructor of the Academy stated that the Academyhas been continuing their program since 1948 and it has now 400 life members. Theyunderstand the situation and agree to relocate their infrastructure with proper compensationbecause Ifitisdemolishedwithout compensation, they will suffer huge financial loss. They requested for a new space for relocation. They also mentioned that currently they rented out the area to R&R Aviation, a unit of Sikdar Group.

Thenthe representative of Builders&Design Mr. AsifulHaquesaid that though their lease for 30 years ended in 2012, accordingto a previous arbitration, the lease is expected to be renewed for 2 more terms. They are now waiting for the verdict from the high court. He also mentioned that one building locating on part of their lease land is now rented to Bengal Foundation.

The Chairmanof the meeting mentioned the importance of the expansion project and explained that the Project cannot proceed unless the former lease holders vacate their lands. He also mentioned that CAAB has good understanding with the former lease holders and discussed several times. As litigation is pending at court, no settlement is possible until the cases are over.

On the query of Dr. Islamabout present status of verdict,CAAB Law OfficerMr. NurunnabiKabirinformed that all hearings were completed except one which was scheduled on 17th Feb but being delayed as the judge wassick.However, he was confident that the verdict will be delivered by March 2017.

On another query of Dr. Islam, representative of Builders & Design informed that they have a 10 year rental agreement with Bengal Foundation, which was started from 2012. According to him, a two years advance notice is required to cancel the rental agreement. Dr. Islam commentedthat the target to start the constructionof the project from 2018may not be achieved if any complexity arises.

Conclusion: The Chairman of the meeting pointed out that this is a nationally important project andthe interest of the nation should be given priority. He expected that all parties will consider this positively and try to solve this with a spirit to support the implementation of the Project.In reply, the representative of Builders and Design said that they support the implementation of the Project. He further said that even if the high court verdict is given against CAAB, they are ready to vacate the land for the sake of the Project subject to proper compensation. The Chair ended the meeting by thanking the participants.

Figure A25-1: Some Photographs with Lease Holders

Figure A25-2: Lease Holders Participants List

Meeting with Lessee and Civil Aviation Authority

Venue: CAAB HQ Date: 26/Feb/2017

S/N	Participant's name	Occupation/address	Mobile no.	Signature
1				
2				
3	Nurul Islam	JICA S.T.	01713121425	[illegible]
4	Dr. Tajul Islam	Env. Consultant	01552547470	[illegible]
5	Md. Mustafizur Rahman	Project Coordinator DDC	01755618840	[illegible]
6	Md. Nurul Islam	DD (Admin), CAAB	01708-162031	[illegible]
7	Muhammad Ikram Ullah	AD (Admin) CAAB	01708-167054	[illegible]
8	[illegible]	[illegible]	01685661055	[illegible]
9	AFM Nurul Alam	CCCI	01674708202	[illegible]
10	Md. Kader Bux	Builders	01711106992	[illegible]
11	Azizul Haque	The Builders & Designs	01711520132	[illegible]
12	Saif Mahmood	[illegible]	01711056676	[illegible]
13	AKM Nuruzzaman Kabir	DS (Law Officer), CAAB	01713076088	[illegible]
14				
15				

Annex-26: Information Disclosure Meeting (IDM)

26.1 Background

Information Disclosure Meeting (IDM) under JICA Preparatory Survey: An Information Disclosure Meeting was arranged on 26 January, 2017, at Dhaka Regency Hotel. The purpose of the meeting was to disclose the ouput of the EIA study along the description of the HSIA Expansion Project. Total number of participants were twenty six (26) representing various Government agencies and local elites including Dept of Forest, Road and Highway, Airlines, Metereology dept., Police, RAB, RAJUK, REB, BWDB, elected councillor, businessmen, etc.

26.2 Inauguration of the program

The program was inaugurated by Eng. Md. Mustafizur Rahman from Development Design Consultant Limited (DDCL) and he is the Coordinator of the Project as well. He started with greeting the participants. He announced Dr. Zainul Abedin, Senior Environmental Expert of DDC as the Moderator of the program and requested him to start the program.

Then Dr.Zainul Abedin greeted all the participants and welcomed them in the program. He firstly requested Engr. Mahbubur Rahman (Director, DDC) to say a few words on today's program.

Engr. Mahbubur Rahman conveyed his welcome to everyone and started his speech. He introduced himself as a Director of DDC and a Consultant of the HSIA Expansion Project. He said that, the IEE for the Project was done and according to the recommendation of JICA an EIA is prepared. He concluded with asking for everyone's opinion on this project.

Then Dr. ZainulAbedin thanked him and requested everyone to give a short introduction about them. The introduction part started from Mr. Golam Mustafa who is a Civil Engineer and currently working as an Environmental Specialist in DDC. After him all the participants gave short introduction about themselves.

During the introduction, Dr.Nurul Islam; member of JICA Preparatory Survey Team, gave a small brief about the project background. He said that, on behalf of the Government of Bangladesh, Civil Aviation took this project few years back. According to him, the capacity of the terminal as well as the entire airport is almost near the exceeding limit. For this reason via Civil Aviation the Government of Bangladesh has taken this Airport Expansion Project. The planning and preliminary drawing design was done by Civil Aviation. Then GoB requested JICA to finance for this project to implement and JICA agreed to finance of the project for implementation. Before the implementation of the project, a team is formed for the project preparation survey and he is one of the members of the survey team.

After his introduction, Dr.Zainul Abedin requested Md. Mustafizur Rahman to announce the Chairman and Presiding Officer of the meeting. Then Md. Mustafizur Rahman announced Md. Habibur Rahman, Executive Engineer of CAAB and also the Deputy Project Director as the Chairman and Presiding Officer of the meeting.

In between some participants arrived and gave short introduction about them. After finishing the introduction part, Dr.Zainul Abedin requested Engr. Golam Mustafa to start his presentation for the meeting.

26.3 Core points of the presentation

Engr. Golam Mustafa started his speech by conveying his welcome to everybody to all the participants. Firstly he said that, it is a matter of great happiness that, JICA is financing this project. According to him, in Bangladesh, many project ideas cannot be implemented due to lack of funding agencies. So, firstly he thanked JICA for being the funding agency of the project.

He said that, the meeting was arranged to disclose information about the HSIA Expansion Project. Firstly, an Initial Environmental Examination (IEE) report was prepared and submitted to the Department of Environment (DoE) of Bangladesh. After getting clearance of the IEE, according to the direction of DoE, the Environmental Impact Assessment (EIA) study is done. He appreciated the involvement of JICA in this EIA study. And he said that, their involvement made the study more scientific, vast and modern.

Then he enlightened the participants about the project background. In this part he said that there are,

- 3 International and 5 Domestic Airlines in Bangladesh.
- 17 Airlines are operating in and out of Bangladesh.
- 47 Countries Signed Bilateral Agreements with Bangladesh.
- 80% of the total air traffic flow of Bangladesh takes place at HSIA in Dhaka.
- Annual Passenger Handling Capacity of HSIA is only 8 million.
- HSIA has 1 runway and 1 International Passenger Terminal Building.

After that he discussed about the limitations of HSIA, which are

- It cannot implement modern five level security concepts.
- And the capacity of handling 8 million passengers annually is already attain.

Because of facing these limitations, GoB has decided to renovate the HSIA and to increase the facilities as well as the passenger handling capacity of the airport. Then he again mentioned JICA as the financing agency and thanked them. In his presentation, it was said that, the cost of the project is estimated as per DPP, 13461 Crore BDT and the construction period of the project will be 3 years.

Then he showed the master plan prepared by Civil Aviation, which shows the developments and renovations that are going to be done within the year 2035. There are 2 Phases for the development and renovation works of HSIA namely, Phase 1 & Phase 2. And he said that, right now only the Phase 1 works will be implemented under the project. The works under Phase 1 includes:

- New Passenger Terminal Building.
- Multi-Level Car Parking linked by Tunnel.
- New Cargo Complex.
- VVIP Complex.
- Rescue & Fire Fighting Facilities & Equipment.
- Parking Apron.
- 9 Connecting Taxiways.
- Landside Service Road with Elevated Road and Connecting Road with Dhaka Elevated Expressway.
- Improvement of Drainage System.
- Taxiways (2 Rapid Exits and 1 Connecting Taxiway for the Runway 14 Threshold).
- Water Supply System.
- Sewage Treatment Plant.
- Intake Power Plant with Distribution System.
- Hydrant Fuel Supply System.
- Communication System.
- Security & Terminal Equipment.

He showed the positions of the above-mentioned constructions in the master plan for better understanding.Then he gave a short brief about the national and international guidelines followed for the EIA study. He also mentioned about the JICA guidelines followed for the EIA study. And according to the categorization rules the project is considered as “Red Category”. Being “Red Category”, the project needed IEE which is already done and then according to the directions of DoE, now EIA study is being done.

Next, he gave some idea about the IEE submission dates and the recommendation of DoE for conducting EIA. After that he gave a short briefing about the major positive and negative impacts

of the project. And he explained that the positive impacts are more than the negative impacts. And this is the reason the project is being implemented.

Then he discussed about the steps taken to prepare the EIA report which include review of the environmental acts, rules & Regulations, study of project alternatives, source testing of air, water & soil samples, noise testing &modeling's, interview with local stakeholders & public consultation meeting & environmental management plan (EMP).

After that he showed the ambient noise, air and water quality tests. For the EIA study some supplementary works were done and being done which include, Alternative Analysis, airport noise measurement &modeling, Key Information Interviews (KII), Focus Group Discussion (FGD), Tree Counting & Inventory, Socio-Economic Survey & Information Disclosure Meeting (IDM).

Then he showed the photographs of the noise measurement and tree inventory as well. The equipment used was also showed in the photographs. Over 6,000 trees were inventoried. And 66 classification & enumeration was done.

After that he talked about the Public Consultation Meeting which was held on 21st November, 2016 at CAAB Seminar Auditorium where 44 invited stakeholders, concerned public & businessmen, consultants and CAAB officials were present. Then he briefed about the Key Information Interview (KII) and gave short introductory about all the interviewed persons.

Then he briefed a short summary of the KII. After that he talked about the Focus Group Discussion (FGD) held on 10th January, 2017 at CAAB Conference Hall. 66 participants were present there including local businessmen, social workers, retired government officials, consultants, CAAB officials as well as residents from Dolipara, Ahalia, Pakuria&Baunia.

Next, he described about the socio-economic survey done for the study along with photographs. Then he suggested mitigation measures for adverse impacts on air quality, noise quality, water quality, occupational health & safety, solid waste management, terrestrial & aquatic ecology followed by the impact assessment and environmental management Plan (EMP) and Environmental Monitoring Program (EMP). In the conclusion, he said about the positive impacts going to be happened due to the project implementation.

26.4 Questions and Discussion on IDM

Then Dr.Zainul Abedin thanked Mr. Golam Mustafa for his presentation and requested some more participants who came in between the presentation to give a short introduction about them.

After the introduction phase, Dr.Zainul Abedin said, the EIA study is done considering the valuable comments and opinions of people in every step. And, this time again they are gathered for collecting the valuable opinions of the participants. Then he requested all the participants to express their valuable comments and remarks.The details of the discussion are given in the **Table A26-1**below.

Table A26-1: Details of Questions & Discussion on IDM

Sl. No.	Name and Profession/Address	Question/Opinion	Response
01.	Md. Asadur Rahman, Assistant Director, Bangladesh Meteorological Department.	Firstly he appreciated for nice presentation. Then he asked, what will be done about the operation building. He said that, the condition of the building is very poor. Without their forecast no landing or take off is possible. Airport forecast is not like normal weather forecast. For airport forecast, they have to consider 25km area around. Now they have to work in a closed room. And they have to go to the rooftop of the building for observation. As it is a big project, the operation building should be considered.	Dr. Nurul Islam responded to his question. He said that, this is a very important issue and thanked Md. Asadur Rahman for his question. But he was sorry to say, the operation building is not part of the project. But the building will be constructed by CAAB under a separate project.
02.	Md. JahidulKabir, Conservator of Forests & Wildlife, Forest Department	Firstly he said that, if any representative from DoE was present, it would have been better. Mainly air, water and noise are discussed in the presentation. But about the terrestrial and aquatic ecology, you only mentioned the number of trees present which is 7,000. But how many trees will be cut down is not mentioned. Secondly, the place for tree plantation is not showed in the plan. He suggested avoiding exotic plants as in our country there are many ornamental trees as well as trees for preventing noise. The species of the trees should be mentioned in the plan. The tree plantation should be multi layered. Otherwise the large trees will be grown together and noise will pass below them. For this reason, trees of various heights should be selected.	Dr. Zainul Abedin thanked him and said that, in this HSIA Expansion Project the biggest concern is saving trees. He said that, 7000 trees are inventoried. He also said that, they have the list of trees will be cut and replacement places for them. And some of the plantation will be done outside the area Then Dr. Tajul Islam, Senior Environmental Expert, DDCL said that, 25% of the trees are alien trees including Akashi, Eucalyptus etc. And most of the trees are small trees which are not yet ready for furniture making. Civil Aviation is selecting places for replacing the trees. And about the greenbelt, he said that, the trees having thick leaves will be considered, so that the noise can be reduced. The species of trees to be planted will be mentioned in the EIA report. And about the animals, there are some migratory birds. But in airport area, some wildlife living in the around areas will not be disturbed. Then Engr. Golam Mustafa said that DoE representatives were invited but they could not attend.
03.	Engr. Rowshan Ara Khanam, Additional Chief Engineer, Roads & Highway Department	She said that the project is very important for the development of Bangladesh. She wanted to know, in this project, how will be the GHG emissions is considered. She also asked about the Resettlement Action Plan (RAP) of the Project Affected Persons (PAP) if there is any. Later she demanded the connection of HSIA with BRT, MRT as well as Dhaka Elevated Expressway.	Dr. Tajul answered that; the project is totally within the land of Civil Aviation. So, there will be no need for any resettlement. And about the GHG emission, he said that, proposed equipment will be CFC free so there will be no GHG emission. Dr. Nurul Islam then said that proper connection with BRT, MRT and DEE will be considered.
04.	Major Rokibul Hasan, Deputy Director (Development), RAB	He said, the project is for increasing the capacity of the airport, but the entry and exit is not considered. People can exit	Dr. Nurul Islam responded to him. He said that, it is a very good observation. He showed in the master plan the situation of the present terminal which is a bit inside from the main

Sl. No.	Name and Profession/Address	Question/Opinion	Response
		from airport Easily but just after that, they have to wait almost an hour at the airport gate. He thinks this has to be addressed in the project. According to him, in all the other countries, there are separate entry and exit facility. But in our country people have to wait for hours. As the project is increasing the capacity of the airport, so the entry and exit should be considered. He suggested multiple entry and exit or separate entry and exit arrangement.	road. He showed the position of entry and exit in the new plan and said that after the inauguration of terminal 3, all the international passengers will be shifted to that. And for the time being, the older terminal will be closed for renovation. And in the new terminal, the entry exit will be in scientific way where all the entries will be in one side and all the exits will be in the other side.
05.	Md. Belal Uddin Biswas, BWBD	He said that being a stakeholder as well as a Government Official, he is very happy to be a part of this program. He talked about the guidelines and policy part. He said that he thinks more guidelines should be incorporated or studied. He also said about Environmental Conservation Act, 1995, which was amended later for three times. He asked for incorporating the amendments.	Dr. Zainul Abedin said, all the acts and their amendments are considered in the report, but not showed in the presentation. He said that, only directly relevant acts are showed in the presentation.
06.	Dipak Halder, Assistant Manager (Electrical), BimanBangladesh	He said that, the BalakaBhaban is very close to the VVIP terminal. Entry to this place from the main city is easy. But after finishing the works fornew terminalthey entry exit might be difficult.	Dr. Nurul Islam said that BalakaBhaban will remain at the same location. But only for this building, a separate connection is not possible. But it will be possible to make entry exit from BalakaBhaban.
07.	Md.Abul Hossain, Member, Horirampur.	In previous meeting, he asked about the land acquisition from his area and got proper answer of that too. He wanted to know if the local people will be affected by the project. Again, the road in the north side of airport is very narrow. He asked about the expansion of the road.	Dr. Nurul Islam confirmed that there will be no land acquisition for this Project. He also said that the mentioned road is out of the project area.
08.	Syed Mahbubur Rahman, Director (PP), BREB	He asked about the fuel that will be used in the power generation plant. He also asked whether it will be combined cycle or simple cycle. And in order to make the plant more efficient many high technologies can be used. He also asked about the importance of baseline data.	Dr. Zainul Abedin answered that the baseline data or the current pollution measurements show the present situation of the area. It is measured to determine the differences between before and during the construction period. Then Dr. Nurul Islam said, no power will be generated in the project. The power will be purchased. And about efficiency he said, as the project will be implemented under an international contract, so they expect the use of modern and efficient equipments.
09.	M. M. Ehsan Zameel, Executive Engineer, RAJUK	He said that, the presentation enlightened them about the geological status, topography etc. of the area. He wanted know about the land use plan of the project. Secondly he said that the project falls in “Red Category”	Dr. Zainul Abedin said about the location of HSIA being in the middle of a heavily populated area that, it is not exception. The Washington D. C. airport is in the middle of the city and the authority is very strict about the landing and takeoff time to avoid disturbance to people. He also said that ECC

Sl. No.	Name and Profession/Address	Question/Opinion	Response
		which needs Environmental Clearance Certificate. He wanted to know if the ECC is already taken or not. Then he wanted to know about the ecological sustainability and the neutralization of the carbon emission for this project. Again, he wanted to know about the comprehensive disaster management system for this project.	is not obtained yet, but will be applied after the EIA finalization. He also assured that all environmental aspects will be covered in the EIA.

Then Dr.Zainul Abedin requested the presiding officer Mr. Habibur Rahman who is the Deputy Team Leader of the project to give his concluding speech, if there are no other questions or opinions from the participants.

26.5 Speech of the Presiding Officer

Mr. Habibur Rahman started his speech by conveying his Salam to the participants. He said that, HSIA is the gateway of Bangladesh. In order to come to or leave Bangladesh, HSIA is the only way. So, in order to operate this airport in the main time, this HSIA Expansion project is being implemented. He said that, the five level security system is not possible in the existing airport. And among 3 categories, the existing airport is Category 1. The renovated HSIA will be Category 2. About the traffic management system he said, multilevel concept will be followed which will stop the traffic jam in the airport. For entry and exit there will be 6 flyovers, 3 for entry and 3 for exit. As it was designed as a regional airport, there are many deficiencies. Internationally, the meteorological towers are established separately with the meteorological office under it and it does not contain any external entry. Even animals are not allowed in the area. But for the security purpose, we cannot allow them. There will be a bridge above the lake in 17 no. sector which he showed in the master plan. He said that, this bridge will be connected with the tunnel. Lastly he thanked the people of the surrounding areas for maintaining the security. He concluded his speech with thanking all the present participants for attending the meeting. At the end Dr.Zainul Abedin requested Md. Mustafizur Rahman to give his concluding speech.

Figure A26-1: Some Photographs on IDM

26.6 Concluding speech

Eng. Md. Mustafizur Rahman thanked the participants for attending and making the meeting successful. He expressed his gratitude to the Civil Aviation authority representative, JICA representative, RHD representative as well as all the other participants. He also thanked his colleagues for their kind coordination. Lastly, he again thanked all the participants and concluded speech and invited all the participants to have lunch with them in the Dhaka Regency Hotel premises.

26.7 Important issues

All the participants expressed their support for the Project and apprciated the proposed measures against anticipated environmental impact. Important issues are mentioned below:

- Importance of new metereological station at airport. It was replied that this is included in ongoing control tower construction project, but excluded from the HSIA Expansion project.
- During tree re-plantation, exotic and invasive species of trees should be avioided.
- There was an inquery if Resettlement Action Plan was prepared or not. It was replied that as there is no land acquisition, RAP is not needed.
- Emphesis on smooth access by various mode of transport, like DEE, BRT, MRT, car, BR, Bus, etc.

Figure A26-2: List of Participants for IDM

Hazrat Shahjalal International (Dhaka) Airport Expansion Project

Information Disclosure Meeting

Venue: Dhaka Regency Hotel, Airport Road, Dhaka
Date : 26 January 2017 Time : 10:30 AM

List of Participants

SL	Participant's Name	Occupation/Address	Mobile No.	Signature
1	M. H. Rahman	CAAB	017-11124609	[illegible]
2	Md. Mustafizur Rahman	DDC Project Coordinator	01755618840	[illegible]
3	Zahirul Abedin	DDC Snr Envr Expt	01716707114	[illegible]
4	Dr Tajul Islam	"	01731-471470	[illegible]
5	Mahbubur Rahman	DIRECTOR DDC	01819 24 23 78	[illegible]
6	Tanzia Sharmin	Jr. Environmental Expert	01787711097	T-Sharmin
7	Afroza Khanam	CM, DDC	01716224947	[illegible]
8	Dipok Halder	AM, Electrical, Biman	01819261690	[illegible] 26/01/2017
9	MD. Tofael Ahmed	Env. Expt. DDCL	01712634607	[illegible]
10	Md. Jahidul Kabir	Conservator of Forests, WL- Forest Dept.	01778454499	[illegible]
11	Engr Roushan Ara Khanam	Additional chief Engineer - Road & Highways Dept	01913257860	[illegible]
12	NURUL ISLAM	Nippon Koei	017 13121415	[illegible]
13	Atiqur Rahman	DSCL	01722013701	[illegible]
14	Md. A. Kaddus	DDCL	01537048390	[illegible]

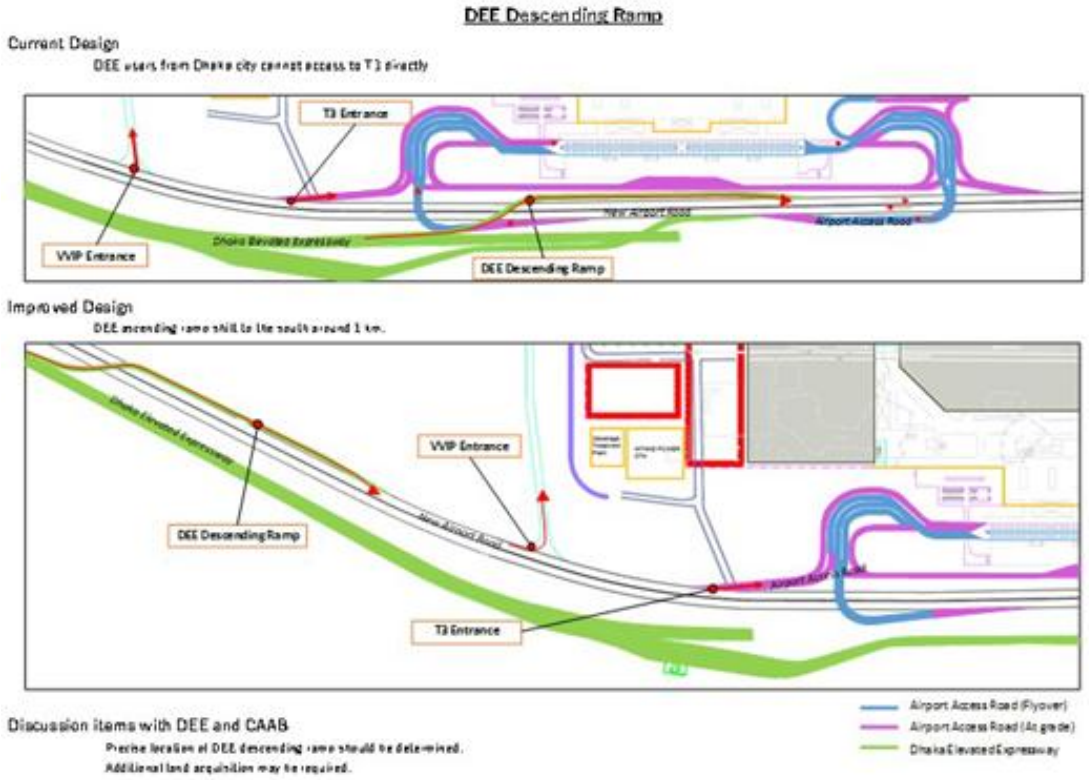
SL.	Participant's Name	Occupation/Address	Mobile No.	Signature
15	Mizanur Rahaman	Manager (Env)	01711193486	
16	Md Solek Miah	Regent Airways	01726479388	
17	[illegible]	[illegible]	01686235788	
18	Syed Mahbubur Rahman	Dir (PP) BREB	01911985671	
19	Major Rokibul Hasan	Deputy Director (Development) RAB	01777720114	
20	Md. Belal uddin Bisswas	Forces Headquarter BWDB	01711264573	
21	PRONOY SAHA FOR (MR. HEZAZ)	LE MERIDIEN DHAKA	01966660034	
22	M.M. Ehsan Zammel	Executive Engr. RAJUK	01730735657	
23	Md Abdur Razzaque	Director	01712160103	
24	MD. ABUL HOSSAIN	MEMBER	01713023891	
25	Sadia Shanji	Jr. Engr. DDC Ltd	01671506515	
26	Md. Azadur Rahman	A. Director	01711385170	
5				
6				
7				
8				
9				
10				
11				

Annex-27: Dhaka Elevated Expressway (DEE)

Dhaka Elevated Expressway is Bangladesh's first elevated expressway project. The DEE project is currently under construction as a 19.7 km long elevated expressway along the alignment of HSIA – Kuril – Banani – Mohakhali – Tejgaon – Moghbazar – Kamalapur – Saidabad – Jatrabari – Dhaka – Chittagong-Highway (Kutubkhali). It is one of the largest infrastructure projects taken up by the incumbent government to ease traffic congestion in the capital. It will be 46.73km long including the connecting roads. The first phase runs from airport to banani, the second fromBanani to Moghbazar and the third from Moghbazar to Kutubkhali

27.1 DEE Descending Ramp/ Ascending Ramp Connectivity

Connectivity with DEE and terminal 3 should be secured, Re-design of location of descending/ ascending ramps of DEE are required. For descending ramp, the location was planned based on the existing entrance of HSIA, and the exit ramp was planned about 500m southward from the existing entrance. However, the vehicles cannot access from descending ramp to entrance to new international terminal, as the access road to international terminal is located about 1km southward from the existing HSIA entrance.For smooth access from DEE to terminal 3, it is proposed that the descending ramp of DEE shall be relocated about 1km southward from the original location as shown in Figure 9.48, which was basically agreed by FDEE, concessionaire of DEE.



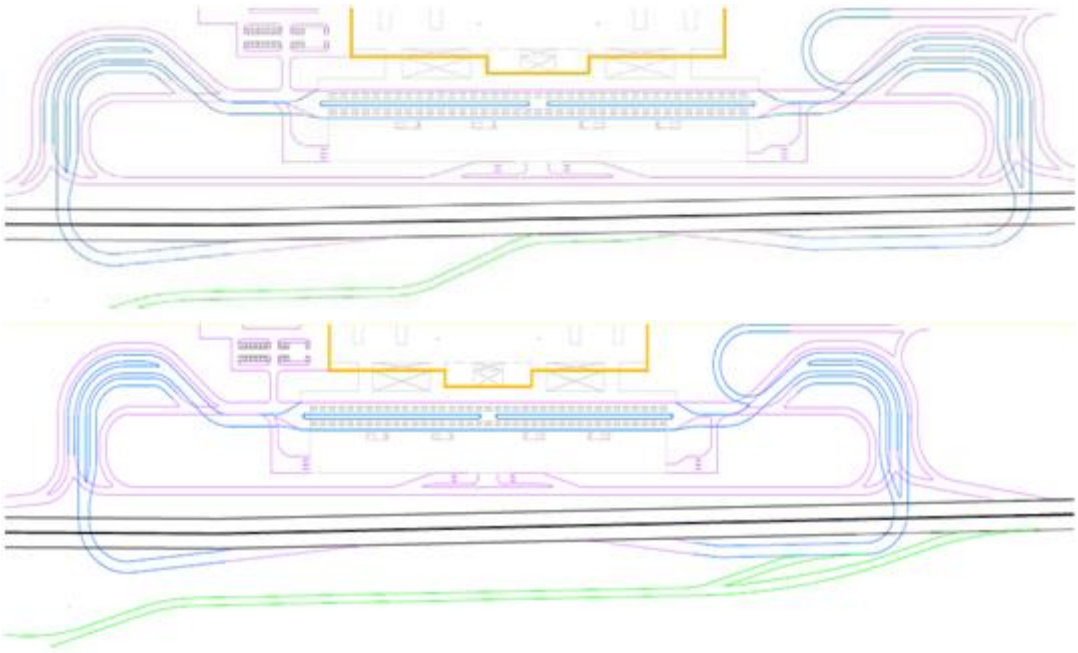
Source: The Study Team

Figure A27-1: Proposed re-location of Descending Ramp of DEE

For ascending ramp, the original location is planned about 700m southward from the existing entranceof HSIA for smooth connection. The location is also just southward from the exit road from Terminal-3, by which access from terminal 3 to DEE is physically possible passing through airport road witharound 200m. However, considering the current serious traffic congestion at the entrance of existingairport on Airport road, heavy traffic jam at the entrance of DEE may occur by both vehicles fromterminal 3 and Airport Road.It is therefore recommended that the ascending ramp of DEE shall be relocated around 500 north-ward,but limited within the south of existing intersection in front of entrance of HSIA (Terminal 1 & 2) andBR Airport Railway station, for the vehicles form there smooth entrance to DEE. From the exit road ofterminal 3, direct connection through viaduct road to approach road of DEE to toll will be provided.The details are shown in **Figure A27-2**.

27.2 DEE Ascending Ramp/ Current and Improved Design

Congestion is anticipated at the end of T3 descending ramp and the beginning of DEE ascending ramp due to their proximity.



Discussion items with DEE and CAAB

- Precise location of DEE ascending ramp should be determined
- Design of the elevated T3-DEE connector road should be determined
- Additional land acquisition may be required

Source: The Study Team

Figure A27-2: Proposed Re-location of Ascending Ramp of DEE

Annex-28: Aircraft Noise Prediction

28.1 Outline

In HazratShahjalal International Airport (HSIA), the number of handling passenger isincreasing drastically. Therefore, the passenger terminal building must be extended since the capacity of the existing terminal building is not enough for future passengers. The new terminal building and some facilities will be installed by this project. Corresponding to the implementation of these facilities, the number of taking off and landing will increase and the effect of aircraft noisewill be concerned in future. This study is executed to grasp change of aircraft noise in future.

28.2 Method of Prediction

The Item of prediction

The Item of prediction is Lden(Day-Evening-Night Average Sound Level) for aircraft noise. Airport operation is exempted from noise regulation of Bangladesh. On the other hand, Lden is using for assessment of aircraft noise in many countries such as EU countries and Japan. Therefore, Lden is used for prediction item on this study.

The propagation formula

Firstly, it is neededto calculate theSound Pressure Level (Hereinafter referred as Lr) form aircraft in this study. The method of calculating Lr is arranging point sound source on the aircraft route and calculate sound level on the ground from these points. Propagation formula of sound from sound source to ground is shown below.

$$\mathrm{Lr} = \mathrm{PWL} + 10 \times log_{10}\left(\frac{Q}{4\pi r^2}\right)$$

Lr = PWL + 10 x $log_{10}(Q/4\pi r^2)$

Where,

Lr is Sound pressure level in the passive point(dB),

PWL isSound power level of sound source(dB),

Q is Directivity factor (Q=1 for full sphere propagation), and

r is Distance to sound source (m).

Calculating LAE

From result of calculating Lr, it is possible to calculate the single event exposure sound level (Hereinafter referred as LAE). During one aircraft moving on the landing path or takeoff path, the value of Lr will be change on the ground. LAE is calculated from integration of variable Lr.

Calculating Lden

The day-evening-night index Lden indicates the noise level over an entire day, with different weightings given to the individual time periods: The time between 7 a.m. and 7 p.m. is considered daytime, between 7 p.m. and 10 p.m. is considered evening, and between 10 p.m. and 7 a.m. is considered night-time. Noise in the evening and at night is weighted more heavily than noise during the day. (This time zone is the stipulated in Japanese regulation)

The daily Lden calculated from formula shown below:

$$L_{den} = 10log_{10}\left\{\frac{T_0}{T}\left(\sum_i 10^{\frac{L_{AE,i}}{10}} + \sum_j 10^{\frac{L_{AE,j}+5}{10}} + \sum_k 10^{\frac{L_{AE,k}+10}{10}}\right)\right\}$$

Where,

Lden is Daily day/evening/night weighted average sound pressure level,
i is The i-th event during day time,
j is The j-th event during evening,
k is The k-th event during night time
LAE is Single event exposure sound level (dB),
T0 is 1(s), and
T is 86,400(second, =60 x 60 x 24)

28.3 Conditions for Prediction

The number of Landing and Takeoff, Types of aircraft

The number of landing and taking off is basic factor for aircraft noise around airport. In this study, two (2) daily total number are using for prediction. One is daily total of current (in 2015) and another is daily total of future (in 2025). The following tables show the number of landing and takeoff.

Table A28-1: Number of Landing and Takeoff

Year	Time zone	Large size				Middle size				Small size			
		Percentage of takeoff and landing	Number of daily takeoff and landing	Takeoff to 324, Landing from 114	Takeoff to 114, Landing from 324	Percentage of takeoff and landing	Number of daily takeoff and landing	Takeoff to 324, Landing from 114	Takeoff to 114, Landing from 324	Percentage of takeoff and landing	Number of daily takeoff and landing	Takeoff to 324, Landing from 114	Takeoff to 114, Landing from 324
2015	Day (AM7-PM7)	45.2%	23	1	11	63.6%	18	1	8	82.8%	101	5	46
	Evening (PM7-PM10)	25.8%	13	1	6	13.6%	4	1	1	13.8%	17	1	8
	Night (PM10-PM12/AM0-AM7)	29.0%	15	1	7	22.7%	7	1	3	3.4%	4	1	1
	Total	100.0%	51	3	24	100.0%	29	3	12	100.0%	122	7	55

Year	Time zone	Large size				Middle size				Small size			
		Percentage of takeoff and landing	Number of daily takeoff and landing	Takeoff to 324, Landing from 114	Takeoff to 114, Landing from 324	Percentage of takeoff and landing	Number of daily takeoff and landing	Takeoff to 324, Landing from 114	Takeoff to 114, Landing from 324	Percentage of takeoff and landing	Number of daily takeoff and landing	Takeoff to 324, Landing from 114	Takeoff to 114, Landing from 324
2025	Day (AM7-PM7)	45.2%	51	3	23	63.6%	65	3	30	82.8%	152	8	68
	Evening (PM7-PM10)	25.8%	29	2	13	13.6%	14	1	6	13.8%	25	1	12
	Night (PM10-PM12/AM0-AM7)	29.0%	33	2	15	22.7%	23	1	11	3.4%	6	1	2
	Total	100.0%	113	7	51	100.0%	102	5	47	100.0%	183	10	82

Note: Large size: B787, B777, B747, A330, A340, Middle size: B737, A320, Small size: DHC 6, Dash 8, ATR72, ERJ 145

Flying Route of Plane and Vertical

Usually, aircraft makes noise problem when flying on low altitude. This prediction study considers less than 2,000ft cruising of aircraft. According to the Aeronautical Information Publication (AIP) of HSIA, both of the plane flight routes (144 degrees and 324 degrees from the north) under the 2,000ft are straight.On the other hand, the vertical route of takeoff is different on aircraft type. The speed of rising up is based on the performance of the aircraft. The performance data of aircraft is shown below table.

Table A28-2: Performance Data of Aircraft

Typical aircraft		raising up ratio (ft/min)	Indicated true airspeed(kt)	approach category code	final approach speed(kt)
Small	ATR72	1500	140	B	85-130(108)
Middle	A320	2500	175	C	115-160(138)
Large	B777	3000	200	D	130-185(158)

In this study, the sound sources are arranged on the flying route of plane and vertical.Following **Figure A28-1**shows the sound source on the flying route:

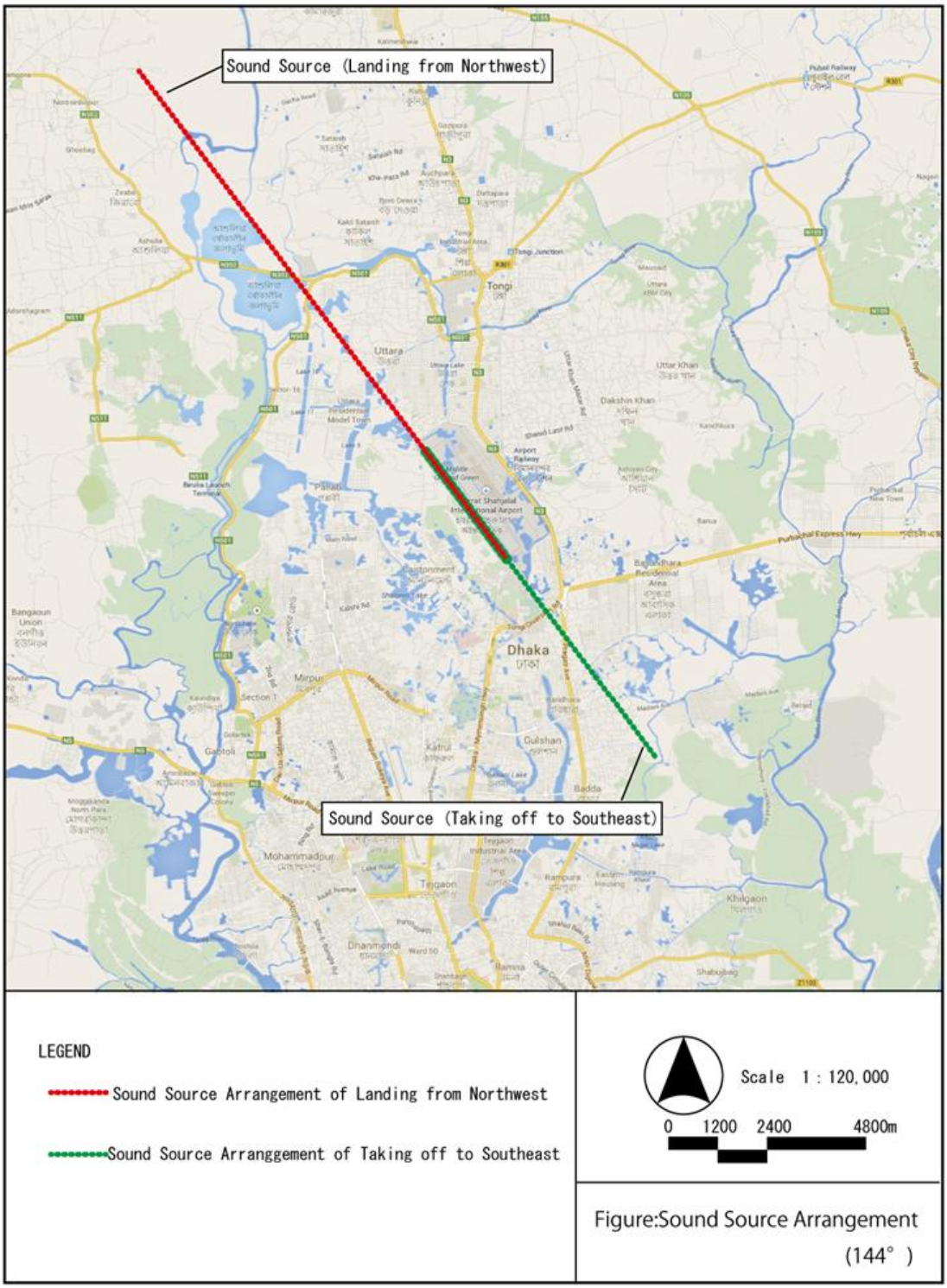


Figure:Sound Source Arrangement (144°)

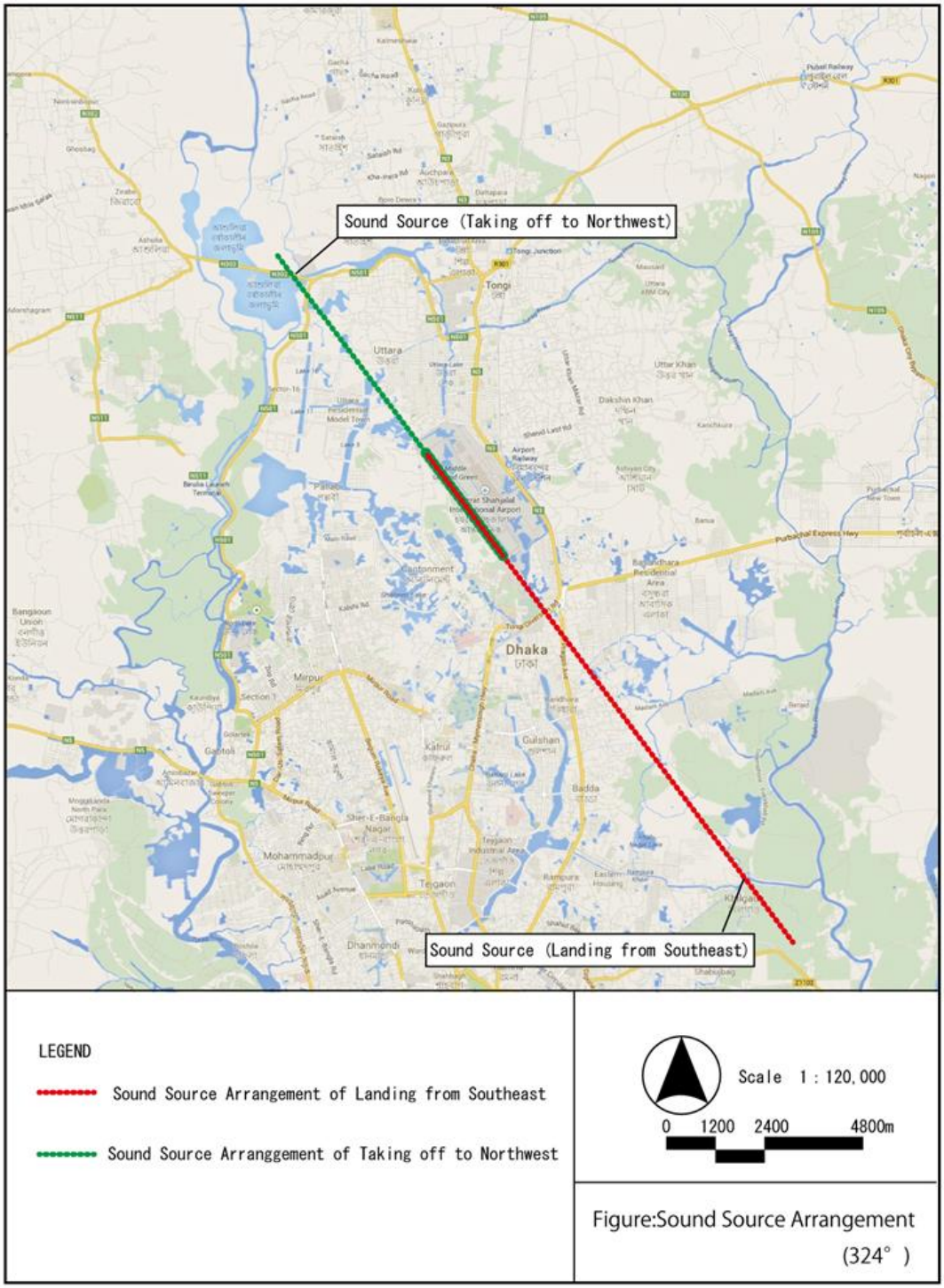


Figure A28-1: Sound Source Arrangement

28.4 Sound Source Data of Aircraft

The sound source data is set from noise observation data in Japan. Ministry of Land, Infrastructure, Transport and Tourism Japan is publishing the aircraft noise data. The Power level of sound sources are based on these published data.

Table A28-3: Sound Source Data

Type	Power level for takeoff(dB)	Power level for landing(dB)	Source
ATR72-200	140	127	FAA
A320	146	138	MLIT
B777-300	149	141	MLIT

28.5 Result of Prediction

The result of predictionis shown on isopleth map. According to thisresult, the impact of aircraft noise around HSIA will increase. Environmental quality standard for aircraft noise (Category II area which means normal living condition) is 62dB in Japan. From the isopleth map of Lden, the area exceeding standard value of Japan is spreading around airport.

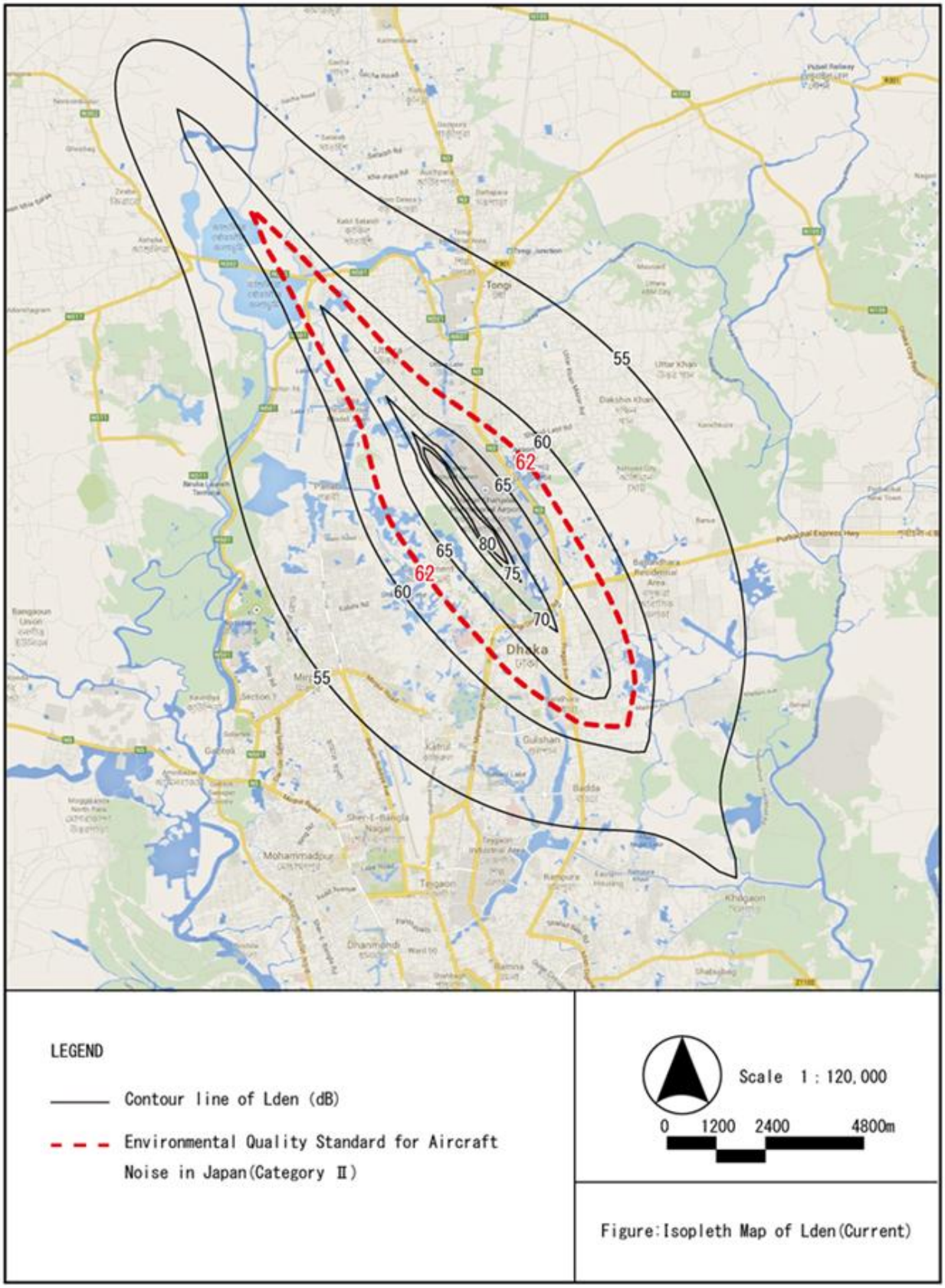


Figure:Isopleth Map of Lden(Current)

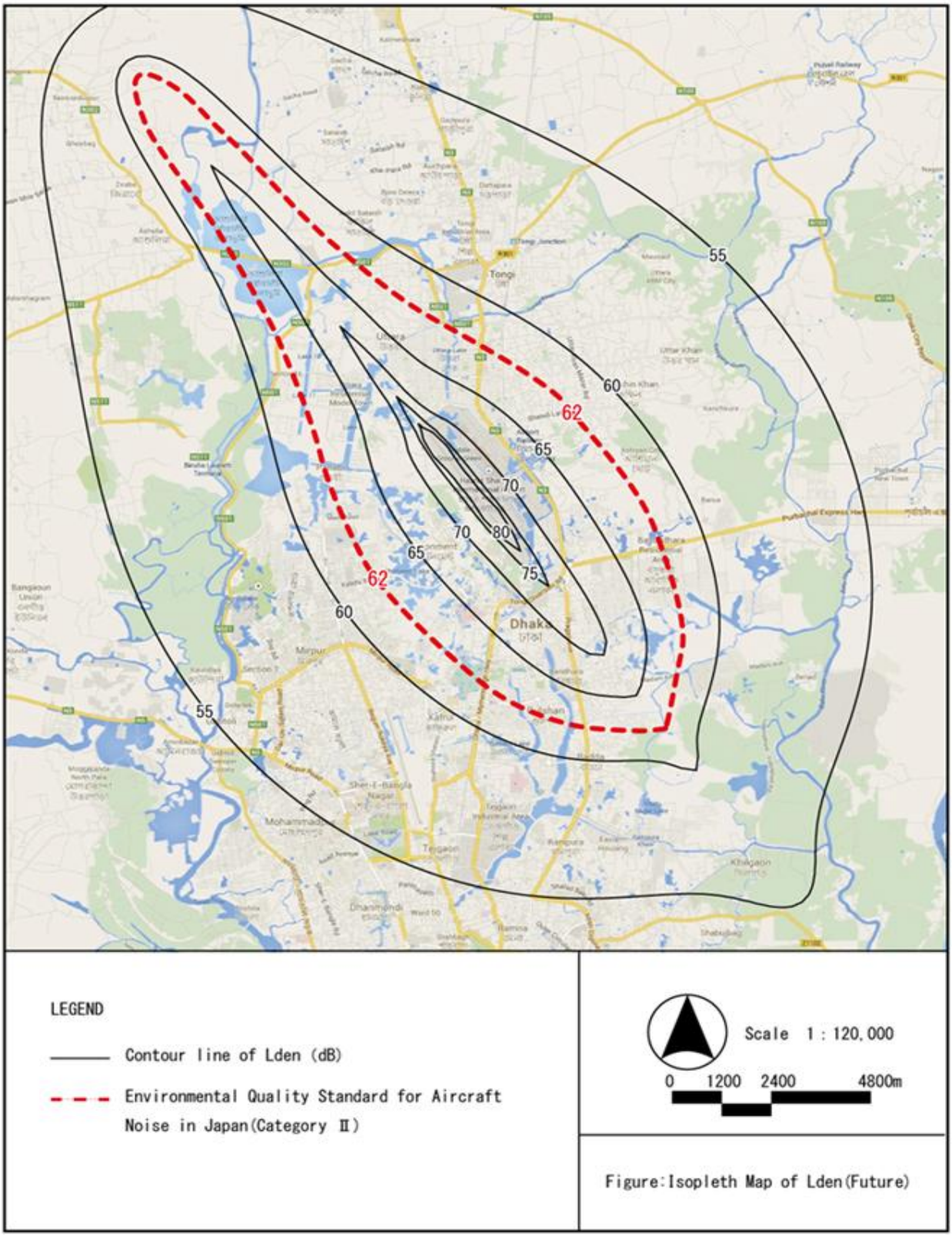


Figure A28-2: Isopleth Map of Lden