



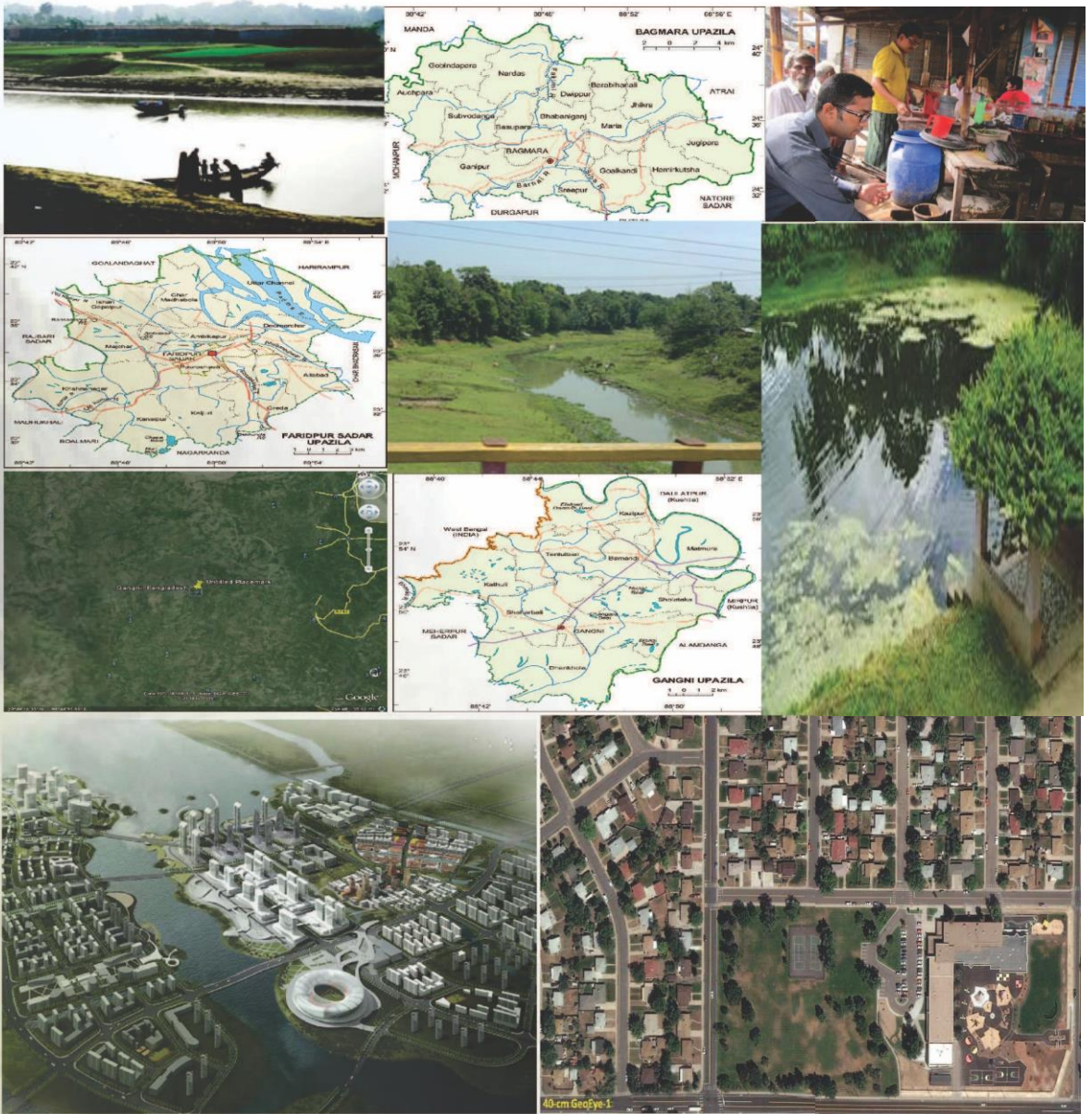
Government of the People's Republic of Bangladesh
MINISTRY OF HOUSING AND PUBLIC WORKS
 Urban Development Directorate (UDD)
 82, Segunbagicha, Dhaka-1000.

INCEPTION REPORT

For

Preparation of Development Plan for Fourteen Upazila **Package-3;**
 Bagmara Upazila , District-Rajshahi; Faridpur Sadar Upazila , District-Faridpur & Gangni
 Upazila, District- Meherpur;

October 2015



Submitted by

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Package-3;
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Faridpur & Gangni Upazila District- Meherpur.**

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Main Report

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Executive Summary

Bangladesh is a small south Asian country having high population density of 1019 persons per km² (UN Data, 2011) and rapid population growth. The urban area of Bangladesh is facing rapid horizontal expansion due to rapid population growth in all urban areas all the country. The present trend of planning practice is mostly

oriented towards planning of cities and towns in Bangladesh. This involves huge amount of financial allocation/grants every year for the development and improvement of urban facilities and utility services for only 20% of the country's population living in the urban areas. In the government's recent policy for overall administrative reorganization, the upazila has been recognized as the most significant tier of administration. So that these areas are need to be planned and developed to accommodate all social, economic, administrative, infrastructure services and service facilities for the region. The current government's intention is to reflect the national policy of bringing development administrative and service facilities to the door step of rural masses and to ensure better delivery of government services to the people. Realizing the fact and importance of formulating development plans for upazilas, Urban Development Directorate has come up with a great initiative to plan those areas. At the first phase of this initiative UDD has decided to prepare development plan for 14 upazilas all over Bangladesh into five different packages. For each package separate consultancy team has been appointed to carry out that job more fruitfully. ECAL has been selected for package-3 (covering Bagmara Upazila, Dist: Rajshahi; Faridpur Sadar Upazila, Dist: Faridpur; and Gangni Upazila, Dist: Meherpur) by project evaluation committee of UDD. The official agreement has been signed between UDD and ECAL on 10th June, 2015 in presence of high officials of UDD and witnesses from both sides. First Sign post Mobilization report was submitted by 14th June, 2015 and was approved by the TMC members at 15th June, 2015.

Bagmara, the biggest upazila of Rajshahi Zila in respect of population, came into existence in 1869 as a thana and was upgraded to upazila in 1983. The upazila occupies an area of 366.26 Sq.km. It is located between 24° 30' and 24° 41' north latitudes and between 88° 41' and 88° 58' east longitudes. The Upazila is bounded on the north by Manda Upazila and Atrai Upazila of Naogaon Zila, east by Atrai Upazila and Natore Sadar Upazila, south by Puthia Upazila and Durgapur Upazila and west by Mohanpur Upazila. Bagmara (Town) located at Bhabaniganj, stands on the bank of the river Fakinni.

Faridpur Sadar came into existence as a thana in 1894. The upazila occupies an area of 412.86 sq.km. It is located between 23° 29' and 23° 34' north latitudes and between 89° 43' and 89° 56' east longitudes. The upazila is bounded on the north by Goalanda upazila of Rajbari zilla and Shibalaya and Harirampur upazilas of Manikganj zila, on the east by Char Bhadrassan upazila, on the south by Nagarkanda and Boalmari upazilas and on the west by Madhukhali upazila and Rajbari Sadar upazila of Rajbari zila.

Gangni Upazila (meherpur district) area 341.98 sq km, located in between 23°44' and 23°52' north latitudes and in between 88°34' and 88°47' east longitudes. It is bounded by daulatpur (kushtia) upazila on the north, alamdanga and meherpur sadar upazilas on the south, Daulatpur (Kushtia), mirpur (Kushtia) and Alamdanga upazilas on the east, Meherpur Sadar upazila and west bengal state of India on the west.

Realistic planning is the first step towards optimum resource utilization. Land is the basic resource which embraces all the natural and man-made resources. The project on "Preparation of Development Plan for Fourteen Upazilas Project" is the outcome of such effort in Bangladesh which will promote well organized development and use of land to ensure a balanced economic growth and reduce misuse of limited scarce natural resources that are attached to land and environment.

The development at the upazila level can be generated only when they are linked with national development plans for proper use of resources and participation of the people. Unplanned infrastructure development and expansion will fail to achieve ultimate goals of planned development. Thus, the planning proposals will have to be tailored to the basic national strategies related to poverty alleviation, disaster management MDGs and SDGs.

This inception report has been prepared as part of the requirements set out in the Terms of Reference under the project of Preparation of Development Plan for Fourteen Upazilas. The contents of the report are the reflection on the introductory description of the project, methodology and the task with an overview of the

planning area and the activities performed during the Inception Period. The report contains the basic concepts of the planning, goals and objectives to be achieved through planning, methods of plan preparation and the output that will be generated.

The broad objective of development plan preparation of upazilas to provide guidelines for physical development based on future need and opportunities and constraints. Under this project, five tier plans namely Sub Regional Plan, Structure Plan, Urban Area Plan, Rural Area Plan and Action Area Plan will be prepared to focus on land-use, transportation and traffic management and comprehensive drainage and environment and disaster management. It will also propose multi-sectoral investment plan which will help create employment opportunities in the upazila. The plans will be developed on the basis of information and data collected from secondary sources and findings through various physical and socio-economic surveys and is produced through participation of local stakeholders. Physical survey will be conducted with the use of GPS, DGPS, RTK-GPS, Total Station and Optical Level. Cross checking, internal verification and monitoring will be ensured during the survey work.

During the Inception Period FGD, Court yard meeting and Tea Stall meeting was conducted in Bagmara Upazila under Rajshahi District and Gangni Upazila under Meherpur District and Faridpur Sadar Upazila under Faridpur District to initiate the programme where representatives of all upazilas and individual consultant and members of UDD were present and local stakeholders expressed their strong support for the preparation of Development Plan.

Utmost efforts have been made to collect basic data and primary documents during the reconnaissance survey in all the upazila under the package. Yet in spite of all efforts collection could not been made which will later be completed in a short period.

A detailed *revised work plan* has been developed to carry out the tasks under package 03 which will help smooth execution of the project.

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List of Abbreviations

AAP	:	Action Area Plan
AHP	:	Analytical Hierarchial Method
AIDS	:	acquired immune deficiency syndrome
ANNs	:	artificial neural networks (ANNs)
AQI	:	Air Quality Index
ASTM	:	American Society for Testing and Materials
BARC	:	Bangladesh Agriculture Research Center
BBS	:	Bangladesh Bureau of Staistics
BIWTA	:	Bangladesh Inland Water Transport Authority
BIWTC	:	Bangladesh Inland Water Transport Corporation
BM	:	Bench Mark
BMD	:	Bangladesh Meteorology Department
BOD	:	Biochemical oxygen demand
BRRRI	:	Bangladesh Rice Research Institute
BRTA	:	Bangladesh Road Transport Authority
BRTC	:	Bangladesh Road Transport Corporation
BTCL	:	Bangladesh Telecommunications Company Ltd
BUTM	:	Bangladesh Universal Transverse Mercator
BWDB	:	Bangladesh Water Development Board
CDA	:	Chittagong Development Authority
CF Cards	:	Compact Flash Memory Cards
COD	:	Chemical Oxygen Demand
CRS	:	coordinate reference system
CS	:	Cadastral Survey
CUS	:	Center for Urban Studies
dB	:	Decibel
DBMS	:	Data Base Management System
dDSM	:	dense DSM generation algorithm
DEM	:	Digital Elevation Model
DGPS	:	Differential Global Positioning System
DITS	:	Dhaka Integrated Transport Study
DLRS	:	Directorate of Land Record and Survey
DM&RD	:	Disaster Management and Rehabilitation Department
DMCs	:	Disaster Management Councils
DO	:	Dissolved Oxyzen
DoE	:	Department of Environment
DPHE	:	Department of Public Health Engineering
dpi	:	dots per inch
DSS	:	Decision Support Systems
DTM	:	Digital Terrain Model
ECAL	:	Engineering Consultants and Associates Ltd
ECD	:	Early Childhood Development
EIA	:	Environmental Impact Assessment
EPA-SWMM	:	Environmental Protection Agency (EPA) Storm Water Management Model (SWMM)

ESCAP	:	he United Nations Economic and Social Commission for Asia and the Pacific
ESRI	:	Environmental Systems Research Institute
FAO	:	Food and Agricultural organization
FEMA	:	United States federal Emergency Management Agency
FGD	:	Focus Group Discussion
FY	:	Fiscal Year
GAD	:	Gender and Development
GCP	:	Ground Control Point
GDB	:	Geo Database
GDP	:	Gross Domestic Production
GIS	:	Geographic Information System
GNSS	:	Global Navigation Satellite System
GOB	:	Government of Bangladesh
GPS	:	Global Positioning System
HAZUS	:	Hazard United States
HEC-HMS	:	Hydrologic Modeling System
HEC-RAS	:	Hydrologic Engineering Centers River Analysis System
HH	:	House Hold
HIV	:	human immunodeficiency virus
ID	:	Identification Number
IPM	:	Integrated Pest Management
JPEG	:	Joint Photographic Experts Group
JPG	:	Joint Photographic Group
KDA	:	Khulna Development Authority
KII	:	Key Informant Interview
LCD	:	liquid crystal display
LGED	:	Local Government Engineering Department
LGI	:	Local Government Institutions
LOC	:	Level of Service
LTM	:	Land Transformation Model (LTM)
LUCIS	:	Land-Use Conflict Identification Strategy
MADA and MODA	:	Multi-attribute and Multi-objective decision analysis,
MASW	:	Multi-channel Analysis of Surface Wave
MATCH-AT	:	MATCH- aerial triangulation
MCDA	:	Multiple Criteria Decision Analysis
MDGs	:	Millennium Development Goals
MSCAD	:	MicroSurvey CAD
MS-DOS	:	Microsoft Disk Operating System
MSIP	:	Multi-Sectoral Investment Programme
MSL	:	Mean Sea Level
NAVSTAR	:	US Navigation Satellites for Timing and Ranging
NGO	:	Non-government Organization
NIBS	:	National Institute of Building Sciences
NRR	:	Noise Reduction Rating
O-D	:	Origin-Destination
ORAQI	:	Oak Ridge Air Quality Index

PCU	:	Passenger Car Unit
PD	:	Project Director
PGA	:	Peak Ground Acceleration
PGV	:	Peak Ground Velocity
PLUD	:	participatory landuse development
PMO	:	Project Management Office
PPE	:	Personal Protective Equipment
PRA	:	Participatory Rapid Appraisal
PRSP	:	Poverty Reduction Strategy Paper
PWD	:	Public Works Department
RAJUK	:	Rajdhani Unnayan Kartripakkha
RAP	:	Rural Area Plan
RCC	:	Reinforced Concrete Cement
RDA	:	Rajshahi Development Authority
RDASPS	:	Rajshahi Development Authority Structure Plan Studies
REB	:	Rural Electrification Board
RF	:	Raduced/ Ratio Factor
RHD	:	Roads and Highway Division
RMSS	:	Road Materials and Standards Study
RS	:	Revised Survey
RTIs	:	reproductive tract infections
SAARC	:	South Asian Association for Regional Cooperation
SDGs	:	Sustainable Development Goals
SEAAP	:	Sustainable Environmental Action Area Plan
SDSS	:	Spatial Decision Support Systems
SFYP	:	Sixth Five Year Plan
SoB	:	Survey of Bangladesh
SOD	:	Standing Orders on Disaster
SPSS	:	Statistical Package for the Social Sciences
SPT	:	Standard Penetration Test
SRS	:	spatial reference system
SSMM	:	Small Scale Microtremor Measurement
STIs	:	sexually transmitted infections
SWMM	:	Storm Water Management Model
TAZs	:	Transportation Analysis Zones
TB	:	Tuberculosis
TBMs	:	Temporary Bench Marks
Tc	:	Time of Concentration
TDS	:	Total Dissolved Solid
TFR	:	Total Fertility Rate
TIN	:	Triangulated irregular network
TL	:	Team Leader
TOP	:	Technology of Participation
ToR	:	Terms of References
TS	:	Total Station
TSS	:	Total Suspended Solids

UAP : Urban Area Plan
UDD : Urban Development Directorate
UN : United Nations
UNDP : United Nations Development Programme
UNICEF : United Nations International Children's Emergency Fund
UNO : Upazila Nirbahi Officer
UTC : co-ordinates and time

CHAPTER-1

BACKGROUND OF THE STUDY

1.1 Background of the project

Bangladesh is a small south Asian country having high population density of 964 persons per km² (BBS, 2011) and rapid population growth. The urban area of Bangladesh is facing rapid horizontal expansion due to rapid population growth in all urban areas all the country. Total four large metropolitans, fiftyeight medium and more than four hundred small urban areas have one quarter of the total country population (UNICEF & CUS, 2010). Therefore it becomes an important issue to prepare Land-use Plan for the cities to manage the growth and development. After the liberation of Bangladesh, there was a little effort to prepare land-use plan. Haphazard urban growth along with poor governance made inconvenient urban life in most of the cases. In recent time, the Government of Bangladesh has been initiated preparing land-use plan for the urban areas to ensure better urban living. However, prepare appropriate land-use plan is not a simple task at all.

Need for an urban focus is urgent because it is no longer a secondary phenomenon. At its birth, Bangladesh had an urban population less than 5 million. By 1990, this had increased to 22.4 million and a decade and a half later, urban population stood at 42.3 million. At an annual growth rate of 3.7%, urban population growth in Bangladesh has been higher than all other countries in South Asia barring Nepal. A revised definition of urban has put current urban population at 23% (BBS Census, 2011) but population density per sq. km which rose to 964 in 2011 from 834 in 2001 points towards an overall urbanized reality that is larger than that indicated by the formal definition of urban area. Projections show a possible urban population of nearly 100 million (98.6) by 2030 (Table 1-1).

Table 1-1: Projected Growth in Urban and Rural Population, 1950-2030

Year	Population (millions)		Share of incremental Population (millions)		percentage of the total	
	Rural	Urban	Rural	Urban	Rural	Urban
1950	40.0	1.8	-	-	95.7	4.3
1960	48.8	2.7	8.9	0.9	94.8	5.2
1970	61.4	5.1	12.5	2.4	92.3	7.7
1980	72.7	12.7	11.3	7.6	85.1	14.9
1990	88.3	21.8	10.6	9.1	80.3	19.8
2000	103.1	34.4	14.8	12.6	75.0	25.0
2010	115.7	52.2	12.6	17.8	68.9	31.1
2020	123.2	74.4	7.5	22.2	62.3	37.7
2030	124.1	98.6	0.9	24.2	55.8	44.3

Source: Computed from UN 2002: Table 3 and 4. Cited in ESCAP 2003:25

The consequences of urbanization for a country is not a given. Both the experience of Bangladesh as well as the general global experience is that urbanization is an inevitable feature of the development process. However, beyond this very general trend, urbanization holds both promise and problems for a country and which feature will come to dominate will very much depend on the nature and efficacy of policy engagement with the urban agenda. Existing urban discourse has proceeded on fragmented premises of physical planning,

slum studies, municipal governance and migration studies while the economic dimension has been a missing focus as have been the issues of social anomie and sustainability. Compounding this fragmented discourse is a process of policy engagement that is at best sporadic and disjointed.

The present trend of planning practice is mostly oriented towards planning of cities and towns in Bangladesh. This involves huge amount of financial allocation/grants every year for the development and improvement of urban facilities and utility services for only 20% of the country's population living in the urban areas. In absence of appropriate planning guidelines regarding the planned development of small urban centers at the local and regional level, important cities specially the major divisional headquarters (such as, Dhaka, Chittagong, Khulna; Rajshahi etc.) along with other important district towns of the country are experiencing tremendous pressure of urbanization for the last one and a half decade. Moreover, the rural to urban migration which is increasing at an alarming rate in search of shelter and occupation mainly, is acting as a big threat to the planned growth of the major division cities. As a consequence, urban dwellers living in the major cities are facing problems like overpopulation, unemployment, lack of utility and services, traffic congestion. Lack of housing and recreational facilities etc. As a part of their everyday life. Ultimately the cities are becoming overcrowded and dirty. As a result air, water and noise pollution is taking a devastating shape in the urban areas of the country. Hundreds of city dwellers specially the rickshaw pullers, drivers of different vehicles, regular road users and small children are becoming prey to various diseases like- blood pressure. Headache, eye infection, heart diseases, problems in the respiratory system, various skin diseases, cancer etc. So, decentralization of the urban activities among the thana and district headquarters can be very effective in getting rid of the present trend of unplanned and haphazard urbanization in the country. Proper initiatives can also be taken to develop small townships with respect to the region's own Potentials providing necessary administrative, economic/industrial activities, health, educational, recreational, housing and infrastructural facilities within the same town boundary. These urban centers should have adequate road/rail or water transport as well as telecommunication linkage with the respective district and divisional headquarter at the same time. This kind of decentralized urbanization can help reduce rural to urban migration to a great extent encouraging local inhabitants reside in the surrounding villages and engage themselves in the economic industrial activities at the thana or district headquarter level. In addition to this, the process of urban decentralization can ensure a sustainable local development throughout the whole country; which in turn can contribute the planned and pollution free healthy growth of the existing cities and towns as well to keep the cities inhabitable and clean, need to develop planning for majority (around 80%) of the total population living in the rural areas first.

City planning authority such as RAJUK, CDA, KDA, RDA etc. made their development plan for own territory. In this course the small towns and other administrative tiers such as district, upazilas and thanas are kept behind all of these. Unfortunately most of these towns, upazilas and growth centers do not have any development plan, so that government, executing agencies, local government and people all are constantly suffers with complicity and indecision. In the government's recent policy for overall administrative reorganization, the upazila has been recognized as the most significant tier of administration. So that these areas are need to be planned and developed to accommodate all social, economic, administrative, infrastructure services and service facilities for the region. The current government's intention is to reflect the

national policy of bringing development administrative and service facilities to the door step of rural masses and to ensure better delivery of government services to the people.

Realizing the fact and importance of formulating development plans for upazilas, Urban Development Directorate has come up with a great initiative to plan those areas. At the first phase of this initiative UDD has decided to prepare development plan for 14 upazilas all over Bangladesh into five different packages. For each package separate consultancy team has been appointed to carry out that job more fruitfully. ECAL has been selected for package-3 (covering Bagmara Upazila, Dist: Rajshahi; Faridpur Sadar Upazila, Dist: Faridpur; and Gangni Upazila, Dist: Meherpur) by project evaluation committee of UDD. The official agreement has been signed between UDD and ECAL on 10th June, 2015 in presence of high officials of UDD and witnesses from both sides. Moving forward the consultant had submitted their first assignment as Mobilization Report to the client by 14th June, 2015 and on 15th June, 2015 honorable TMC members for the concerned members has approved the report on the occasion of 1st workshop or presentation on mobilization report. With respect to ToR, at this stage the consultant team is submitting Inception as their second responsibility to UDD.

1.2 Understanding the Assignment

According to the Sixth Five Year Plan (SFYP) the main goal of the government's land use policy and management is to ensure the best possible use of land resources and delivery of land related services to the people through modernized and efficient land administration for sustainable development including accelerated poverty reduction. (SFYP, p.68).

A comprehensive development plan is required to address the required land use transformation which will not allow any unauthorized and unplanned development, either in urban area or in rural area. Due to lack of such plan, it is generally found that most of the upazilas in Bangladesh have developed with least coordinated manner possessing very little development control. Measures for the adequate provision .of infrastructure, service, utility and modern amenities for maintaining a minimum standard of life, considering environment and sustainability has to be taken. Moreover, in preparing such plan, development constraints and local development potentials are to be identified clearly, and plans should be formulated addressing such development constraints and potentials of the area to make the plan practicable. In the government's recent policy of overall administrative re-organization, the upazila has been recognized as the most significant tier of the administration. It will be planned and developed to accommodate all social, economic, administrative and infrastructure services for the region.

This also reflects the national policy of bringing development, administrative and services facilities to the door step of the rural masses and to ensure better delivery of government services to the people. Initially the project area consisted of nine upazilas under Constitutional area of member of the Parliamentary Standing Committee concerning Ministry of Housing and Public works. The total Project area is 2748.37 sq.km. and total population is 2698872.

Above presents the briefly discussion on understanding of TOR

- Project Design

- Collection of Reports, Relevant Documents/Statistical Data and other Information from relevant sources
- Explanation, Discussion and Consultation with Local People/Local Leaders/ Representatives/ Communities to involve them in the Process of Plan Preparation through Participatory Rapid Appraisal (PRA). Incorporation of the knowledge and opinions of local/community people in formulating planning proposals.
- Reviewing and Updating Physical Feature Survey and Land Use Survey data using 3D Satellite Images and Field Survey.
- Prepared and make in inter linkage between all spatial data and attribute in ArcGIS
- Processing of 3D Satellite Images, Spatial analysis and Preparation of Maps/Charts/Diagram/Reports.
- Review and Analysis of Strategies, Policies, Plans and Programmes of every components of the project area
- Review and Analysis of policies and programmes of the Government/Semi- Government/ Corporation/Departments/ Institutions, NGOs and Donors Agencies.
- Detailed studies on demographic and other socio-economic forecasting, land use, land suitability for development, housing, area wise height and density zoning, transportation, flood & drainage, disaster, environment, energy, water supply, public space, growth management, legal frameworks and regulatory functions.

1.3 Objectives of Project /Assignment

A. National Development Objectives

To find out development issues and potential of the upazila and make a 20 years development vision for the upazila (both urban and rural area) and prepare a Master Plan in line with the vision for the development. Prepare plan for the people of the town to develop and update provisions for better transport network, housing, infrastructures for roads, markets, bus terminals, sanitation, water supply, drainage, solid waste management, electricity, education, leisure and such other infrastructure facilities for meeting the social and community needs of the poor and the disadvantaged groups for better quality of life and at the same time ensure the development of rural area within the project area;

- Prepare a multi-sector short and long term investment plan through participatory process for better living standards by identifying area based priority-drainage master plan, transportation and traffic management plan, other specific plan need as per requirement in accordance with the principle of sustainability;
- Provide controls for private sector development, clarity and security with regard to future development;
- Provide guide line for development considering the opportunity and constrains of future development of Upazilla Town and Rural area.
- Prepare 20 years Development Plan to be used as a tool to ensure and promote growth of the city in line with the guiding principles of the Master Plan and control any unplanned growth by any private and public organization.

- Facilitating the Urban Growth to protect the valuable farmland and at the same time provide space and facilities for non-agricultural activities.
- Provision of standards for use by public bodies.
- Supporting the livelihood of the inhabitants of Bagmara, Faridpur Sadar and Gangni Upazila.
- Protecting the Eco-system with the understanding that we are a component of the system rather than the consumer of the system.
- Discouraging the involuntary displacement of the inhabitants in the name of development.
- Control of undesired development in all areas for which plans have been prepared.

B. Immediate Objectives

Following immediate objectives should have to be performed by the consultants for achieving the National Development Objectives:

Objective 1: Determination of Present and Future Function of the Upazila

Preparation of Sub Regional Plan, Structure Plan, Urban Area Plan, Rural Area Plan and Action Area Plan (AAP) are to be based on land use survey, topographical survey, environmental, disasters/hazards and agricultural studies. The major studies relating to Traffic & Transportation, Drainage & Environmental, Formal and Informal Economic Studies, Slums and Squatters, Unauthorized Encroachment, Recreational Facilities and Stakeholders Participation for planning and development control.

Objective 2: Mechanism for Improving and Guiding Development

The mechanisms for improving and guiding development are:

- ✓ Preparation of five tier Development Plan namely: Sub Regional Plan, Structure Plan, Urban Area Plan, Rural Area Plan and Action Area Plan.
- ✓ Development of mechanism for stakeholders, especially communities, control over all development initiatives.
- ✓ Preparation of a set of Institutional and Legislative Restructuring Proposals.
- ✓ Selection of appropriate standards and guidelines for improving present conditions and guiding future development.

Objective 3: Review of Existing Problems and Propose initiatives

Review of existing problems and proposed initiatives are as stated below

- ✓ Detailed analysis of problems presently hampering development, which can be eliminated by action in the short term.
- ✓ Development of sectoral programs to alleviate poverty problems
- ✓ Prepare a minimum number of action area plans for early area development or area upgrading of parts of the town that exhibits a representative cross section of development problems.
- ✓ Undertake initiative at town level to promote sustainable economic activity by formal private sector and individuals, groups, GOB and NGOs.

Objective 4: Formulation of Bankable Projects

The factors for formulation of bankable projects areas mentioned below:

- ✓ To determine methodology for identifying Multi-sectoral Investment Projects (MSIP) with their major priorities.
- ✓ Prepare a multi-sector investment plan through participatory process for better living standards by identifying areas based priority-Drainage Master Plan, Transportation and Traffic Management Plan and other specific plan as per requirement.
- ✓ Providing controls for private sector development and clarity and security with regard to future development for inhabitants and investors. The targeted objective and guideline of the development projects would be to initiate and implement through participation.
- ✓ To identify a range of projects suitable in both sectoral and spatial terms.
- ✓ To develop a package for the priority to a level suitable for financial appraisal.

Objective 5: Increasing Capacity/formulation of Local Authorities for Urban and Rural Management and Development

The factors to be considered in regard to increasing the capacity/formulation of local authorities for urban management and development are:

- ✓ To prepare a detailed analysis of the past budgets, their expenditure, liabilities and sources of funds of Pourashava, Upazila Prishad and Union Parishad.
- ✓ Providing Land use maps and information at Mouza dag level (parcel) as a professional manner for efficient updating, exchange, dissemination and decision support use.
- ✓ To prepare practical and detail proposal for increasing the income of the local authorities with reference to any forthcoming donors proposal to assist financial management and paying particular attention to the possibilities of increasing revenue from existing and proposed development activities.
- ✓ Providing guideline for development considering the Opportunity and Constraints of future development. Moreover for the betterment of the community, action would be taken through government, public private partnership, privately owned and non-government initiatives as indicated in Action Area Plan (AAP).
- ✓ To prepare proposal for rationalizing the roles and divisions of responsibilities between Upazila and other development agencies.
- ✓ To prepare priority list of projects which can be funded from local resources and examine any new forms of funding for such developments.
- ✓ To assist Upazila, Pourashava and Unions in drawing up schemes within the framework of Strategic Plan and Action Plans for inclusion in Development Programs.
- ✓ To strengthen the technical capabilities of local authorities involved in urban management and development.
- ✓ Providing Planned Development to ensure Sustainable Environment Action Area Plan (SEAAP) should be undertaken with the cooperation of other development agencies. So all the agencies

should cooperate, coordinate and participate in the process of preparation of Master Plan for proper planning and development. The Plan would be the guiding document for implementation by all concern. GIS based data; map and information would be the resource which could be easily updated and when necessary.

1.4 Understanding of the Scope of Services

The scope of Consultancy Services encompasses for Preparation of four tiers Development Plan (five key plans) for three Upazilas, which includes Sub Regional Plan, Structure Plan, Urban Area Plan, Rural Area Plan and Action Area Plan. The study will cover surveys of physical features and preparation of Land use Plan, Traffic and Transportation Management Plan, Drainage and Environmental Plan and Action Plans for the project area.

Considering the above scope of services and to prepare an efficient Development Plan for Bagmara, Faridpur Sadar and Gangni Upazila, the specific tasks to be performed by the consultant in realization of the scope of services as spelled out in the ToR are given below in brief:

- ✓ Determination of study area based on suitable physical boundary.
- ✓ Explanation of the plan (report) indicating population, density, livelihood and its future plan.
- ✓ Collection of socio-economic and demographic information and data both from primary and secondary sources in the study context to forecast future population, requirement of different services, physical and social infrastructure facilities, employment generation.
- ✓ Identify the exiting natural and man-made drains in the town and investigating the mechanisms of the drainage and local river system to assess the extent and frequency of flood damage and determine areas where flooding or poor drainage is most severe.
- ✓ Preparing a conceptual report on the various alternative solutions to the present storm water problems and selecting the most appropriate and economical alternatives.
- ✓ Prepare a Development Plan of the storm water drainage & sewerage system treatment plant for all areas in the town, which will include discharge calculations for the catchment areas, design of main and secondary drains/sewerage including their sizes, types and gradients and retention areas with preliminary cost estimates for the proposed drainage/sewerage system.
- ✓ Prepare a conceptual plan to show the phase-wise implementation schedule in an affordable and practical manner considering the technical, environment, institutional, economic and social feasibility of the proposed works.
- ✓ Proposal for preparation of hydraulic and structural designs for the priority areas of the study area and preparing a first phase implementation program.
- ✓ Study of the existing drainage maintenance procedures and budgets, if any including solid waste collection and design and estimate costs for a planned maintenance system to ensure that the drains are kept free from blockages and physical damage.
- ✓ Recommend planning, institutional and legal mechanisms to ensure provision of adequate land for rights of way for storm water drainage, which will also determine illegal encroachments.

-
- ✓ Investigate methods to find the other phases of the storm water drainages & Sewerage master plan.
 - ✓ Assess additional data requirements, critical additional data, not currently available should be collected through reconnaissance and traffic surveys which should estimate present traffic volume and forecast the future traffic growth and identify travel patterns, areas of traffic, conflicts and their underlying causes.
 - ✓ Study the viability of different solutions and develop a practical short term traffic management scheme of implementation, including one way systems, restricted access for large vehicles, improved signal system traffic islands, roundabout, pedestrian crossings, deceleration lanes for turning traffic, suitable turning radius, parking policies and separation of pedestrians and rickshaws.
 - ✓ Assess the current land use with regard to transportation, bus and truck terminals, stations, railway stations etc. and recommend actions to optimize this land use.
 - ✓ Assess existing plot information.
 - ✓ Prepare a Long Term traffic and Transportation Plan.
 - ✓ The Development Plan shall assess major investments and activities of the various development agencies/Ministries and indicate the stages of development preferably through 5 year programming approach. Consultants shall be making to liaison with all government and semi-government and other agencies concerned with their development at the Study area.
 - ✓ Contract should also be made with the headquarters of such agencies and full details of such plans should be referenced in the plan.
 - ✓ Survey and evaluate Land Capabilities considering factors such as flood basin, topography, fertility etc.
 - ✓ The Development/Master Plan Package shall indicate/outline possible frameworks/strategy for management and development control, institutional arrangement ensuring people's participation etc. for effective implementation of the plan.
 - ✓ Development of Proposal of By-laws for Land Development, Real Estate Development. Urban Plan Development control and Natural Resources/Green belt and places of historical interest.
 - ✓ In line with the Master Plan, propose a Detailed Area Plan with a list of priority schemes for the development of roads, drains, traffic management and other social infrastructure for implementation during the first five years of plan period.
 - ✓ Facilitate City Authority, Union Parishad about the publicity of Development Plan, its preparation strategy, function and their role through making, leaflet, newspapers, cable line, FGD etc.
 - ✓ Allocating zones for as high, middle and low density areas.
 - ✓ Guidelines for control/promote industries at different locations according to their nature such as heavy industrial, light industrial and service industries including waste disposal / treatment plants.
 - ✓ Guidelines for controlling/guiding location of commercial use.
 - ✓ To identify the areas reserved for agriculture, flood flow, public / private open spaces, parks, playgrounds, play-lots and other recreational uses like green belts, retention pond, water bodies, water front, natural reservoirs, historical monuments.
 - ✓ Action Area Plan will cover all related issues to bring about expected result.

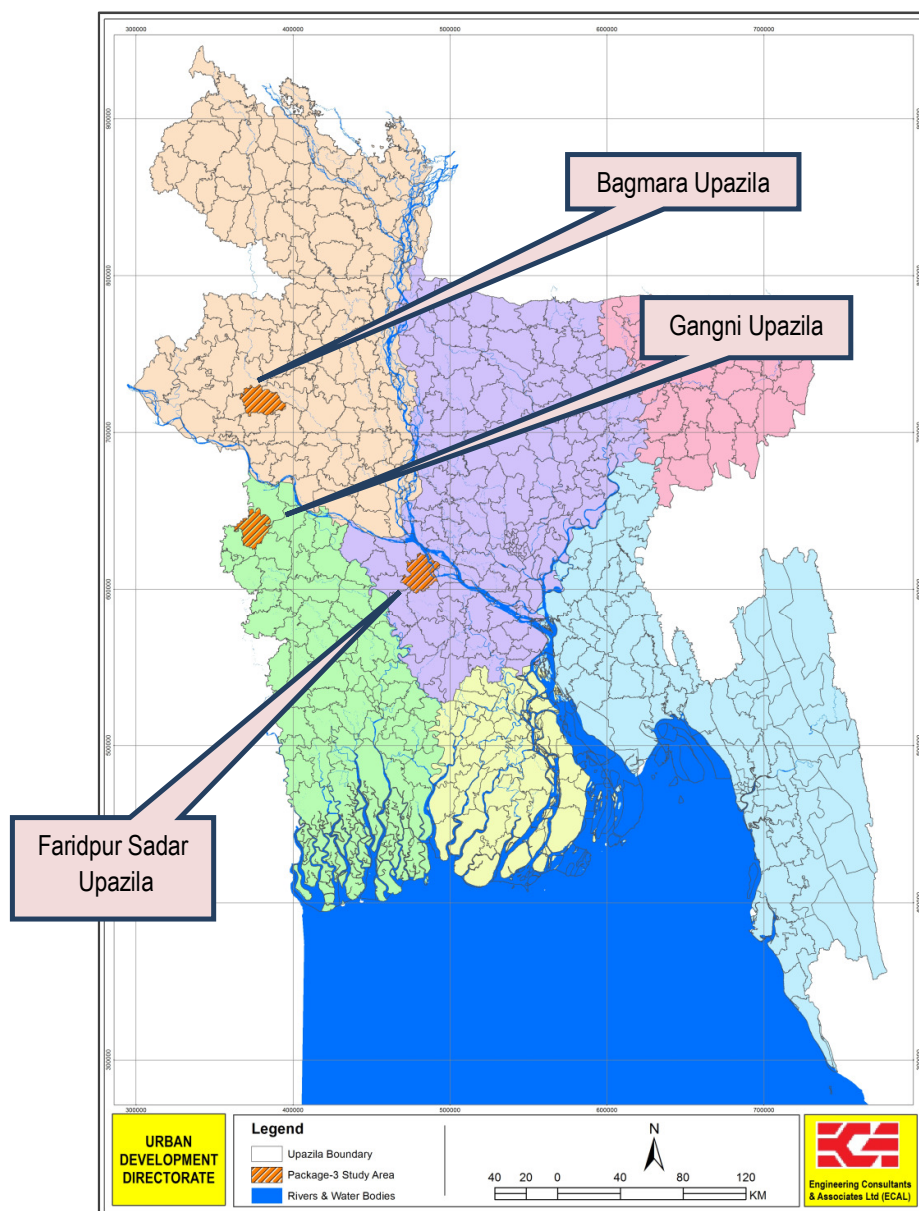
- ✓ Allocating the zones where public utilities, institutions and civic services will be established. Moreover zones of urban deferred areas, for future development expanded areas and areas for new development have to be considered.
- ✓ To ensure planning principles/standards, gross/net densities, guideline for future development and development control.
- ✓ To exercise control over architectural features, elevations, frontage of buildings and structures including zoning regulations to regulate locations, preservation of heritage, and type of buildings within each zone.
- ✓ Earthquake hazard, vulnerability, risk and loss assessment for project area.
- ✓ Development of scenario based spatial earthquake contingency plan for project area.
- ✓ Prepare and submit Development Plan and Report with required standards as specified in the TOR.

1.5 Scope of Work in the Inception Period

Planned development of settlement areas is a prerequisite for proper utilization of natural resources. Bangladesh being a densely populated area with limited land and natural resources needs to value conservation of resources and guided use of them for infrastructure development as technological and financial capability restricts the country to adopt expensive plans. On the other hand, dependence on foreign assistance limits the scope of development to a great extent. The scope of work under this inception report will cover all methodology of survey techniques of all aspects related to the preparation of development plan of Bagmara, Faridpur Sadar and Gangni Upazila. An assessment of the actual provision of inputs in relation to the expected outputs. Analysis and findings from reconnaissance survey including problems and possible solutions to the survey activities and prospects of development. This also include results of tea stall meeting, courtyard meeting and focus group discussion (FGD) in the project area. Review of all relevant reports, documents and other materials, which items are already acquired and those requiring official assistance for acquisition. An assessment of all additional data collected and survey works to be carried out for completion of the database. Development of methodology for each component of the structure plan. The above mention subjects are the scope of work in this inception report.

1.6 Project Area Profile

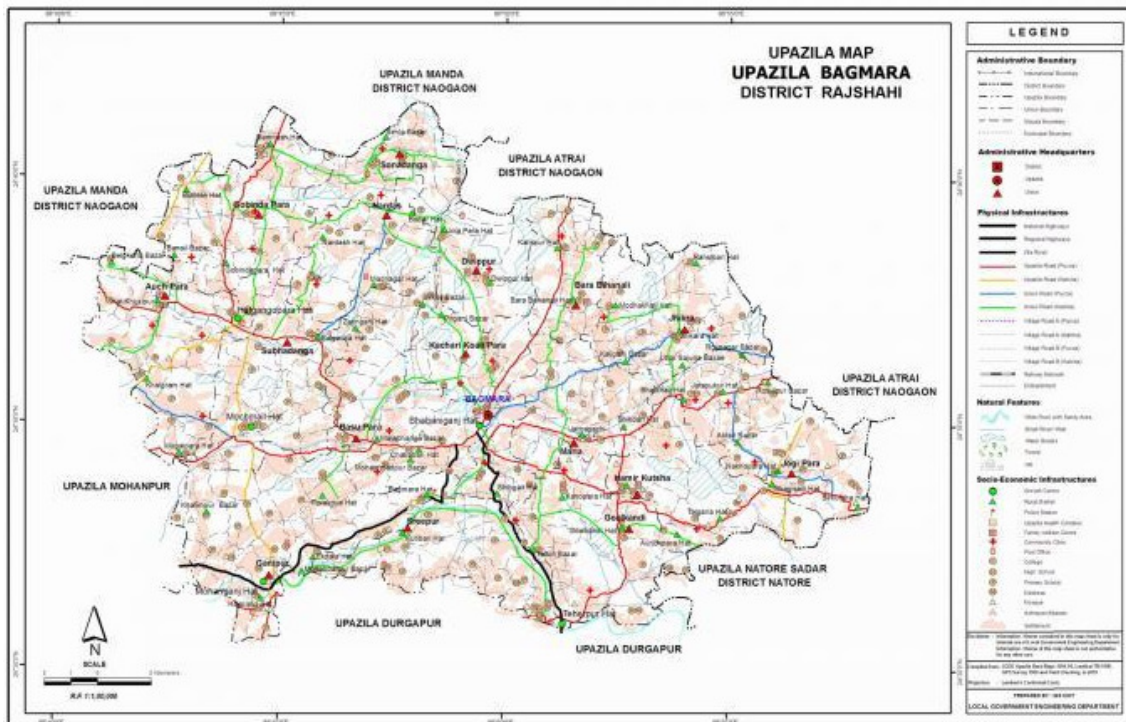
Preparation of development plan for fourteen upazila project- package 3 covers three upazila as Bagmara, dist: Rajshahi; Faridpur Sadar, Dist: Faridpur and Gangni, Dist: Meherpur. Geographical location for these areas are shown in **Map 1-1**. This chapter will mainly describes all the social, geographical, demographic, geological, administrative, landuse, hydrological and so on information of these study areas which will pave the base line profile information. To maintain the sequence all three upazilas information are discussed one by one.



Map 1-1: Project Area Locations with respect to Bangladesh

1.6.1 Bagmara Upazila, Rajshahi

Bagmara, the biggest upazila of Rajshahi Zila in respect of population, came into existence in 1869 as a thana and was upgraded to upazila in 1983. The upazila occupies an area of 363.3 Sq.km. It is located between 24° 30' and 24° 41' north latitudes and between 88° 41' and 88° 58' east longitudes. The Upazila is bounded on the north by Manda Upazila and Atrai Upazila of Naogaon Zila, east by Atrai Upazila and Natore Sadar Upazila, south by Puthia Upazila and Durgapur Upazila and west by Mohanpur Upazila. Bagmara (Town) located at Bhabaniganj, stands on the bank of the river Fakinni. The following **Map 1-2** shows the geographic location of Bagmara Upazila.



Map 1-2: Geographic Location of Bagmara Upazila

Administrative/Geographic Unit

The upazila consists of 2 paurashavas, 18 wards, 40 mahallas, 16 unions, 273 populated mauzas and 332 villages. The average size of population of each ward and mahalla are 1994 and 897 respectively. On the other hand, the average size of population of each union, mauza and village are 19923, 1168 and 960 respectively.

Housing and Household Characteristics

In the upazila, there are 94050 households. Distribution of household by type shows that there are 99.91% general unit, 0.02% institutional and 0.07% other unit. The average household size (General) for the upazila is 3.8 persons, for rural area the size is slightly lower i.e. 3.7 and for urban area the size is slightly higher i.e. 4.0. Type of Housing Structure: In the upazila, 3.8% general households live in pucca house, 29.3% in semi-pucca house, 66.0% in kutch house and the remaining 0.9% live in *jhupri*.

Source of Drinking Water

In Bagmara Upazila, 91.4% general households get the facility of drinking water from tube-well, 3.0% from tap and the remaining 5.6% household get water from other sources.

Sanitation

In the Bagmara Upazila, 57.1% general households use sanitary latrine, 36.0% non-sanitary latrine and the remaining 6.9% have no toilet facility. Sanitation 16.24% (rural 16.28% and urban 15.85%) of dwelling households of the upazila use sanitary latrines and 44.22% (rural 42.72% and urban 56.78%) of dwelling households use non-sanitary latrines; 39.55% of households do not have latrine facilities.

Access to Electricity

All the 16 unions of the upazila have brought under the Rural Electrification Program. However, a total of 41.6% general households reported to have electricity connection in the entire upazila in 2011 as against 15.8% in 2001.

Population Characteristics

According to Population and Housing Census 2011, the total population of the upazila is 354664 of which 177157 are males and 177507 are females. The sex ratio of the upazila is 100 in 2011 as against 104 in 2001.

Table 1-2 shows the population distribution of Bagmara Upazila.

Table 1-2: Population Distribution at Different Administrative Tier in Bagmara Upazila

Upazila								
Municipality	Union	Mouza	Village	Population		Density (per sq km)	Literacy rate (%)	
				Urban	Rural		Urban	Rural
2	16	292	332	34632	285336	881	44.30	38.31
Bhawaniganj Municipality								
Area (sq km)	Ward	Mahalla	Population		Density (per sq km)	Literacy rate (%)		
13.34	9	23	15714		1178	Ñ		
Taherpur Municipality								
Area (sq km)	Ward	Mahalla	Population		Density (per sq km)	Literacy rate (%)		
10.84	9	18	16826		1552	60.83		
Upazila Town								
Area (sq km)	Mouza	Population		Density (per sq km)	Literacy rate (%)			
2.40	1	2092		872	49.83			

Source: BBS, 2011

Literacy and Education

In Baghmara Upazila, it is found that 46.3% population aged 7 years and over are literate. Literacy rates by sex of three consecutive censuses are shown in **Table 1-3**.

Table 1-3: Literacy Rate by Sex, 1991-2011

Item	1991	2001	2011
BothSex	22.9	39.0	46.3
Male	32.5	47.0	52.2
Female	13.3	30.8	40.5

Source: BBS, 2011

Water bodies Main River

Baranai; Fakinni river, Beel Joshoi, Takta Beel, Mosher Beel, Nakkati Beel, Katila Beel and Bagir Dara (water channel), Talgharia Dara and Komorpur Dara are notable.

Educational institutions

College 35, technical education institute 2, secondary school 120, primary school 210, madrasa 80. Noted educational institutions: Taherpur Degree College, Pania Nardas College, Bhawaniganj College, Machmail College, Mohanganj College, Bir-kutsha Abinash High School (1917), Hat Ganga Para High School (1925).

Main Sources of Income

Agriculture 76.76%, non-agricultural labourer 1.97%, industry 0.05%, commerce 9.35%, transport and communication 2.55%, service 3.33%, construction 0.63%, religious service 0.08%, rent and remittance 0.09% and others 4.72%.

Ownership of Agricultural Land

Landowner 69.88%, landless 30.12%; agricultural landowner: urban 59.29% and rural 71.14%.

Main crops

Paddy, wheat, potato, corn, mustard, sesame, betel leaf, vegetables. Extinct or nearly extinct crops Barley, kaun, jute, linseed, masuri, gram, khesari.

Main Fruits: Mango, banana, jackfruit, litchi, papaya, guava, plum.

Fisheries, dairies and poultries: Poultry 20, dairy 45, hatchery 11.

Communication Facilities

Pucca road 127 km, mud road 406 km. Extinct or nearly extinct traditional transport Palanquin, bullock cart and horse carriage.

Industries

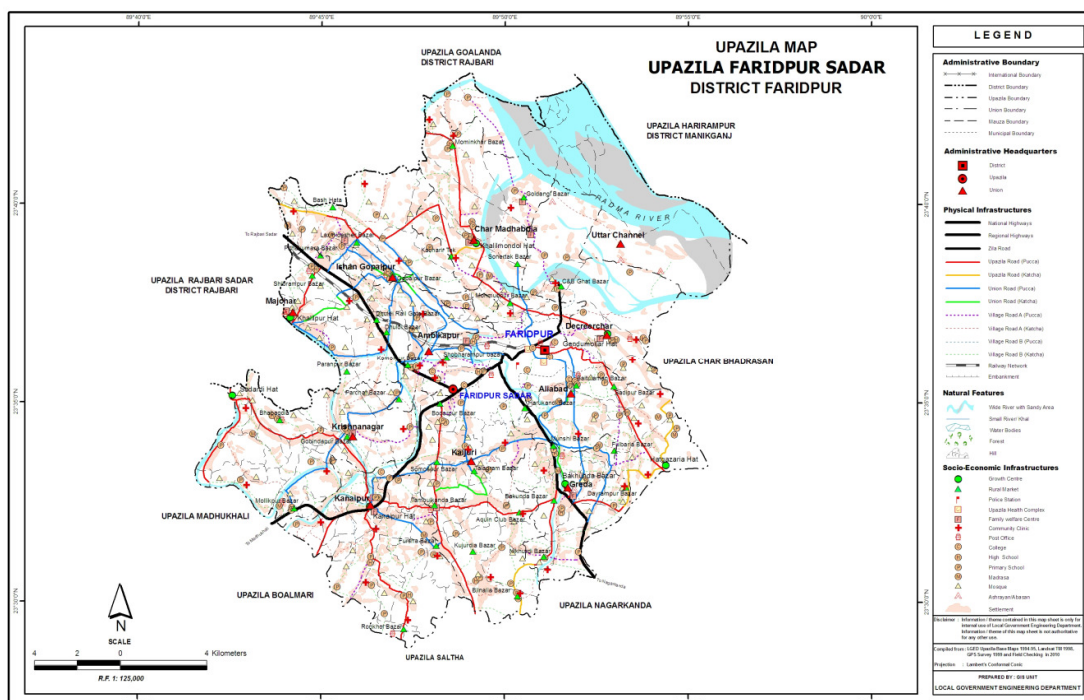
Noted manufactories Ice factory 15, welding 20, cold-storage 4. Cottage industries Blacksmith 80, potteries 140, weaving 15, bamboo work 230, cane work 76.

Markets and Bazars

Hats, bazars and fairs Hats and bazars are 30, fairs 5, most noted of which are Taherpur, Bhawaniganj, Mohanganj, Madariganj, Machmail, Gangopara, Barahat, Hamir Kutsha, Akdala, Nardas, Damnash, Shikdari hats and Dekhaltala Mela.

1.6.2 Faridpur Sadar Upazila, Faridpur

Faridpur Sadar came into existence as a thana in 1894. The upazila occupies an area of 407.02 sq.km. It is located between 23° 29' and 23° 34' north latitudes and between 89° 43' and 89° 56' east longitudes. The upazila is bounded on the north by Goalanda upazila of Rajbari zilla and Shibalaya and Harirampur upazilas of Manikganj zila, on the east by Char Bhadrassan upazila, on the south by Nagarkanda and Boalmari upazilas and on the west by Madhukhali upazila and Rajbari Sadar upazila of Rajbari zila. The following **Map 1-3** shows the geographic location of Faridpur Sadar Upazila.



Map 1-3: Geographic Location of Faridpur Sadar Upazila

Local Administration

Administration Faridpur Sadar Thana was formed in 1896 and it was turned into an upazila in 1983. The following **Table 1-4** shows the different administrative units located within Faridpur Sadar Upazila.

Table 1-4 :Administrative Information of Faridpur Sadar Upazila

Items	Zila		Upazila	
	2011	2001	2011	2001
Upazila/Thana	9	8	-	-
Union	79	79	11	11
Mauza	997	1,038	150	157
Village	1,899	1,860	342	332
Paurashava	4	4	1	1
Paura Ward	36	36	9	9
Paura Mahalla	100	94	41	35

Source: BBS, 2011

Population

Total 413485; male 213765, female 199720; Muslim 367829, Hindu 44615, Buddhist 967, Christian 31 and others 43. The following Table 1-5 shows the demographic Information of Faridpur Sadar Upazila.

Table 1-5: Population Distribution at Different Administrative Tier in Faridpur Sadar Upazila

Upazila								
Municipality	Union	Mouza	Village	Population		Density (per sq km)	Literacy rate (%)	
				Urban	Rural		Urban	Rural
1	11	157	332	101084	312401	1016	73.3	41.6
Municipality								
Area (sq km)	Ward	Mahalla	Population	Density (per sq km)	Literacy rate (%)			
22.65	9	35	99945	4413	73.6			
Upazila Town								
Area (sq km)	Mouza	Population	Density (per sq km)	Literacy rate (%)				
0.80	2	1139	1424	49.2				

Source: BBS, 2011

Water Bodies

Main rivers: padma, Kumar, Old Kumar, Bhubaneshwar; Chapa Beel, Hari Beel, Shakuner Beel, Dhol Samudra, Kole (a strip of shallow water) of Beel Mamunpur and Tapa Kholar Lake (excavated) are notable.

Literacy Rate

Average literacy 49.7%; male 53.7%, female 45.4%.

Educational Institutions

Medical college 1, law college 1, homeopathic college 1, teachers' training college 1, technical and vocational college 1, primary teachers' training institute 1, college 13, open university 1, secondary school 40, primary school 148, satellite school 13, community school 14, orphanage 3, madrasa 39. Noted educational

institutions: Faridpur Medical College (1992), Government Rajendra College (1918), Faridpur High School (1889), Hitoishi High School (1889), Ishan Girls' High School (1908), Shiva Ram RD Academy (1917), Faridpur Government Girls' High School (1918), Moiez Uddin High School (1926), Adarsha Girls' High School (1927), Faridpur Zila School (1840).

Main Sources of Income

Agriculture 39.72%, non-agricultural labourer 4.03%, industry 1.65%, commerce 17.49%, transport and communication 9.19%, service 14.23%, construction 3.68%, religious service 0.15%, rent and remittance 1.41% and others 8.45%.

Ownership of Agricultural Land

Landowner 77.77%, landless 22.23%; agricultural landowner: urban 72.28% and rural 77.95%.

Main Crops

Paddy, jute, wheat, potato, sugarcane, onion, garlic, turmeric, pulse, vegetables. Extinct or nearly extinct crops Kaun, kusum phul, sesame, sonamuk, china, barley, arahar, sweet potato.

Main fruits Mango, jackfruit, litchi, banana, papaya, coconut.

Fisheries, Dairies And Poultryes: Fishery 22, dairy 109, poultry 32, hatchery 3.'

Communication Facilities

Pucca road 223 km, semi-pucca road 120 km, mud road 408 km; railway 25 km; waterway 40.50 nautical miles; bridge 70, culvert 90. Extinct or nearly extinct traditional transport Palanquin, bullock cart, buffalo cart.

Industries

Jute mill, textile mill, rice mill, flour mill, pulse mill, ice cream factory.

Cottage Industries: Goldsmith, blacksmith, potteries, wood work, bamboo work, cane work.

Markets and Baazars

Hats, bazars and fairs Hats and bazars are 37, fairs 6, most noted of which are Kanaipur, Tepakhola, Mominkha, Gendu Mollar, Gajaria, Tambulkhana, Bakhunda and Khalilpur hats; Angina, Chawdhury Bari, Jasim Palli and Akpara melas.

Main Exports: Jute, onion, garlic, sugarcane molasses, pulse, vegetables, turmeric.

Access to Electricity

All the wards and unions of the upazila are under rural electrification net-work. However 35.41% (urban 79.96% and rural 22.12%) of the dwellings have access to electricity.'

Sources of Drinking Water

Tube-well 93.51%, tap 3.91%, pond 0.16% and others 2.42%.

Sanitation

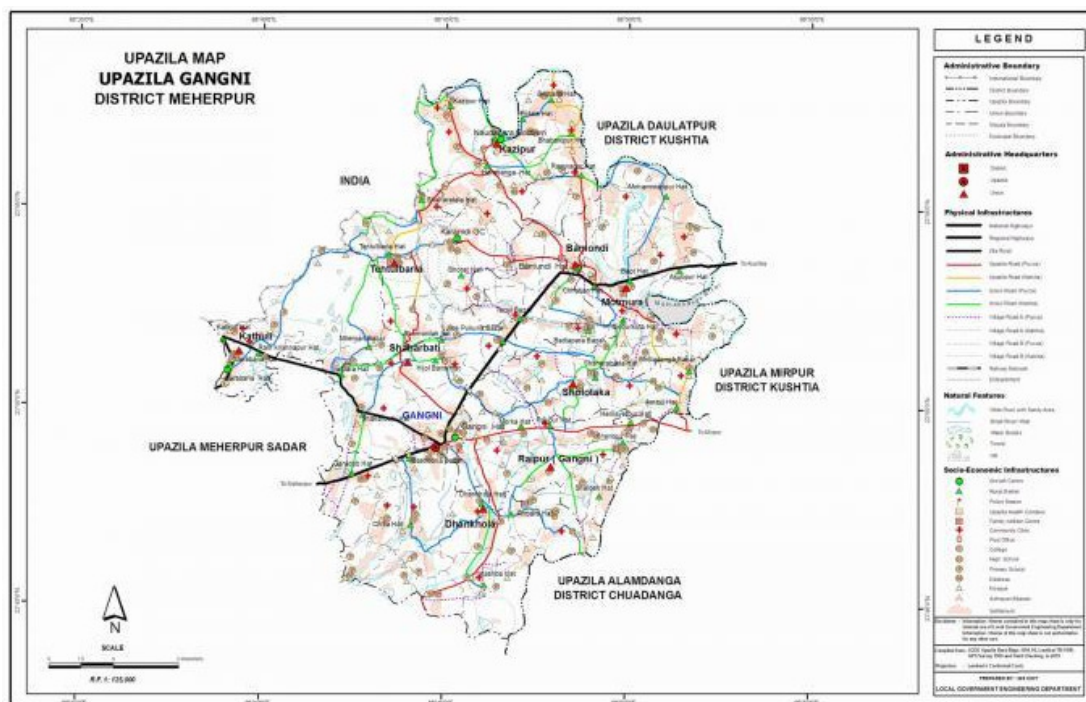
55.95% (urban 89.37% and rural 45.98%) of dwelling households of the upazila use sanitary latrines and 39.02% (urban 9.22% and rural 47.91%) of dwelling households use non-sanitary latrines; 5.03% (urban 1.41% and rural 6.10%) of households do not have latrine facilities.

Natural Disasters

The cyclone, originated from the eastern region of meghna, of 9-10 and 30-31 October 1960 caused huge damages to settlements, livestock and crops of the upazila. The eastern part of the upazila is under constant threat due to river erosion.

1.6.3 Gangni Upazila, Meherpur

Gangni Upazila (meherpur district) area 341.98 sq km, located in between 23°44' and 23°52' north latitudes and in between 88°34' and 88°47' east longitudes. It is bounded by daulatpur (kushtia) upazila on the north, alamdanga and meherpur sadar upazilas on the south, Daulatpur (Kushtia), mirpur (Kushtia) and Alamdanga upazilas on the east, Meherpur Sadar upazila and west bengal state of India on the west. The following **Map 1-4** shows the geographic location of Gangni Upazila.



Map 1-4: Geographic Location of Gangni Upazila

Administration and Population

Administration Gangni Thana was formed in 1923 and it was turned into an upazila on 24 February 1984. Population Total 269085; male 137921, female 131164; Muslim 264976, Hindu 2239, Buddhist 1677 and others 193. Demographic and administrative information of Gangni Upazila are shown in **Table 1-6**.

Table 1-6: Demographic and Administrative Information of Faridpur Sadar Upazila

Upazila								
Municipality	Union	Mouza	Village	Population		Density (per sq km)	Literacy rate (%)	
				Urban	Rural		Urban	Rural
1	9	103	143	23846	245239	787	50.00	35.1
Municipality								
Area (sq km)	Ward	Mahalla	Population		Density (per sq km)	Literacy rate (%)		
12.17	9	13	20780		1707.47	48.94		
Upazila Town								
Area (sq km)	Mouza	Population		Density (per sq km)	Literacy rate (%)			
22.86	5	23846		1043	50.00			

Source: BBS, 2011

Annual Average Temperature

Maximum 37.1°C and lowest 11.2°C; annual rainfall 1467 mm.

Water bodies Main Rivers

Bhairab, Ichamati, Mathabhanga and Kazla; Elangi Beel, Nuner Beel and Elagari Damash Beel are notable.

Archaeological heritage and relics: Shaharbari Neelkuthi (1859), Gosaidubi Mosque at Karamdi.

Literacy Rate

Average literacy 36.5%; male 38.7%, female 34.1%.

Educational Institutions

College 9, secondary school 68, primary school 164, kindergarten 14, community school 4, madrasa 9. Noted educational institutions: Gangni Degree College (1983), Gangni Mohila College (1995), Hoglabaria Mohammadpur Hazi Bharasuddin Secondary School (1945), Gangni Secondary School (1945).

Main Sources of Income

Agriculture 70%, non-agricultural labourer 2.83%, industry 0.96%, commerce 13.38%, transport and communication 1.90%, service 3.13%, construction 1.03%, religious service 0.13%, rent and remittance 0.59% and others 6.05%.

Ownership of Agricultural Land

Landowner 57.82%, landless 42.18%; agricultural landowner: urban 59.02% and rural 57.71%.

Main Crops

Paddy, jute, wheat, tobacco, maize, vegetables. Extinct or nearly extinct crops Indigo, arahar, khesari pulse.

Main fruits Mango, jackfruit, litchi.

Fisheries, Dairies and Poultryes: This Upazila has a number of fisheries, dairies, poultryes and hatcheries.'

Communication Facilities

Pucca road 223.59 km, mud road 467.25 km. Extinct or nearly extinct traditional transport Palanquin, bullock cart, horse carriage.

Factories and Industries

Flour mill, jute mill, ice factory.

Cottage industries: Weaving, blacksmith, potteries, bamboo work, wood work, nakshi kantha.

Main Exports: Tobacco, paddy, jute, wheat.

Market and Baazar

Hats, bazars and fairs Hats and bazars are 20, fair 1, most noted of which are Garabari Hat, Tentulbaria Hat, Karamdi Hat, Kazipur Hat, Betbaria Hat, Naodapara Hat and Baishakhi Mela.

Access to Electricity

All the wards and unions of the upazila are under rural electrification net-work. However 26.27% of the dwellings have access to electricity.'

Sources of Drinking Water

Tube-well 92.72%, tap 1%, pond 0.16% and others 6.12%. The presence of arsenic has been detected in 12.02% out of the 31965 shallow tube-wells of the upazila.

Sanitation

17.19% (rural 15.98% and urban 30.10%) of dwelling households of Gangni Upazila use sanitary latrines and 45.49% (rural 44.76% and urban 53.30%) of dwelling households use non-sanitary latrines; 37.32% of households do not have latrine facilities.

CHAPTER-2

APPROACH AND METHODOLOGY

2.1 Methodology of Field Survey & Plan Preparation

A comprehensive methodology as per the study procedures shortly given in the ToR will be followed in detailed form to accomplish the proposed evaluation. The methodology includes: a) Data gathering from the concerned government officials, development partners, civil society and others with a carefully formulated instrument/format; b) Collection of all relevant documents, reports, recent studies to get relevant information; c) Assessing the indicators of the progress with qualitative and quantitative methods; d) Study reports of the sample sectors, if any; e) Cross cutting issues across the sectors receiving aids; f) Data validity through cross check and counter check at the operational level; and g) others.

Furthermore the detailed work plan will present the effective and detailed works of the project. It is mentioned that the activities of methodology somehow may overlap the activities of the detailed work plan.

2.2 Review of National Development Plan and Policies

2.1.1 Introduction

Bangladesh's planning model is dominated by a central planning system where the central governments set out relevant plans and policies and implement the goal and objectives of those on sectoral basis. Either a central government body or a local institution of a particular sector under a central ministry initiates the planning process with directives from that higher authority. It can be mentioned here that both the orientation and the process of development planning have been entirely top-down approach. However, this type of plan decision making system is to be followed in undertaking even any planning initiatives at the smaller urban centre levels.

In recent times there appears to be some understanding at the national levels about the importance of physical planning which has been voiced in various national development plans and policies viz. Plans - the Five Year Plans, later Poverty Reduction Strategy Paper (PRSP), Vision 2021, Millennium Development Goals (MDGs); and Policies – land use policy, agriculture policy, water policy, environmental policy, industrial policy, health policy, education policy, disaster policy, transport policy, etc. These documents would be of paramount importance in the process of preparing development plans for Bagmara, Faridpur Sadar and Gangni Upazilas. It is vitally needed to consider the spatial aspects of these national plans' and policies' goal and objectives so that these are harmonized as well as reflected in the Strategy Plans, the Structure Plans, the Urban Area Plans and the Detailed Area Plans of the above mentioned Upazilas in the context of respective local circumstances.

In these sections, the consultants will carefully consult the penitent national plans and policies which will eventually guide in preparing appropriate development plans for the Bagmara Upazila, Faridpur Sadar Upazila and Gangni Upazila in line with the ToR of the consultancy services.

2.1.2 National Development Plans and Strategies

The following national development plans and strategies will be studied here so as to obtain some guidelines and pertinent information in the preparing the subject development plan highlighting the spatial aspects and identification of inter-linkages and relevancy with the subject plans making processes:

2.1.2.1 Development Goals of Bangladesh: Vision 2021

A nation without vision is meaningless. In the case of Bangladesh whose independence in 1971 was the culmination of a people's struggle to attain political freedom as well as their economic emancipation. In keeping with those aspirations, the Government's Vision 2021 is an articulation of where this nation needs to be in 2021 – the year which marks the 50th anniversary of Bangladesh's independence. That milestone, ten years away from 2011, will be a high point in Bangladesh's war against chronic poverty and the struggle to attain middle income country status, from its beginning as a low income country. This "Perspective Plan of Bangladesh (2010-2021): Making Vision 2021 a Reality" is a strategic articulation of the development vision, mission, and goals of the Government in achieving a prosperous Bangladesh grounded in political and economic freedoms a reality in 2021.

It is estimated that by the year 2021 nearly one-third or 33% of the population of Bangladesh will be living in urban areas. The urban population recorded during the 2001 Census was nearly 28.6 million and is currently (2010) estimated at 40 million. The tremendous challenge of absorbing such a massive number of people in urban areas and providing them with shelter, food, employment, healthcare, education, municipal services and recreation facilities is made more difficult given shortage of urban facilities and resources, skilled manpower and good governance. The urbanization challenge unless managed well could pose a serious problem to the future growth prospects for Bangladesh. Rapid urbanization has been posing serious challenges for sustainable urban development.

Despite the challenges, urban areas demonstrate immense economic potential to generate growth in the country and can be instrumental in enhancing prosperity and increasing per capita income. As income grows and the economy relies more and more on manufacturing and organized services, urbanization will grow. The challenge for public policy is to manage this natural transition of Bangladesh from an agrarian economy to a modern economy well through appropriate institutions, programs and policies. The Government is cognizant of this challenge. It also understands that this is a long-term challenge. The back-log of unmet demand and new demand for basic urban services like housing, sanitation, water supply and urban transport requires huge resources, sound planning, and strong implementation capacity. These require strategic planning and implementation over a long period. Ambitious urban development programs during the perspective plan period will be adopted. These programs will be based on the following policies and strategies:

- Process and the patterns of urbanization in Bangladesh would be achieved through a more balanced distribution of urban centres in terms of population size, employment opportunities, housing and essential infrastructure and services

- Ensuring urban governance focusing on institutional reforms and decentralization of responsibilities and resources to local governments and participation of civil society in decision-making and urban development processes; and facilitating networking at all levels.
- Achieving urban economic development involving initiative to combine available skills to be suitably upgraded, resources and ideas to stimulate the local economy towards the goals of job creation, economic growth and poverty alleviation
- Managing urban management seeking to promote cleaner environment, control pollution and protect public health from environmental hazards.
- Providing accessibility to affordable urban housing through bringing about improvement in terms of quality and quantity of housing units, housing tenure and housing accessibility
- Developing an integrated and balanced transportation system taking into consideration the needs of the road system, non-motorized transport, public passenger transport and mass transit.
- Promoting sustainable land-use planning and innovative land management practices, with the objective of providing for the land requirements for urban development through integrated and environmentally sound physical planning and land use
- Delivering safe water, sanitation, waste management, social welfare, transport and communications facilities, energy, health and emergency services, schools, public safety, and the management of open spaces.
- Ensuring equal access to and maintenance of basic services, including those related to education, employment and livelihood; basic healthcare services; safe drinking water and sanitation; adequate shelter; and needs and rights of women and children who often bear the greatest burden of poverty.

2.1.2.2 Sixth Five Year Plan (SFYP) including Poverty Reduction Strategy Paper

In recognition of the long-term development challenges, the Government of Bangladesh adopted the Vision 2021. The Vision 2021 and the associated Perspective Plan 2010-2021 have set solid development targets for Bangladesh by the end of 2021. Those targets if achieved will transform socio-economic environment of Bangladesh from a low income economy to the first stages of a middle income economy. The implementation of Vision 2021 will be done through two medium term development plans, with the first spanning FY2011-FY2015. This Five-year Plan is the sixth in the series of development plans in Bangladesh starting in 1973. A key focus of the plans will therefore be on strategies, policies and institutions to help guide helping Bangladesh achieve the goals set in Vision 2021. At the operational level the fundamental task of the Sixth Five Year Plan is to develop strategies, policies and institutions that allow Bangladesh to accelerate growth and reduce poverty.

However, a review of past policies, institutions and programs suggest that the urbanization strategy needs to change substantially to meet the challenges of future urbanization in Bangladesh. In the past much of the focus has been on implementing piecemeal programs. Multitudes of local government agencies, weak planning, poor governance, inadequate resources and weak project implementation capacity have limited the progress with meeting the urban challenge. The Sixth Five-Year Plan will internalize these lessons of experience and shift the emphasis to the development of sound urban institutions, improve city governance,

emphasize urban resource mobilization, facilitating NGO involvement in housing, better environmental management, developing sustainable urban transportation, promoting balanced development of urban centers, making provision of infrastructure and services, and reducing urban poverty.

Sixth Five Year Plan has also set up objectives and strategies for the Paurashavas and City Corporation. They are:

- Development of effective road network to setup congestion free, safe and sound communication system.
- Development of pedestrian facilities in the cities.
- Reduction of traffic accident.
- Auto traffic signalization for better traffic management.
- Sustainable parking management.
- Improvement of solid waste management.
- Improvement of environment & infrastructure.
- Provision of safe water supply for the citizens.
- Development of recreational facilities (parks, playgrounds etc.)
- Development of modern street lighting
- Development of primary health facilities.
- Improvement of drainage system to address the problems of water logging.
- Development of Commercial complexes for expanding economic activities.
- Infrastructure development of low-income settlements.

Sixth Five Year Plan has also set up vision, objectives and strategies for the Rural Infrastructure Development. The vision of Rural Infrastructure Development sub-sector includes, among others, developing, maintaining and managing transport, trading infrastructure at the local level by ensuring LGI and community participation and taking care of environmental and social issues. The objectives of the sub-sector will include the following:

- Improvement and maintenance of rural infrastructure
- Create direct employment opportunity for the rural poor and the destitute women through improvement and maintenance rural infrastructure.
- Create indirect employment opportunity in road transport, trading and other farm and nonfarm sectors. Improve utilization of health and education services/facilities
- Facilitate participation of community people in development work and promote good local governance.
- Contribute towards poverty reduction at the local level.

2.1.2.3 The Perspective Plan (2010-2021)

The Perspective Plan provides the road map for accelerated growth and lays down broad approaches for eradication of poverty, inequality, and human deprivation. Specific strategies and the task of implementation will be articulated through the two five-year plans: Sixth Five Year Plan (2011-2015) and the Seventh Five Year Plan (2016-2020). The expectation is that by 2021, the war against poverty will have been won, the country will have crossed the middle income threshold, with the basic needs of the population ensured, and

their basic rights respected, when everyone is adequately fed, clothed and housed, and have access to health care. And all this is achieved on a sustainable basis without damaging the environment. Furthermore, this progress will be ensured in an environment where every citizen has the opportunity fully and positively to contribute to the economy and society and equitably share the benefits from progress achieved. The salient features of this plan discuss briefly below:

Institutional foundations of stability and prosperity: The principal dimensions of governance or institutional quality may include: voice and accountability, political stability and absence of violence, government effectiveness, and regulatory quality, rule of law and control of corruption. In this perspective plan there are providing strategy to ensure those institutional foundations stability and prosperity.

Strategy for food security: agriculture and rural development: to enhance agriculture production and ensuring food security, by 2021, food deficiency will be eliminated and the country will attain self-sufficiency in food production enabling to meet nutritional requirement of the population. To establish a powerful autonomous local government body. This is imperative to initiate and provide coordination among private and public rural development institutes. To ensure the rural development.

Transport and communication for the future: The vision of the perspective plan is to establish a safe, low cost, modern and technologically dependable, environmentally friendly inter-modal transport system with a view to reducing the financial cost and time for both commercial traffic, cargo and for public transportation. The main policy objectives taken by this plan for the transport and communication are,

- Meeting the transport demand generated by higher rate of growth of GDP.
- Introduction of modern technology for increasing capacity and improving quality and productivity
- Development of the two sea ports. Establishment of effective railway linkages between the east and west zones of the country.
- Re-orientation of the development strategy for rural transport for efficient external access through optimal integration of road and inland water transport and off-road internal accesses.
- Efforts will be made to develop some of the critical inter-modal transport network that allows connectivity of neighboring countries to the two sea ports of Bangladesh.
- Efforts will also be made to fully participate in global and regional transport connectivity initiatives that help develop the land route links between South Asia and East Asia through Bangladesh.
- Improvement in resource mobilization will be made through introduction of user charges and fees.
- Provision of required incentive packages for the private sector for greater participation will be ensured, not only in transport services, but also for infrastructure building.
- Transport development strategy framework will be broadened by incorporating the vital urban transport dimension starting with improvement in transport services of greater Dhaka city.
- Adequate care will be taken while developing transport network and service so that these do not cause
- Environmental pollution and affect ecological balance.

Rural Transport

It is important to give attention to ways that the rural transport infrastructure, particularly the physical infrastructure, can support rural economies. Roads, waterways, or both serve most of rural markets and growth centers. The long-term goals of the perspective plan with respect to rural roads are (i) to provide all weather access to all growth centers, all union parishad complexes, most rural markets and other rural service delivery centers, and (ii) to improve rural accessibility to facilitate agricultural production and marketing. The strategies may be adoption of a Rural Road Master Plan and Maintenance Plan with priority accorded on maintenance over new construction, and more involvement of LGIs in ensuring utilization and maintenance of constructed facilities.

Addressing the urban challenge: Bangladesh has been experiencing rapid increase in its urban population ever since its independence in 1971. Urban population as a percentage of total population increased from around 8.8 % to nearly 23 % during 1974-2001 period. It is estimated that by the year 2021 nearly one-third or 33% of the population of Bangladesh will be living in urban areas. Urban development Policies and Strategies has taken based on, Patterns and Process of Urbanization, Urban Governance, Urban Economic Development, Urban Environmental Management, Urban Housing, Urban Transportation, Urban Land Management and Planning, Infrastructure and Services, Urban Poverty.

Addressing challenge of poverty eradication: The main elements of the poverty reduction strategy in Bangladesh will consist of policies and programs to:

- promote growth by sustaining increases in labor productivity and job creation in manufacturing and services;
- increase farm income through better productivity;
- enhance the access of the poor to production inputs (fertilizer, seed, irrigation water, power, rural roads) and to institutional finance
- expand employment opportunities in lagging regions by improving connectivity with growth poles through better infrastructure and by investing in human capital;
- facilitate migration from poor areas given the poverty-reducing impact of remittances;
- stimulate women's participation in the labor force;
- sustain Bangladesh's past successes in reducing fertility;
- improve poor household's access to and quality of education, health and nutrition services;
- strengthen the coordination, targeting and coverage of social protection programs;
- enhance the access to micro finance;
- ensure stable food prices; and
- mitigate the adverse consequences of climate change

2.1.2.4 Millennium Development Goals (MDGs)

The Millennium Development Goals, set forth in the UN Millennium Declaration 2000, are a set of quantified and time-bound goals to reduce extreme poverty, disease, and deprivation of the world's poorest people. The project sets a deadline of 2015 to achieve eight goals, called Millennium Development Goals (MDGs). In fact, the achievement of the social goals under the MDGs is now at the centre of public policy in Bangladesh as in most other developing countries. It is seen that while Bangladesh has achieved considerable success in

certain areas like expansion of health and education facilities, and income earning opportunities for women, sustained efforts will be needed to consolidate these gains and achieve MDGs in these and other areas by 2015.

It is encouraging to note that Bangladesh has already met several targets of the MDGs like reducing headcount poverty and poverty gap ratio, attaining gender parity at primary and secondary education, under five mortality rate reduction, containing HIV infection with access to antiretroviral drugs, children under five sleeping under insecticide treated bed nets, detection and cure rate of TB under DOTS and others. In addition, Bangladesh has made remarkable progress in reducing the prevalence of underweight children, increasing enrolment at primary schools, lowering the infant mortality rate and maternal mortality ratio, improving immunization coverage and reducing the incidence of communicable diseases. On the other hand, areas in need of greater attention are hunger-poverty reduction and employment generation, increases in primary school completion and adult literacy rates, creation of decent wage employment for women, increase in the presence of skilled health professionals at delivery, increase in correct and comprehensive knowledge on HIV/AIDS, increase in forest coverage, and coverage of Information and Communication Technology.

2.1.2.5 National Plan for Disaster Management

The National Plan for Disaster Management is prepared by the Disaster Management and Relief Division. The plan includes the following as minimum:

- Introduction
- GoB Vision for Disaster Management
- Hazards profile of Bangladesh
- Disaster development linkages: national and international drivers for change
- Aim of the plan
- Strategic goals of the plan
- Conceptualizing disaster management in Bangladesh
- Disaster management system in Bangladesh
- The roles and responsibilities of entities involved in emergency operations and risk reduction
- Disaster management regulative framework
- Action matrix for disaster risk reduction and emergency management in Bangladesh describing the priorities and the strategies
- Review and evaluation
- Implementation and follow-up
- Financing of the plan
- Other matters relating to disaster management as deemed necessary by appropriate authority for inclusion in the plan

The Plan is to be used to:

- Articulate the long-term strategic focus of disaster management in Bangladesh.

- Demonstrate a commitment to address key issues: risk reduction, capacity building, information management, climate change adaptation, livelihood security, issues of gender and the socially disadvantaged, etc.
- Show the relationship between the government vision, key result areas, goals and strategies, and to align priorities and strategies with international and national drivers for change.
- Detail a road map for the development of disaster management plans by various entities.
- Guide the DM&RD in the development and delivery of guidelines and programmes.
- Illustrate to other ministries, NGOs, civil society and the private sector how their work can contribute to the achievements of the strategic goals and government vision on disaster management.
- Provide a framework within which to report performance and success in achieving goals and strategies.

2.1.2.6 Sustainable Development Goals (SDGs)

Sustainable Development Goals are accompanied by targets and will be further elaborated through indicators focused on measurable outcomes. They are action oriented, global in nature and universally applicable. They take into account different national realities, capacities and levels of development and respect national policies and priorities. They build on the foundation laid by the MDGs, seek to complete the unfinished business of the MDGs, and respond to new challenges. These goals constitute an integrated, indivisible set of global priorities for sustainable development. Targets are defined as aspirational global targets, with each government setting its own national targets guided by the global level of ambition but taking into account national circumstances. The goals and targets integrate economic, social and environmental aspects and recognize their inter linkages in achieving sustainable development in all its dimensions. Principal goals of SDG include the following:

- End poverty in all its forms everywhere.
- End hunger, achieve food security and improved nutrition and promote sustainable agriculture.
- Ensure healthy lives and promote well-being for all at all ages.
- Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.
- Achieve gender equality and empower all women and girls.
- Ensure availability and sustainable management of water and sanitation for all.
- Ensure access to affordable, reliable, sustainable and modern energy for all.
- Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.
- Reduce inequality within and among countries.
- Make cities and human settlements inclusive, safe, resilient and sustainable.
- Ensure sustainable consumption and production patterns.
- Take urgent action to combat climate change and its impacts.
- Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.
- Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.

- Strengthen the means of implementation and revitalize the global partnership for sustainable development.

Issues like environmental sustainability, eradication of poverty and hunger, quality education, sustainable industrialization and health related matters are directly related to plan preparation process. In the preparation of Bagmar Upazila, Faridpur Sadar Upazila and Gangni Upazila development plan land use zoning will endeavor to protect the environmentally sensitive areas through conservation, promote education through allocation of appropriate quantity of land for setting up of academics, industry and health facilities. The plan will be directed to reduce urban and rural deprivation through appropriate proposal for strengthening urban and rural economy and adequate provision of utility services.

2.3 National Policies

The following national policies have also been studied:

- National Agriculture Policy, 1999
- National Land Use Policy, 2001
- National Fisheries Policy, 1998
- Forestry Policy, 1994
- National Water Policy, 1999
- National Environment Policy, 1992
- Health Policy, 2000
- Population Policy, 2004
- Housing Policy, 2004
- Industrial Policy, 2005
- National Tourism Policy, 1992
- National Policy for Safe Water Supply & Sanitation, 1998
- Urban Management Policy Statement, 1999
- Proposed National Urban Sector Policy
- Local Government Act, 2011
- National Disaster Management Plan
- Local Level Plans

2.3.1 National Agriculture Policy, 1999

In Bangladesh, it is possible to reduce rural poverty and raise the living standard of common people by establishing agriculture as a profitable sector. It is, therefore, necessary to reorganize and develop the agricultural production system into a more dynamic and commercially profitable sector. In this context, the primary goal of the National Agriculture Policy is to modernize and diversify the crop sector, in other words the entire agricultural system, through initiation and implementation of a well-organized and well-coordinated development plan.

The overall objective of the National Agriculture Policy is to make the nation self-sufficient in food through increasing production of all crops including cereals and ensure a dependable food security system for all. The specific objectives of the National Agriculture Policy are to:

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- Ensure a profitable and sustainable agricultural production system and raise the purchasing power by increasing real income of the farmers;
 - Preserve and develop land productivity;
 - Reduce excessive dependence on any single crop to minimize the risk;
 - Increase production and supplies of more nutritious food crops and thereby ensuring food security and improving nutritional status;
 - Preserve existing bio-diversity of different crops;
 - Take up programs for the introduction, utilization and extension of bio-technology;
 - Take necessary steps to ensure environmental protection as well as 'Environment-Friendly Sustainable Agriculture' through increased use of organic manure and strengthening of the Integrated Pest Management (IPM) programs;
 - Take appropriate steps to develop an efficient irrigation system and encourage farmers in providing supplementary irrigation during drought with a view to increasing cropping intensity and yield;
 - Establish agriculture as a diversified and sustainable income generating sector through
 - Strengthening of 'Farming System' based agricultural production and agro-forestry programs;
 - Take effective steps to ensure input supplies to the farmers at fair prices in a competitive market and remove difficulties at the farmers' level which have arisen out of the privatization of input distribution system;
 - Develop marketing system to ensure fair prices of agricultural commodities;
 - Introduce an appropriate institutional system of providing credit to ensure the availability of agricultural credit in time;
 - Produce and supply of agricultural commodities as required by the industrial sector;
 - Reduce imports of agricultural commodities and find out newer opportunities for increasing exports as well;
 - Create opportunities for establishing agro-processing and agro-based industries;
 - Protect interests of the small, marginal and tenant farmers;
 - Update the agricultural system in the light of the Agreement on Agriculture under WTO,
 - Develop contingency management system to combat natural disasters.

2.3.2 National Land Use Policy, 2001

It is indispensable to give proper emphasis on the use of land as it is a very scarce resource in a densely populated country like Bangladesh. Major portion of the population of Bangladesh maintain their livelihood on land based agricultural activities. Personal possession of land is also considered as a symbol of social prestige and security. That is why land is still considered as an important source of income and livelihood of the people of the country. Considering dependency of poor and opportunity deprived families on land, Ministry of Land is conducting a range of activities to protect agricultural land and ensure planned use of land.

The objectives of land use policy are governed by what people want or think they should have, and what the functions of government are conceived to be in bringing about better use of land including water bodies. Changes in land use and water bodies are desired only when people are dissatisfied with existing conditions or

when people conceive of better use of land and water bodies. These conceptions or notions as to how things ought to be may be called value judgments or goals. Keeping above in view, the specific purposes of land use policy of Bangladesh may be as follows:

- To ensure suitable or best possible use of land and water bodies and to restrict misuse and inappropriate use of land and water bodies.
- To ensure best utilization of khas land through rehabilitation of landless and marginalized poor.
- To protect the gradual decreasing trend of agricultural land to feed the increasing population.
- To introduce zoning system in order to make demarcation of land and water bodies according to rational criteria for use of land and water bodies for various purposes.
- To ensure legitimate rights of the marginalized community (indigenous peoples) in respect of land and land related issues including community ownership and use.
- To prevent soil and water pollution in order to ensure environment-friendly land utilization.
- To ensure rights of women in land and water bodies.
- To control speculative trading of land by the land grabbers.
- To reduce landlessness, alleviate poverty and promote income generation in the country.
- To conserve national forestry, reduce river erosion and effective utilization of embankments including using as roads for easy communication.
- To prevent cutting and leveling of hills particularly in Chittagong and Sylhet areas to protect environment.
- To ensure best utilization of Char land through rehabilitation of Landless and marginalized poor.

2.3.3 National Fisheries Policy, 1998

The role of fisheries resources in the national economy is very important. Bangladesh is rich in water resources. Inland and marine waters are the main sources of fisheries production and exploitation. Although there is great potential and scope for the fisheries sector in the economy very little national effort has been undertaken in the recent past. Fish is the principal source of animal protein in our food. Increased rates of child mortality have occurred due to deficiencies of balanced protein.

However, there is an acute shortage of food in the country and expansion of livestock production is limited due to a lack of space. For this reason dependency on fish for animal protein-rich food will increase day by day. There are many possibilities for increasing the Contribution of fish to socio-economic development goals such as increasing nutrition, employment opportunities, foreign currency earnings and the establishment of different industrial organizations.

There are many obstacles to the development of the fisheries sector. These are, Conservation of fisheries resources, various natural calamities and man-made problems, lack of proper management and technically skilled manpower and lack of funds. Besides these, lack of a national fish policy is one of the important causes for not developing this sector up to the mark. To get rid of this, the National Fish Policy has been formulated.

Objectives of the National Fisheries Policy

- Enhancement of 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 provide recreational facilities.

2.3.4 Forestry Policy, 1994

- To meet the basic needs of the present and future generations and also to ensure greater contribution of the generations and also to ensure greater contribution of the forestry sector in the economic development, about 20% of the total area of the country will be afforested by taking up various afforestation programs.
- By creating employment opportunities, strengthening the rural and national economy, the scope for poverty rural and national economy, the scope for poverty alleviation and trees and forest based rural development sectors will be extended and consolidated.
- Biodiversity of the existing degraded forests will be enriched by conserving the remaining natural habitat of birds and animals.
- Agricultural sector will be strengthened by extending assistance to the sectors related with forest development.
- National responsibilities and commitments will be fulfilled by implementing various international efforts and government ratified agreements relating to global warming, decertification and control of trade and commerce of wild birds and animals.
- Through the participation of the local people, illegal occupation of the forest lands, illegal tree felling and hunting of the wild animals will be prevented.
- Effective use and utilization of the forest goods at various stages of processing will be encouraged.

2.3.5 National Water Policy, 1999

Water is central to the way of life in Bangladesh and the single-most important resource for the well-being of its people. It sustains an extremely fragile natural environment and provides livelihood for millions of people. Unfortunately, it is not infinite and cannot be treated as a perpetual free gift of nature to be used in any manner chosen. The unitary nature of water makes its use in one form affect the use in another. Its availability for sustenance of life, in both quantitative and qualitative terms, is a basic human right and mandates its appropriate use without jeopardizing the interest of any member of the society.

Water resources management in Bangladesh faces immense challenge for resolving many diverse problems and issues. The most critical of these are alternating flood and water scarcity during the wet and the dry seasons, ever-expanding water needs of a growing economy and population, and massive river sedimentation and bank erosion. There is a growing need for providing total water quality management (checking salinity, deterioration of surface water and groundwater quality, and water pollution), and maintenance of the ecosystem. There is also an urgency to satisfy multi-sector water needs with limited resources, promote efficient and socially responsible water use, delineate public and private responsibilities, and decentralize state

activities where appropriate. All of these have to be accomplished under severe constraints, such as the lack of control over rivers originating outside the country's borders, the difficulty of managing the deltaic plain, and the virtual absence of unsettled land for building water structures.

- The water policy provided hereunder, lays down the broad principles of development of water resources and their rational utilization under these constraints. It will help guide both public and private actions in the future for ensuring optimal development and management of water that benefits both individuals and the society at large.
- The water policy of the government aims to provide direction to all agencies working with the water sector, and institutions that relate to the water sector in one form or another, for achievement of specified objectives. These 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 under privileged, 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
 - 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.

2.3.6 National Environment Policy, 1992

Bangladesh is situated at the unique juxtaposition of the composite, sprawling, interlinked Ganges-Brahmaputra-Meghna river systems, the second largest river system in the world, which drains an area of 1,086,000 square kilometers from China, Nepal, India and Bangladesh. Because of this unique geophysical location, the country has been endowed with rich biological diversity, hosting a rich variety of species superbly evolved to populate the ecosystems of the country.

Bangladesh is recognized to be one of the most susceptible countries in the world, highly vulnerable to climatic manifestations (short-term and long-term impacts of climate change) due to its unique geographic location, hydro-geological characters like dominance of floodplains, low elevation from the sea and lastly the socio-economical characters like high population density, high levels of poverty, and overwhelming dependence on nature.

In the context of the environment, the Government of Bangladesh formulated an Environment Policy in 1992. The objectives of Environment Policy are to:

- Maintain ecological balance and overall development through protection and improvement of the environment;
- Protect the country against natural disasters;
- Identify and regulate activities which pollute and degrade the environment;
- Ensure environmentally sound development in all sectors;
- Ensure sustainable, long term and environmentally sound use of all national resources; and
- Actively remain associated with all international environmental initiatives to the maximum possible extent.

The policy covered all geographical regions and 15 development sectors like Agriculture, Industry, Health & Sanitation, Energy and Fuel, Water Development, Flood Control and Irrigation, Land, Forest, Wildlife and Bio-diversity, Fisheries and Livestock, Food, Coastal and Marine Environment, Transport and Communication, Housing and Urbanization, Population, Education and Public Awareness, Science, Technology and Research, Legal Framework and Institutional Arrangements.

The policy mentioned the suitability of environmentally sound development on proper changes in production management and relations of production of agriculture sector to guaranteeing improvement of environment and sustainable use of its resources (Section 3.1). Moreover, the policy necessitated firmly to review Environmental Impact Assessment (EIA) on industries of public and private sectors and also encompassed the necessity of integrated environmental concerns that shaped into the National Health Policy (Section 3.2.2). The policy also recommends to ensure environmentally sustainable steps in the local, zonal and national levels of Bangladesh on flood control and its related matters such as construction of embankments, dredging of rivers, digging of canals etc and to make certain alleviated measures of adverse environmental impact on flood control projects and water resources development projects. The policy subsequently stated the formulation and application of national land use policy to ensure sound and balance environment and prevention of land erosion, preservation and increase in soil fertility, conservation of environmentally sound management of new accreted land, compatible land use system with various ecosystems, prevention of salinity and alkalinity on land (3.6.1 – 3.6.4). These uphold adaptation mechanisms on land use systems will compress the risks and disasters of climatic change. The policy emphasized the need for sustainable ecological balance on existing forests

Conservation, expansion and development of forests to establish programmers on tree plantation in all relevant development schemes and took measures to stop shrinkage and depletion of forest lands and resources. The policy called for the protection viability of mangrove forests and eco-systems against adverse appliance of fisheries and livestock and suggested alternative fish culture upon environmental friendly conditions and environmentally sound conservation and development of coastal and marine eco-systems and resources (Section 3.8.3, 3.8.4, 3.10.1).

2.3.7 Health Policy, 2000

First: To make necessary basic medical utilities reach people of all Upazila as per Section 15 (A) of the Bangladesh constitution and develop the health and nutrition status of the peoples as per Section 18 (1) of the Bangladesh Constitution

Second: To develop system to ensure easy and sustained availability of health services for the people, especially the poor communities in both rural and urban areas

Third: To ensure optimum quality, acceptance and availability of primary health care and governmental medical services at the Upazila and union levels

Fourth: To reduce the intensity of malnutrition among people, especially children and mothers; and implement effective and integrated programs for improving nutrition status of all segments of the population

Fifth: To undertake programs for reducing the rates of child and maternal mortality within the next 5 years and reduce these rates to an acceptable level

Sixth: To adopt satisfactory measures for ensuring improved maternal and child health at the union level, and install facilities for safe and hygienic child delivery in each village

Seventh: To improve overall reproductive health resources and services

Eighth: To ensure the presence of full-time doctors, nurses and other officers/staff, provide and maintain necessary equipment and supplies at each of the Upazila health complexes and Union Health and Family Welfare Centers (UHFWCs)

Ninth: To devise necessary ways and means for the people to make optimum usage of available opportunities in government hospitals and the health service system, and ensure satisfactory quality management, cleanliness of service delivery at the hospitals

Tenth: To formulate specific policies for medical colleges and private clinics, and to introduce laws and regulation for the control and management of such institutions including maintenance of service quality

Eleventh: To strengthen and expedite the family planning program with the objective of attaining the target of Replacement Level of Fertility

Twelfth: To explore ways to make the family planning program more acceptable, easily available and effective among the extremely poor and low-income communities

Thirteenth: To arrange special health services for the mentally retarded, the physically disabled and elderly populations

Fourteenth: To determine ways to make family planning and health management more accountable and cost-effective by equipping it with more skilled manpower

Fifteenth: To introduce systems for treatment of all types of complicated diseases in the country, and minimize the need for foreign travel for medical treatment Road.

The following policy principles have been adopted in order to attain the foregoing goals and objectives:

1. To create awareness among the enable every citizen of Bangladesh irrespective of caste, creed, religion, income and gender, and especially children and women, in any geographical region of the country, through media publicity, to obtain health, nutrition and reproductive health services on the basis of social justice and equality through ensuring everyone's constitutional rights;
2. To make the essential primary health care services reach every citizen in all geographical regions within Bangladesh; To ensure equal distribution and optimum usage of the available resources to solve urgent health-related problems with focus on the disadvantaged, poor and unemployed persons.

3. To involve the people in various processes like planning, management, local fund raising, spending, monitoring and review of the procedure of health service delivery etc. with the aim of decentralizing the health management system and establishing people's right and responsibilities in this system.
4. To facilitate and assist in the collaborative efforts between the government and the non-government agencies to ensure effective provision of health services to all.
5. To ensure availability of birth control supplies through integration, expansion and strengthening of the family planning activities.
6. To carry out appropriate administrative restructuring, decentralization of the service delivery procedure and the supply system, and to adopt strategies for priority-based human resource development aimed at overall improvement and quality-enhancement of health service, and to create access of all citizens to such services.
7. To encourage adoption and application of effective and efficient technology, operational development and research activities in order to ensure further strengthening and usage of health, nutrition and reproductive health services.
8. To provide legal support with regard to the rights, opportunities, responsibilities, obligations and restrictions of the service providers, service receivers and other citizens, in connection with matters related to health service; and
9. To establish self-reliance and self-sufficiency in the health sector by implementing the primary health care and essential services programs, in order to fulfill the aspirations of the people for their overall sound health and access to reproductive health care.

2.3.8 Population Policy, 2004

Socio-economic development for all citizens is the cornerstone of Bangladesh's constitution. According to the articles 15, 16, 17 and 18 of the constitution, the state has the responsibility to ensure to its citizens certain basic needs such as health, education, food and security. In order to translate these constitutional goals into reality, the Government had undertaken a wide array of public policies. Realizing the importance of population and development, the Government prepared a Population Policy Outline and had identified population problem as the national problem. The Policy stands out as one of the most remarkable achievements of the government.

The objectives of the National Population Policy are to improve the status of family planning, maternal and child health including reproductive health services and to improve the living standard of the people of Bangladesh through making a desirable balance between population and development in the context of Millennium Development Goals (MDGs) and Interim Poverty Reduction Strategy Paper (IPRSP): A National Strategy for Economic Growth, Poverty Reduction and Social Development. The following major policy objectives will help address the future challenge.

- ✓ Reduce Total Fertility Rate (TFR) and increase the use of family planning methods among eligible couples through raising awareness of family planning;
- ✓ Attain NRR equal to one by the year 2010 so as to stabilize population around 2060;
- ✓ Ensure adequate availability and access of Reproductive Health Services, specially family planning services to all including information, counseling and services for adolescents;

- ✓ Improve maternal health with emphasis on reduction of maternal mortality;
- ✓ Reduce RTIs/STIs and prevent spread of HIV/AIDS.
- ✓ Reduce infant and under five mortality rates;
- ✓ Reduce maternal and child malnutrition;
- ✓ Promote and actively support programs for elimination of gender disparity in education, health and nutrition;
- ✓ Ensure Early Childhood Development (ECD) program;
- ✓ Ensure and support gender equity and empower women;
- ✓ Develop the human resource capacity of planners, managers and service providers, including improved data collection, research and dissemination;
- ✓ Actively support measures to provide food and social security and shelter for the disadvantaged including the elderly, destitute, physically and mentally retarded persons;
- ✓ Actively support measures to regulate and reduce rural to urban migration;
- ✓ Support measures for environmental sustainability with emphasis on access to safe drinking water;
- ✓ Support poverty alleviating strategies and conducive environment for improved quality of life;
- ✓ Ensure coordination among relevant Ministries in strengthening population and development linkages and making their respective mandates and implementation strategies more population focused;

2.3.9 Industrial Policy, 2005

Bangladesh is a developing country, and the present government is striving relentlessly to attain rapid economic development in the country. Many programs taken so far have been carried out successfully. Despite a lack of resources faced by the government, development programs in the key sectors have continued. At the same time, considering the importance of the private sector, an all-out support is being provided to initiatives taken in this sector. As a result, a new kind of dynamism is under way in both the public and private sectors. In this backdrop, it is essential to examine various aspects of industrialization and its impacts on overall economic activities.

- ✓ One of the foremost objectives of the Industrial Policy 2005 is to set up planned industries considering the real domestic demand, prospect of exporting goods abroad, and discouraging unplanned industries in the light of past experience.
- ✓ Accept private initiatives as the main driving force of economic development and uphold the government's facilitating role in creating a favorable atmosphere in order to augment private investments in the country's industrialization, given the background of a free market economy and globalization.
- ✓ Arrange for state owned industrial enterprises to be sold/transferred/leased or administered in any other way by the Privatization Commission or concerned ministries in order to accelerate the privatization process.
- ✓ Take necessary initiatives to set up industries with private entrepreneurships, and where that is feasible, establish industries on state initiative in those sectors that are considered very important and essential because of national interest, where private entrepreneurs are not forthcoming.

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- ✓ Catering the needs for local and foreign market and also for consumer satisfaction of the local products; Measures to be undertaken (a) produce world class quality products, (b) diversification of goods, (c) introduce cost effective management in the production system, (d) more value addition in the industrial sector, and (e) provide support for enhancing productivity by using continuous, appropriate and advanced technology.
 - ✓ Provide assistance to augment the industrial sector's contributions to the GDP of the national economy, meet the general demands of local consumers and earn more foreign exchange so that local industrial entrepreneurs can attain further capacity to establish industries, and industrial goods can have access to the overseas market on a competitive basis.
 - ✓ Provide inspiration for the speedy expansion of cottage industries and SMEs and for further investment in these sectors so that new employment opportunities are generated, unemployment reduced and poverty alleviation program made in the country.
 - ✓ Prioritize the expansion and development of agro-based and agricultural processing industries, and assist in the expansion of poultry, dairy and goat sheep industry as agricultural industries.
 - ✓ Provide women entrepreneurs with all necessary assistance in establishing industries in various sectors.
 - ✓ Increase productivity at enterprise level; Produce high value added products step by step through development and application of appropriate technology and increase of export through export diversification.
 - ✓ Provide all necessary assistance for producing environment friendly product with the objective for creating a pollution free environment in the industrial sector.
 - ✓ Expand the local market and establish more backward linkage industries in order to accelerate the export of high value added garments produced in the export oriented garment industries and other relevant industrial subsectors.
 - ✓ Further enrich the industrial sector with the proper utilization of the country's various natural and mineral resources.

2.3.10 National Tourism Policy, 1992

The National Tourism Policy of Bangladesh was declared in 1992. Its main objectives are:

- To create interest in tourism among the people
- To preserve, protect, develop and maintain tourism resources
- To take steps for poverty-alleviation through creating employment
- To build a positive image of the country abroad
- To open up a recognized sector for private capital investment
- To arrange entertainment and recreation
- To strengthen national solidarity and integrity

In line with the policy, the Bangladeshi Government provides incentives to attract private sector partners. The incentives include tax-holiday, loans, concession rates for taxes and duties and in specific cases, allotment of land etc.

2.3.11 National Policy for Safe Water Supply & Sanitation, 1998

The objectives of the “National Policy for Safe Water Supply and Sanitation” are to improve the standard of public health and to ensure improved environment. For achieving these objectives, steps will be taken for:

- ✓ Facilitating access of all citizens to basic level of services in water supply and sanitation;
- ✓ Bringing about behavioral changes regarding use of water and sanitation;
- ✓ Reducing incidence of water borne diseases;
- ✓ Building capacity in local Governments and communities to deal more effectively with problems relating to water supply and sanitation;
- ✓ Promoting sustainable water and sanitation services;
- ✓ Ensuring proper storage, management and use of surface water and preventing its contamination;
- ✓ Taking necessary measures for storage and use of rain water;
- ✓ Ensuring storm-water drainage in urban areas.

2.3.12 Proposed National Urban Sector Policy

In Bangladesh cities and towns are playing a crucial role in the national development despite the adverse socio-economic and environmental consequences resulting from rapid growth of these urban centers.

The National Urban Policy envisions strengthening the beneficial aspects of urbanization and at the same time effectively dealing with its negative consequences so as to achieve sustainable urbanization, keeping in view the multi-dimensional nature of the urbanization process. The policy also envisions a decentralized and participatory process of urban development in which the central government, the local government, the private sector, the civil society and the people all have their roles to play.

The major objectives of National Urban Sector Policy for Bangladesh, therefore, will be to

- Ensure regionally balanced urbanization through decentralized development and hierarchically structured urban system;
- Facilitate economic development, employment generation, reduction of inequality and poverty eradication through appropriate regulatory frameworks and infrastructure provisions;
- Ensure optimum utilization of land resources and meet increased demand for housing and urban services through public-private and other partnerships;
- Protect, preserve and enhance the urban environment, particularly water bodies;
- Devolve authority at the local urban level and strengthen local governments through appropriate powers, resources and capabilities so that these can take effective responsibility for a wide range of planning, infrastructure provision, service delivery and regulatory functions;
- Involve all sectors of the community, including women and the poor, in participatory decision-making and implementation processes;
- Ensure social justice and inclusion by measures designed to increase the security of poor people through their access to varied livelihood opportunities, secure tenure and basic affordable services;
- Take into account particular needs of women, men, children, youth, the elderly and the disabled in developing policy responses and implementation;

- Assure health, safety and security of all citizens through multifaceted initiatives to reduce crime and violence;
- Protect, preserve and enhance the historical and cultural heritage of cities and enhance their aesthetic beauty;
- Develop and implement urban management strategies and governance arrangements for enhancing complementary roles of urban and rural areas in sustainable development; and
- Ensure good governance by enhancing transparency and establishing accountability.

2.3.13 Local Government Act, 2011

Local Government Act, 2011 deals with the relationship between the central government and local government. Political motives in local government reform initiatives, constitutional aspects and legislative notions, fiscal aspects as well as notions, administrative aspects and Bangladesh perspective on democratic decentralization have also been analyzed.. Concepts and issues of fiscal decentralization, pertaining to the assignment of expenditure responsibilities to different government levels, the assignment of tax and revenue sources to different government levels, intergovernmental fiscal transfers and local governments' borrowing have been underscored.

In Chapter 6 of this act, 'Gender Mainstreaming in Rural Local Governments and Rural Local Government', the writer begins with the paragraph: 'Despite the extensive debates on the governance and development approach, there is a widespread belief that Gender and Development (GAD) or gender mainstreaming, poverty reduction and local governance are interrelated and likely to be central to the local government, particularly in Bangladesh context'. The author further informs us that in spite of the wide range of discrimination against women in rural Bangladesh, basically owing to the traditional structure of society --- prejudice, unequal land and resource authority, non-recognition of their labour and so on --- extensive strides in gender mainstreaming have been made in the field of local governance since the Beijing Conference of September 1995.

This act also deals with the contextual analysis of regeneration of the Upazila system. The concluding chapter tells of the role of decentralization in fulfilling MDGs, especially poverty reduction. In Appendices, UNDP Study (2008) on the proposed Local Government Commission, Structure/Models of Selected Countries and Report of the Roundtable Discussion on the Proposed Local Government Commission Ordinance 2008 have been added.

2.3.14 Disaster Management Plans

The Bangladesh National Plan for Disaster Management is a strategic document to be effective for a certain period of time. This is an umbrella plan that provides the overall guideline for the relevant sectors and the disaster management committees at all levels to prepare and implement their area of roles specific plans. The Disaster Management and Relief Division (DM&RD) being the focal ministry for disaster risk reduction and emergency management will take the lead role in disaster risk reduction and emergency management planning. Additionally, there will be a few hazard specific management plans, such as Flood Management Plan, Cyclone and Storm Surge and Tsunami Management Plan, Earthquake Management Plan, Drought Management Plan, River Erosion Management Plan, etc. Moreover, there will be a detailed Disaster

Management Plan for each District, Upazila, Union and Pourashava and City Corporation of the country. A District Disaster Management Plan will be the compilation of the Upazila Disaster Management Plans of the District. Similarly an Upazila Disaster Management Plan will be the compilation of the union disaster management plans of that Upazila prepared by the Union DMCs. So DMCs at Union and Pourashava levels will be mainly responsible for conducting the risk assessments and prepare the ground level plans. Once developed those will be sent to the DMCs at one level higher – Upazila DMCs, whose role will be to verify and compile the union plans and identify the resource requirements for the Upazila.

National Disaster Management Policy:

The National Disaster Management Policy defines the national policy on disaster risk reduction and emergency response management, and describes the strategic policy framework and national principles of disaster management in Bangladesh. It is strategic in nature and describes the broad national objectives and strategies in disaster management.

National Plan for Disaster Management (2010-2015)

The National Plan for Disaster Management for 2010-2015 is a long desired document based on the global and regional commitment of the Government of Bangladesh and its vision on disaster management. The plan reflects the basic principles of the SAARC Framework on Disaster Management to minimize the disaster risk at the community level and country as well. The key focus of the National Plan for Disaster Management is to establish institutional accountability in preparing and implementing disaster management plans at different levels of the country. Development Plans incorporating Disaster Risk Reduction and Hazard Specific multi-sectoral Plans have made this plan an exclusive tool for reducing risk and achieving sustainable development. For the first time, a national document on disaster management has included both natural and human induced hazards in its action plan, involving government and non-government organizations, and the private sector in a comprehensive way. The plan has been prepared in a participatory way, having several consultations with stakeholders and established a road map of effective partnership with the organizations working at local, national and regional levels. It is expected that this plan will contribute towards developing and strengthening regional and national networks.

Standing Orders on Disaster (SOD):

The Standing Orders on Disaster describes the detailed roles and responsibilities of committees, Ministries and other organizations in disaster risk reduction and emergency management, and establishes the necessary actions required in implementing Bangladesh's Disaster Management Model. The Standing Orders have been prepared with the avowed objective of making the concerned persons understand their duties and responsibilities regarding disaster management at all levels, and accomplishing them. All Ministries, Divisions/Departments and Agencies shall prepare their own Action Plans in respect of their responsibilities under the Standing Orders for efficient implementation. The National Disaster Management Council (NDMC) and Inter- Ministerial Disaster Management Coordination Committee (IMDMCC) will ensure coordination of disaster related activities at the National level. Coordination at District, Thana and Union levels will be done by

the respective District, Thana and Union Disaster Management Committees. The Disaster Management Bureau will render all assistance to them by facilitating the process.

2.3.15 National Water Management Plan, 2004

The National water management plan, 2004, promulgated in 2004 provides policy direction for water sector. The objectives of NWMP are:

- i. To address issues related to the development of all forms of surface water and ground water in the efficient and equitable manner.
- ii. To ensure the availability of water to all elements of the society.
- iii. To accelerate the development of both public and private water delivery systems.
- iv. To decentralize the management of water resources and enhance the role of women.
- v. To develop a legal and regulatory environment for decentralization, sound environmental management, and improve conditions for private sector investment in the water sector.
- vi. To develop a state of knowledge and capability for sustainable planning.

2.3.16 Local Level Development Plans

The consultant has come to know that for Faridpur Sadar LGED has completed master plan by the year 2011 and for remaining two upazilas Urban Development Directorate has Plan too (previously done). All these documents the consultant will collect and thereafter will be extensively reviewed before taking any field inquiry or survey initiative.

2.3.17 Linkage of National Plans and Policies with Development Plans of 14 Upazilas Project

The current project would emphasize over agriculture, fisheries, forestry and ecology activities focusing on all relevant social and physical infrastructure services and facilities including the national level communication network. It would emphasize over the economic development in and around the project area and also livelihood of the local people, who are very much depended on local economic activities. The current project would also emphasize over the change in land category, land use and livelihood pattern. In this circumstances, the review of different national plans and policies, we found that there are specific rules and regulations to develop this plan of these areas, which were discussed in the previous section elaborately.

2.4 Collection of Relevant Documents

To conduct this development plan including Sub Regional Plan, Structure Plan, Urban Area Plan, Rural Area Plan, Action Area Plan, there require huge different types of primary and secondary data to collect. The primary data of different kinds as like socio economic, environmental, drainage, physical feature, transportation data all are collected from field study. The secondary data and other relevant documents will collect from different government offices and government web portals.

2.4.1 Collection of Maps, Basic Statistics and Information

To conduct this development plan including Sub Regional Plan, Structure Plan, Urban Area Plan, Rural Area Plan, Action Area Plan, there require different kinds of maps and reports as like Geo-physical maps and reports (Geology, Hydrology, Soils major type) Topographical maps and reports as like Physical features, Infrastructure, Land use are prepare from different field survey and study.

There require different statistical data as like number of inhabitants/households, differentiated according to income level/type/density and quality of housing, Production and employment (formal/informal, number and size of establishments, type of production/activity, income/education level), Public services (education, health, security etc.) and utilities (drinking water, sewerage/sanitation, garbage disposal, gas, electricity, telecommunication); administrative institutions, Commercial activities (shops, markets both formal and informal), Transportation facilities (roads, public transportation, parking facilities, waterways, railway, foot path) etc. these basic information and statistics will collect from different socio economic survey and secondary sources as like reports of bureau of statistics, economic review (for details please see **Table 2-1**).

Table 2-1: Relevant Data, and their Sources of Collection

Sl. No	Type	Description	To be collected from Secondary sources
1.	Collection of Mouza Map	The original C.S or R.S Mouza maps in the scale of 1:3960 (1"=330ft) will be collected from DLRS/DC office covering whole of project area three Upazila destined for Package-03.	DLRS/DC/Local offices
2.	Collection of Geo-physical Maps and Reports		
	Geology	<ul style="list-style-type: none"> □ The geological maps and reports will be collected from the office of the Geological Survey. □ Sedimentation and stratification Load bearing capacity of soils including old river valley and deeps filled with clays will be identified. 	Office of the Geological Survey
	Hydrology	<ul style="list-style-type: none"> □ Topographical and contour map of three Upazila will be collected from BWDB office in the scale of 1:10,000. □ Top-sheet containing contour lines, water courses, embankments and all other structures are available with survey of Bangladesh 	BWDB office Survey of Bangladesh
3.	Collection of Topographical Maps and Reports		
	Physical feature	□ Physical features (land/water, urban/rural, built-up/open, landmarks, bridge/culvert, and embankment/floodwall, sluice gate)	Survey of Bangladesh
	Infrastructure	<p>The study of infrastructures includes the examination of maps and reports on drainage, roads, public infrastructure transportation and utilities.</p> <ul style="list-style-type: none"> □ Maps and Report on Drainage □ Maps and Report on roads & Public Transportation 	Survey of Bangladesh

	Land use	Residential, industrial, commercial, agricultural, floodflow, etc. each differentiated according to density and quality	Survey of Bangladesh
4.	Collection of basic statistics (Present Activities)		
	Inhabitants and Households	<ul style="list-style-type: none"> □ Population and number of Household □ Union and ward wise density of population □ Union and ward wise data on quality of housing classified as Pucca, Semi-pucca, Kuthca, Thatched etc. □ Data on Income level 	BBS (Population Census Reports) 2011 Statistical Year Book.
	Production and Employment	<ul style="list-style-type: none"> □ Statistical data on production and employment □ Employment in formal and informal sectors. □ Data on number of Industrial establishment. 	BBS (Statistical Year Book) 2011
	Public Services	<ul style="list-style-type: none"> □ Union and ward wise data on public services like, Education, Health & Security etc □ Utilities like Water Supply, Sewerage, Sanitation, Garbage disposal, Gas and Electricity □ Telecommunication and Administrative institution. 	BBS (Statistical year book of Bangladesh) Upazila Office, Telephone exchange office, REB
	Commercial activities	Commercial Activities (shops, markets both formal and informal) and their impact on socio-economic developments of the respective area	Upazila Office

2.5 Preparation of Base Map using GIS and Mouza Map

2.5.1 Collection of Mauza Maps

The CS/RS Mauza maps are the basis of the base map for the project area. The project area will be delineated on Mauza sheets. Mauza maps have been collected from the Assistant Commissioner's Land of Bagmara, Faridpur Sadar and Gangni upazila and DLRS covering the entire project area. The Mauza sheets having distortion due to rapping or pasting of cloths/tape have been avoided during collection of Mauza maps. Original copies of mauza maps were supposed to be collected. As original mauza sheets were not available, photocopy versions of the same have been collected from DLRS.

2.5.2 Collection of Other Materials

Collation of available secondary sources information, data, maps, photographs, satellite images, reports etc. and their review and identification of shortcomings and gaps, and assessment of real data requirement and survey of both primary and secondary sources will be made by the study team

2.5.3 Scanning of Mauza Maps

Large line scanning technology, most suitable for map scanning where distortion and deviation is nearly nil, will be used for scanning Mauza maps. During scanning operation, care shall be taken to maintain the geographical north line alignment. Specifications to be used for scanning Mauza maps are tabulated in **Table 2-2**. Necessary processing shall be done to get rid of the noises on the image of unwarranted marks and spots attributed to senile reasons. Also, the technical specifications of the scanner to be used for the purpose are provided in **Table 2-3**. The scanned image files of each individual mauza shall be saved in JPG format organized and named individually. The tentative nomenclature of image files is provided in **Table 2-4**. All the image files of scanned mauza maps shall be structurally organized and backed up in sufficient number of CD electronic media and shall be handed over to UDD as end product of this exercise.

Table 2-2: Specifications for Scanned Images

Image type	Grayscale
Image format	JPG
Image Resolution	300 dpi
Bit depth & Level	8 or 16 Bit (256)
Image Scale	100% (1:1)

Table 2-3: Specifications for Scanner to be used for Scanning of Mauza Maps

Brand & Model	HP Design jet 815mfp
Scan Resolution, enhanced	2400x2400 dpi, with variable resolution setting from 50 dpi in increments of 1 dpi
Scan Resolution, hardware	800x800 dpi
Bit depth	24-bit color
Levels of grayscale	256
Maximum scan size	42 x unlimited in

Table 2-4: Nomenclature of Image Files (Example)

File Name	XX_XXX_XX		
	XX		Initial Code used for District & Thana/Upazila (1 st digit for District and 2 nd digit for Thana/Upazila)
		XXX	JL No. (3 digits string)
		XX	Sheet No. (2 digit string)

Example: "RS_185_00.jpg" represents the image file in JPG format of Mauza having JL no. 185 & sheet no. 0 of Gangni thana of Meherpur district. Underscores are used as separators of Initial Code, JL No & Sheet No fields.

2.5.4 Digitization of Mauza Maps

On screen digitization method will be used for digitization of Mauza maps. ArcGIS software will be used for this purpose. All features (Line, Point and Annotation) will be stored in different feature type in shape or geodatabase file with separate ID or code number. Proposed manuscripts for digitization of Mauza maps are given in **Table 2-5** and **Table 2-6**. Polygon features would be built using the line, point and annotation features using ArcGIS software. To keep uniqueness of all features the ID or code numbers of respective features will be finalized as per suggestion and discussion with UDD. Following steps would be followed during the process of digitization of individual Mauza maps:

- ✓ Preparing the Manuscript.
- ✓ Converting Digitized Maps to Shape/Geo-database Format.
- ✓ Edit Plot Check.

Preparing the Manuscript

Feature wise, two types of manuscripts shall be developed for digitizing the mauza maps where all the features of mauza sheets shall be stored as shape file with a unique ID or code number for respective features. Details for the two types of manuscripts are described below:

Manuscript-1: Point Features- This manuscript will contain all point features of the Mauza Maps like Plot Number, Bench Mark, Travers Station, GT Station, Iron Pillar, Other Pillars, etc. Every point shall be digitized and stored with a numeric user ID (Code) representing feature type. Details for Manuscript-1 are given in **Table 2-5.**

Table 2-5: Sample Feature Description for Digitization Manuscript-1

SI No	Feature Type	Shape Type	Shape Name	Code (ID)
1.	Mauza Name	Point	xx_xxx_xxP	As in mauza sheets
2.	JL No.	Point		As in mauza sheets
3.	Sheet No.	Point		As in mauza sheets
4.	Plot No.	Point		As in mauza sheets
5.	Unidentified Plot Number (not readable)	Point		99999
6.	Boundary Pillar	Point		41
7.	Bench Mark	Point		42
8.	Iron Pillar	Point		43
9.	Travers Station (Old)	Point		44
10.	Travers Station (New)	Point		45
11.	GT Station	Point		46
12.	Other Pillars	Point		47
13.	Pucca Well	Point		51
14.	Tube Well	Point		52
15.	Mosque	Point		53
16.	Temple	Point		54
17.	Adjacent Mauza/Sheet	Point		61
18.	Any other point feature	Point		88
19.	Demarcation Pillar	Point		71
20.	Settlement Pillar	Point		72
21.	Stone	Point		73
22.	Station	Point		74
23.	Pucca Pillar	Point		75
24.	Municipality Pillar	Point		76
25.	CS Iron Pillar	Point		77

Manuscript-2 and 3: Line & Polygon Features- This manuscript will contain all line and/or closed boundary type features such as mauza boundary, sheet Boundary, plot boundary, road, halot, khal, railway, pond &

water bodies, structures, etc. All the features shall be digitized and stored as line having unique ID (Code) representing feature type. Details for Manuscript-2 are given in **Table 2-6** and attribute database format for digitized mauza map are given in **Table 2-7**.

Table 2-6: Feature Description for Digitization Manuscript-2 & 3

SI No	Feature Type	Shape Type	Shape Name	Code (ID)
1.	Mauza Boundary	Line	xx_xxx_xxl	11
2.	Sheet Boundary	Line		12
3.	Mauza/Sheet Match-line	Line		13
4.	Plot Boundary	Line		14
5.	Road	Line		21
6.	Halot	Line		22
7.	Khal (Canal)	Line		23
8.	River	Line		24
9.	Rail Line	Line		25
10.	Slope	Line		26
11.	North Line	Line		27
12.	Unknown Line	Line		99
13.	Permanent Structure (<i>Dalan</i>)	Polygon	xx_xxx_xxS	31
14.	Tin Shade Structure	Polygon		32
15.	Other Structure	Polygon		33
16.	Pan Baraz	Polygon		34
17.	Pond/Water-body	Polygon		35

Table 2-7: Attribute Database Format for Digitized Mauza Map

Field Name	Description	Data Example
Mz_ver	Mauza Map Version	CS
Layer	Name of the Feature which the field contains	Mauza Boundary Sheet Boundary Mauza/Sheet Match-line Plot Boundary, Road, Halot, etc
Layer_Code	ID of different Features	11, 12, 22, 31, etc
M_Code	Mauza Code	RS_185_00 This code represents the example for the Mauza having JL no. 185, Sheet no. 00 of Gangni Thana, Mymensingh District.
Mauza	Name of the Mauza (as in Mauza Map)	Charpubail, Bakripara, etc
JL_No	JL Number (as in Mauza Map)	185, 169, etc
Sheet_No	Sheet Number (as in Mauza Map)	01, 02, 03, etc. (this would be '00' where the Mauza is within a single sheet)
M_Thana	Name of Thana (as in Mauza Map)	Gangni
M_Dist	Name of District (as in Mauza Map)	Mymensingh
Scale	Original Scale of the Mauza Map (as in Mauza Map)	16" = 1 Mile, 64" = 1 Mile, etc
Sv_Period	Survey Period (as in Mauza Map)	1980, 1984-2000, etc

Field Name	Description	Data Example
Revenue_No	Revenue Survey Number (as in Mauza Map)	728, 730, etc

Converting Digitized Maps into Shape/Geo-database Format

Line, point and annotation features of digitized mauza sheets/maps would be stored in shape/geo-database (ArcGIS) or dwg (Autodesk) format and merged with **master geodatabase or spatial data bank** (final data output) described in **section 2.44.1**. Later on these lines, point/annotation features would be used to build polygon database of mauza maps using ArcGIS.

Edit Plot Check

After digitization of Mauza maps, edit plots of Mauza maps will be produced containing all the features and boundaries with different legend. The digitized Mauza maps will be checked and verified by superimposing on the original Mauza maps using the light table. All possible errors (missing arcs, dislocation arcs, and wrong or missing polygons, labels, ID etc.) will be solved with this edit plot checking and final digital Mauza maps will be prepared. After digitization and necessary edit plot check, both soft and hard copy of all the digital Mauza maps will be supplied to UDD for preservation.

GCP Survey

Ground control points will be selected by photo identification of existing ground features. Considerable number of GCP will be collected as required for the whole project area. All GCPs will be collected by conducting field survey using DGPS and RTK-Total Station Survey method. After collecting DGPS data of the GCP, post processing will be done day to day in the sites. Accuracy level will be maintained within 10 m interval as per ToR.

Aerial Triangulation is a mathematical process used to determine the position and orientation of each photograph at the moment of exposure.

Input for AT	Output of AT
<ul style="list-style-type: none"> - IMU data - GPS (on board) - GCP (collected from field) - Image 	Geo-referenced Stereo Model

Imagine Photogrammetry 2014 will be used as the software for aerial triangulation.

2.5.5 Geo-referencing & Super-imposing of Mauza Maps

After completion of data base preparation, individual maps/ sheets will be geo-referenced with reference to the collected GCP values (Easting and Northing value) in ArcMap using Spatial Adjustment tool. Mouza sheets will be georeferenced with reference to rectified satellite images. After completion of geo-referencing of mauza maps, the total study area can be perceived to Individual plot level.

2.5.6. Joining & Edge Matching of Mauza Maps

After geo-referencing, mauza or sheet boundary will be overlapping with each other or there may be gaps among them. So, edge matching is a very important for producing proper landuse plan of any area. To do this operation consultant will create/draw a common mauza or sheet boundary line whether by removing one from two lines in the boundary or by drawing a new line between the gaps. After this operation the whole project area will be a seamless cadastral map.

2.5.7. Preparation of Study Area Map

After the edge matching mauza maps layout of study area map will be prepared as per specification suggested by PD, UDD using ArcGIS 10.1 software. All the features of mauza maps including plot, mauza and boundary of the project area will be identified and shown in the base/study area maps in separate color. Later on this study area map will be incorporated in the physical and topographic survey maps. Both soft and hard copy of base/study area map will be supplied to UDD as per specification and scale mentioned in the ToR.

2.6 Preparation of Base Map using Satellite Image and Photogrammetric Method

The field of photogrammetry is a rapid science with new technologies being developed constantly. Within a short period of time, the practice of photogrammetry has been changed from analog to digital. The development of digital aerial cameras/satellite has advanced significantly over the past 4-5 years. The use of digital aerial images would be more advantageous for all map and image production, especially for orthophoto generation.

2.6.1 Collection of Satellite Image

Since the internal precision of extracted DEMs is strictly related to the mean scale of photographs, image quality, pixel dimension and obviously, morphology of the area, Image Collection is a crucial part of the project. Image will be collected from Satellite image provider Pleiades. (Purchase Order of Satellite Image is available in **Appendix-01**)

2.6.2 Satellite Image Acquisition

The Pleiades Satellite image in 0.5-meter panchromatic and 2.0 -meter multi spectral four-band images in stereo pairs will be procured. The 0.5-meter pan and 2.0 meter multi spectral imagery will also be fused to yield 0.5-meter color imagery (pan-sharpened).

2.6.3 Image Processing

Base map will be prepared combining mauza maps (CS/RS) and using satellite images of the area. Latest possible image will be collected from an authentic source with resolution of 0.5m. Image processing will be done after collecting raw digital 3D images. The tasks involved in image processing are:

- Epi-polar Correction
- Color Balance
- Contrast Adjustment
- Sharpening
- Pyramid
- Bit Rate Setting

All the image processing tasks will be done in Imagine Photogrammetry Workstation Platform and each and every final output will be finalized by the TL and later on all these outputs will be sinked with master geodatabase or spatial data bank.

2.6.4 GPS/ INS Processing

Raw IMU (GPS/INS) data of image will be processed and adjusted to accomplish Aerial Triangulation. **MATCH-AT and Imagine Photogrammetry-2014** software will be used in processing the aerial triangulation. As it is understood that the proposed assignment includes the works as shown in the flow chart (**Figure 2-1**) in next page, the methodology has been prepared based on these activities and the assignment will be carried out accordingly.

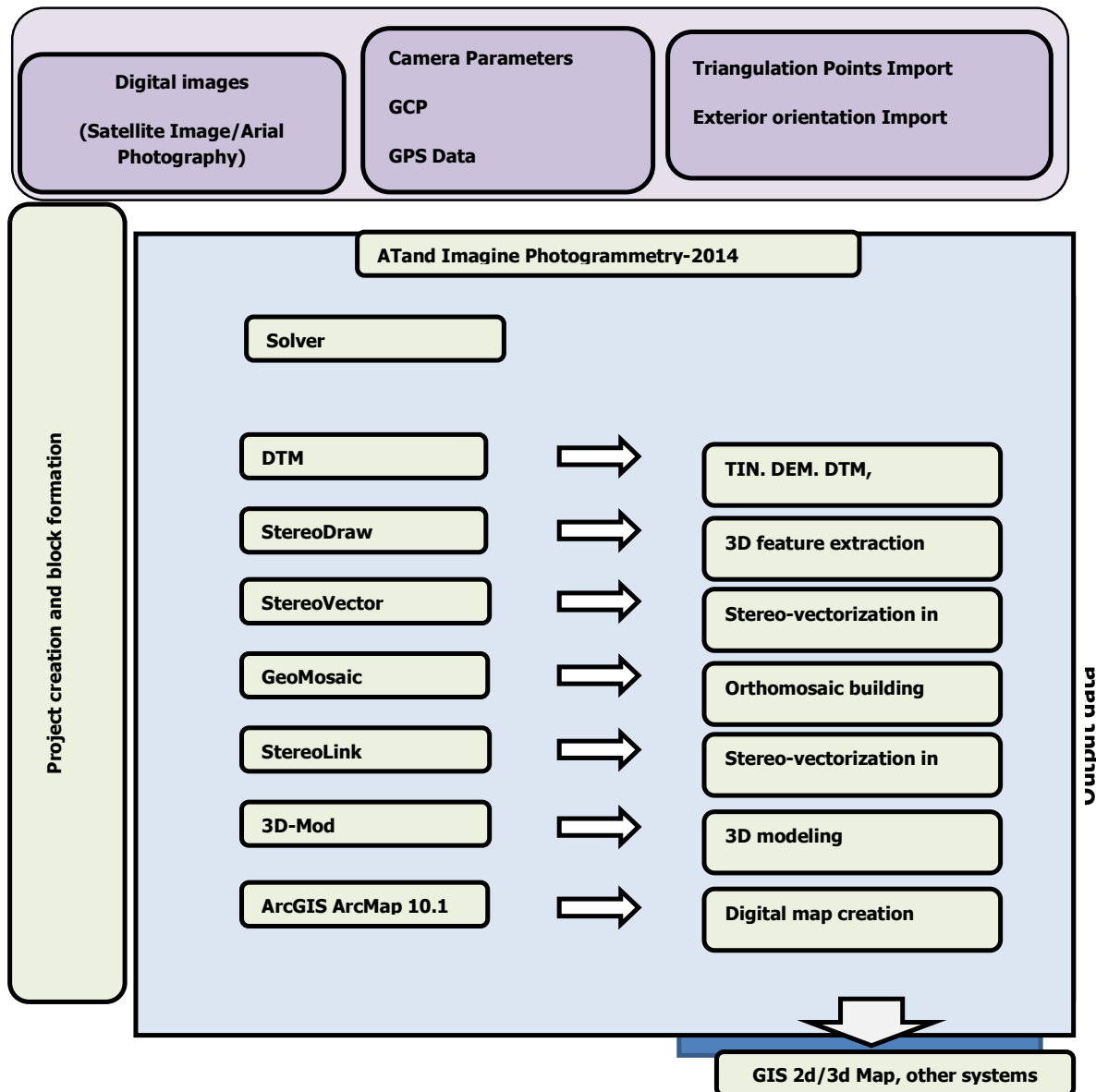


Figure 2-1: Flow Chart of Image Processing Methodology

2.6.5 Digital Mapping from Stereo Model

After the orientation of stereo models, digital mapping will be carried out. We propose ArcGIS Geo-database model for storing geo-spatial data (Window View of Geodatabase is shown in **Figure 2-2**). By the photogrammetric technique of feature collection, each vertex of each feature will be registered in three dimension (3D). The proposed Geo-database and its Feature classes will be designed based on the followings:

- Projection Parameters of the Coordinate System
- Name and type of layer (feature classes)
- Structure of Attribute Tables of the Feature classes

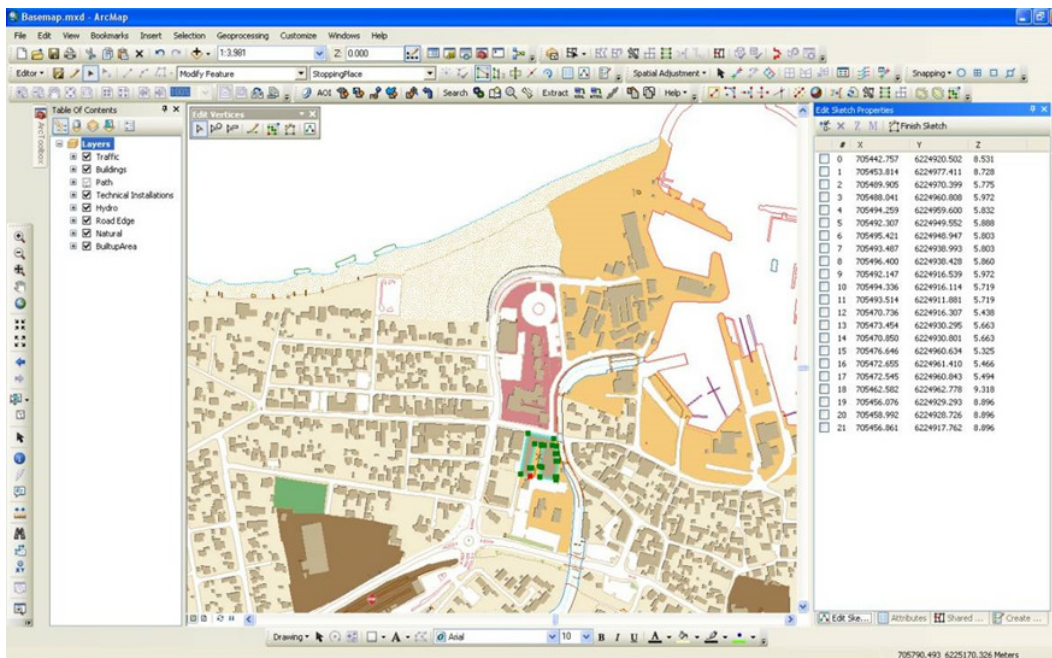


Figure 2-2: 3D Data Structure (Height Value (Z) Enable) and 3D GIS Data Output

2.6.6 DTM/DEM/TIN/Contour Generation

DTM Point

Digital photogrammetry is able to acquire 3D points for high spatial resolution DEM generation through semi-automatic procedures, overcoming the problems of process.

In our approach, DTM Points will be generated from Stereo Pair images by the Imagine Photogrammetry-2014 software, and editing of the software generated DTM points will be done by the Photogrammetric technique comparing them with stereo model. Creation and editing of Break lines will be done after this stage.

CONTOUR

After creating DTM Points, Contour lines will be produced with 1.0 meter contour interval (will be generated by using GCP survey and Spot Survey / Topographic Survey at 10.0 m interval also as per ToR). The contour lines will be delivered in 1 km x 1 km or 5 km x 5 km blocks for the project area. Detail method statement for DTM extraction, contour and DEM generation is shown in **Figure 2-3**.

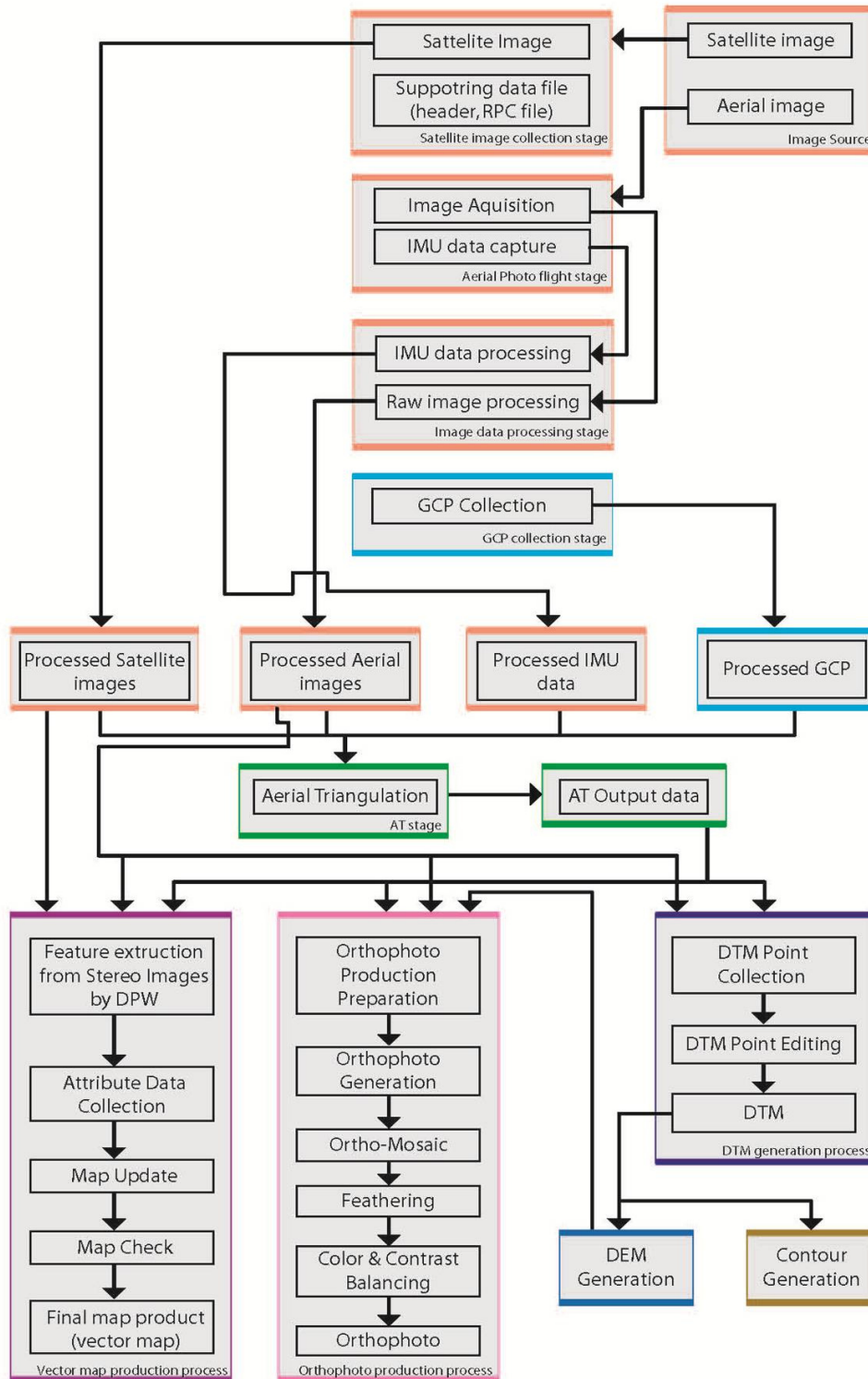


Figure 2-3: Methodology in Flow Chart for DEM and Contour Generation through AT from Satellite Imagery

DEM

Using DTM Points DEM will be generated at a resolution of 1.0 meters in 1 km x 1 km or 5 km x 5 km blocks or one single file for the project area (Sample DEM shown in **Figure 2-4**).

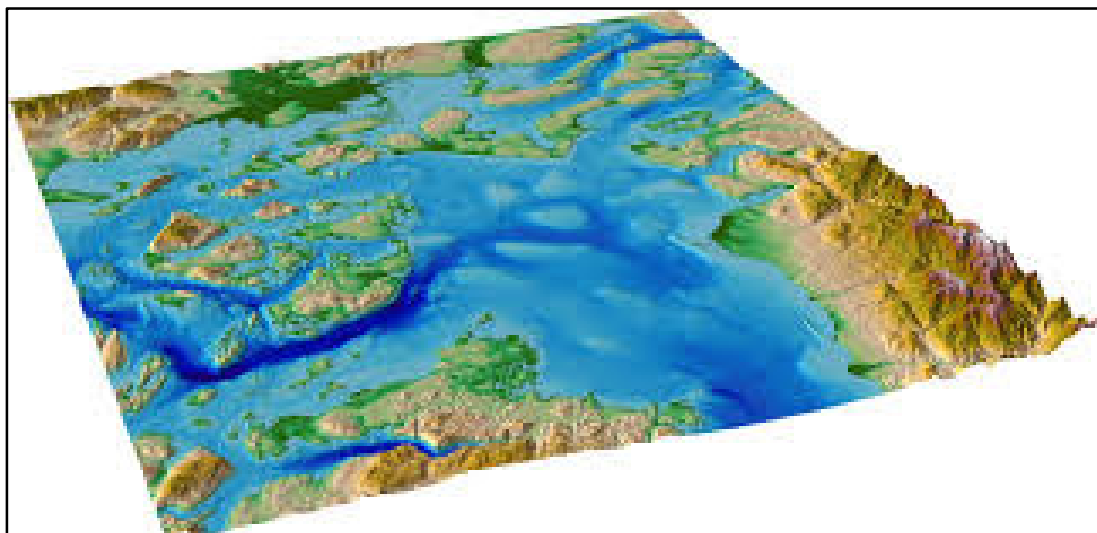


Figure 2-4: Snap Shoot Digital Elevation Model

TIN

Using DTM Points TIN will be generated and delivered in 1 km x 1 km or 5 km x 5 km blocks for the project area.

2.6.7 Ortho-rectification of Images

Ortho-rectification is a process by which image distortions caused by topography and image orientation are geometrically corrected by the incorporation of a terrain model. Ortho-rectification of every image will be carried out using digital photogrammetric system based on result of aerial triangulation and the generated DEM. Obliqueness of the images will be adjusted in this stage.

2.6.8 Mosaic of Orthophoto

- Individual rectified photograph will be assembled to form seamless mosaic.
- Mosaicing of OrthoPhoto includes the following tasks
 - Seam line Drawing: Drawing the boundary of the image delineating which part of the image will go which image.
 - Balancing of Color and Contrast
 - Feathering

Digital Photogrammetric Workstation (DPW) will be used as the platform for acquiring features from digital stereo images (model). A sample 3D Stereo (Photogrammetry) Mapping (Vector Mapping) is shown in **Figure 2-5**.

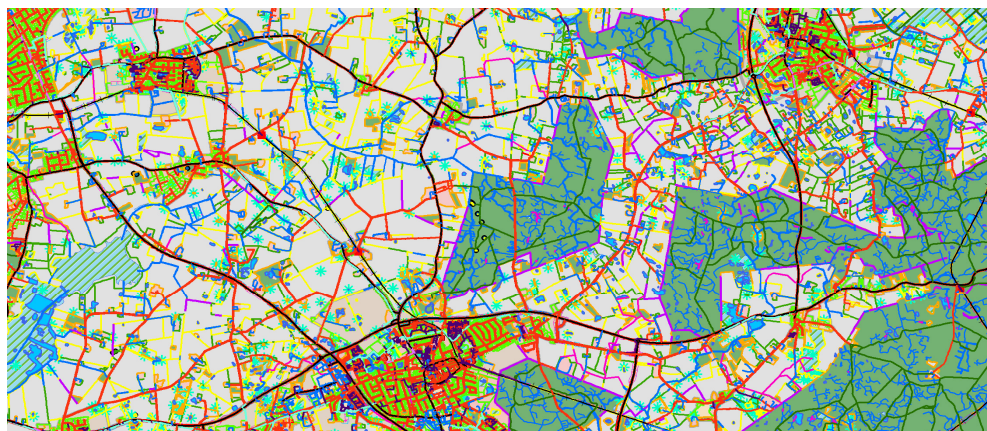


Figure 2-5: 3D Stereo (Photogrammetry) Mapping (Vector Mapping)

All these outputs will be finally merged with master geodatabase or spatial data bank as final output discussed in Section 2.44.1.

2.6.9 Geo-referencing of Mouza Maps

A spatial reference system (SRS) or coordinate reference system (CRS) is a coordinate based local, regional or global system used to locate geographical features on the earth surface. A spatial reference system defines a specific map projection system as well as transformations between different spatial reference systems. Bangladesh Universal Transverse Mercator (BUTM 2010) projection system is used in all the survey and mapping tasks for the project. BUTM 2010 projection System is developed by Survey of Bangladesh (SoB). The following are the projections parameters for BUTM 2010.

Projection Parameters	:	
Projection	:	Bangladesh Universal Transverse Mercator (BUTM 2010)
Spheroid	:	WGS 84
Central Meridian	:	90 Degree East Greenwich
Latitude of Origin	:	0 Degree (The Equator)
False Northing	:	0 Meters
False Easting	:	500,000 Meters
Scale Factor at the Central Meridian	:	0.9996
Coordinate System	:	Geographic Coordinate
System	:	WGS 84
Angular Unit	:	Degree (0.017453292519943299)
Prime Meridian	:	Greenwich (0.000000000000000000)
Datum	:	WGS 84
Spheroid	:	WGS 84
Semi Major Axis	:	6378137.000000000000000000
Semi Minor Axis	:	6356752.314245179300000000
Inverse Flattening	:	298.257223563000030000

Source: BUTM (2010), Survey of Bangladesh (SOB)

All the mapping tasks of geo-referencing of Satellite Imageries, extracted different type of physical features, land uses and cartographic map composition will be performed using BUTM Coordinate System and All these outputs will be finally merged with master geodatabase or spatial data bank as a final output discussed in Section 2.44.1..

2.6.10 Preparation of mosaic Maps & Demarcating the Project Boundary

The latest Gazette of the Upazila will be taken for demarcation of present and extended Upazila boundary for the future growth and expansion considering 20 years growth planning. A consultation meeting will be conducted with participation of Pourashava Mayor, Councilors, Engineer, other staff and local elites to demarcate the existing Pourashava and Ward Boundary.

2.6.11 .Preparation of Project Area Map

Physical features (road, building, waterbodies, embankment, etc.) along with administrative boundaries will be the base information for preparing base map. A standard map having a scale of 3960 will be composed showing the different physical features, administrative boundaries and project boundaries upon the feasible paper size preferably A1. A number of sheets for the base map will be produced at the given scale. All mapping, composing and printing tasks will be done in ArcGIS platform.

2.6.12 .Super-imposing project area map prepared by mouza map and satellite image

Geo-referenced mouza maps will be superimposed on the administrative mouza maps from which we will be able to know the actual geographic boundary of the project. Necessary features from image e.g. roads, rivers, khals, homesteads, agricultural lands, etc. will be superimposed. More necessary layers will be append from different maps which have already been developed by other organizations.

The major task is to prepare a separate GIS coverage with topographical and physical infrastructure feature by fitting to mouza coverage and Compose and prepare Base Maps using the mouza and topographic & physical feature survey data in Mouza Map scale.

2.7 Field Survey Using RTK GPS Based Advanced Survey Technique

2.7.1 Mobilization of Survey Team

Survey Manager along with survey and equipment experts, GPS and Total Station surveyors will be mobilized immediately after approval of the Inception Report by the project authority of UDD.

2.7.2 Ground Control Point (GCP Survey)

GPS and Total Station based advanced survey technique will be used for conducting physical feature, topographic, physical infrastructure and landuse survey. Survey techniques to be used for conducting all types of physical surveys are narrated below.

2.7.2.1 Establishment of Bench Marks (BM)

For GPS and Total Station Survey, establishment of adequate and uniformly distributed Bench Mark is very crucial. Since all the subsequent survey operations are dependent on and related to the Bench Mark, any error simply multiplies and compounds to a huge total deviation. As such accuracy of Bench Mark coordinate values both along horizontal and vertical axes is of utmost importance.

As mentioned in the ToR, covering the project area including approximately 1BM pillar per 5 sq.km. grid in urban area and 1BM pillar per 5.0 sq.km grid rural area (as per drawing provided by UDD). RCC pillars are to

be constructed marking unique identification number Coordinate X, Y of these pillars along with Z value is to be marked on base map for future reference. Establishment of BMs comprises the following item of works:

- ✓ Construction and Installation of BM pillars.
- ✓ Establishment of Co-ordinate of BM Pillars (x, y, z i.e. Northing, Easting & RL in mMSL).
- ✓ Construction and Installation of BM Pillars

The BM pillars will be constructed and installed before the survey work start. The construction design and specification BM pillars will be obtained from the UDD. The BMs will be established with uniformly distributed grid covering the total project area. However, in selecting the sites for BM Pillars following factors will be taken in to consideration.

- ✓ Availability of open sky for good satellite signals.
- ✓ Secure place for long term preservation.
- ✓ Local resistance to installation of pillars at private lands.

2.7.2.2 Establishment of Co-ordinates (x,y,z) of BM Pillars

Establishment of co-ordinates {x, y, z i.e. latitude/northing, longitude/easting & Reduce Level (RL) in MSL} of BM Pillars needs extensive GPS survey and data processing work. The total work comprises the following items:

- Selection of reference BM (x, y, z)
- Baseline survey by RTK-GPS Static Method.
- Network Adjustment

Permanent Benchmarks - Benchmarks that are to remain as reliable elevation references over a period of years, or even for extended construction duration, such as major structures, should generally meet the following criteria:

- Place in stable, undisturbed original ground.
- Establish on abutments or wing walls of older existing structures that have become stabilized.
- Locate near "join" lines of cross streets, intersection of sidewalks and existing facilities outside of the construction area.
- Select locations with locally level terrain. A benchmark on top of a high slope is not as desirable as one lower on the slope, provided all other criteria can be met. Quite often, the positions of horizontal (traverse) points are not compatible with project use of benchmarks, but are compatible with other considerations. In such instances, benchmarks in more usable locations should be established from the traverse control.
- Utilize baseline monuments when practical.
- Benchmarks destroyed during construction activities must be replaced to ensure a minimum of one benchmark per thousand feet.

Temporary Benchmarks - Less permanent benchmarks may be required for a limited use period for a specific survey operation, slope staking. Such stakes are called temporary benchmarks and they are not perpetuated after construction. Temporary benchmarks are usually marked with wooden stakes.

2.7.2.3 Selection of Reference BM

Selection of existing reference BM inside or around the project area is essential for establishment of new BM network for the project area. Reference BM provides geo-reference (x, y) and elevation (z) with respect to a datum i.e. the co-ordinates of the BM pillars. For establishing co-ordinates of the new BMs, the available SoB BMs of the project area has already been collected.

2.7.2.4 Baseline Survey by RTK-GPS Static Method

The Baseline survey is the simultaneous data collection in static mode at two or more fixed points using two or more dual frequency GPS receivers. The measurement network for RTK-GPS baseline survey will be planned by connecting the BM/Control Points to be established and the selected SoB reference BM points (known Latitude, longitude and ellipsoidal height) available inside and around the project area. A line connecting two measurement points is known as baseline. It is important to emphasize that the configuration of network was based on practical considerations rather than requirements of an ideal network.

The GPS measurements consist of a simultaneous static measurement with dual frequency GPS receivers at the ends of a concerned baseline. Measurement or logging time for a session is usually 15 minutes to one hour. During the measurements the GPS receivers at the two points record the information or data (Latitude, Longitude, Ellipsoidal Height) on the configuration of available satellite at the time, which at the end of day's work will be processed using **Spectrum Survey Suite Software v3.5 (L1/L2)**. If results from the field measurements found unacceptable, measurements will be repeated.

Network Adjustment

The verified results of each baseline will be stored for the subsequent network adjustment. After completing the baseline survey, network adjustment will be done with respect to the known values (Latitude, Longitude, and Ellipsoidal Height) of selected SoB reference BMs available inside and around the project area. After network adjustment the precise co-ordinates (Latitude/Northing, Longitude/Easting, and Ellipsoidal Height) of each BM will be obtained.

2.7.2.5 GPS Survey Technique

The Global Positioning System (GPS) is worldwide all-weather radio-navigation and positioning system formed from a constellation of 24 satellites and their 5 nos. ground control & monitor stations. GPS receivers use these US Navigation Satellites for Timing and Ranging (NAVSTAR) to calculate positions accurate to meter of meters. GPS receives radio waves, modulated for positioning, transmitted by a maximum number of 24 satellites, which enables to work out the distance between satellite and observation points. By receiving radio waves from four satellites simultaneously it is possible to find out the three-dimensional co-ordinates and time (UTC) of the observation point with an accuracy level which cannot be conceived in traditional ground survey. The facility of GPS has been utilized in different kinds of ground surveys including geodetic, topographic and hydrographic survey in the recent times. GPS based survey with its computer based data storage and processing facility on and off the field offers immense flexibility in map production under a GIS environment. To ensure precision and accuracy in survey work and to facilitate geo-reference/digital map production by GIS

software and finally to complete the whole work in a rather shortened time schedule, GPS technology is the best and logical approach to be followed.

Differential Global Positioning System (DGPS) and Real-Time Kinematic Global Positioning System (RTK-GPS) are different versions of GPS technology, each with its own range of applicability and accuracy level. DGPS option gives about

- one meter accuracy data and RTK option deliver
- Centimeter position accuracy data.

2.7.2.6 Total Station Survey Technique

Total Station (TS) is combination of electronic theodolite, distance meter and leveling machine with on-board computer having graphic icon menu with LCD display and built-in MS-DOS operating system. It can measure and store the positioning data of a target point in digital form. It consists of a microprocessor with special software for operation, data capture, storage & processing, transmission and receiving to/from a computer. The data can be stored in internal memory or in external memory card. It transmits ledger beam towards the target where a reflector (i.e. prism) is placed and receives the reflected beam by which calculate the distance, bearing and 3-D coordinate of that target point with respect to the reference points whose coordinates are known. Measurements to be done by a Total Station survey technique are as below:

- Distance measurement.
- 3-dimensional co-ordinate measurement (x, y, z).
- Traverse-style co-ordinate measurement.
- Resection.
- Offset measurement.
- Missing line measurement.
- Remote elevation measurement.

2.7.2.7 Survey Data Processing (GPS and Total Station Data)

To transfer the survey data to a computer in a usable format. These involve copying the data from the CF cards to a computer's hard-drive. Once on the hard-drive the data can be processed using software provided by the manufacturer. The result is a table which includes information on each point acquired, such as the time recorded, coordinates, elevation, and quality. The table can be copied into a text file or a spreadsheet, ready for further processing and lastly it will merged with **master geodatabase or spatial data bank** as a final output discussed in **Section 2.44.1**.

2.7.2.8. Preparation of Map Layout and Legend

Map layout is the presentation format of map which will also present the legend, scale north sign and also the approval authority of the map. The final map layout proposed by the consultant is enclosed herewith in **Figure 2-6** and legend of different physical feature is given in the following **Figure 2-7 to 2-9**.

2.8 Physical Features Survey

Before deployment of the survey team, base map for conducting field level surveys shall be prepared using both high resolution satellite image and Mauza maps of the project area. Base map shall be compiled with major road network of the project area, important infrastructures, permanent & prominent physical features/structures etc. superimposed on Mauza maps having all Mauza features. Physical features shall be surveyed using RTK GPS and Total Station (TS) survey technique. Location of all existing structures and installations along with types in respect of use, construction and number of storey will be surveyed. Names of structures, type of construction, uses and storey etc will also be recorded during physical feature survey. Survey will also cover location of all existing exposed light/electric, telephone posts and towers, water supply structures, roads etc. Data will be recorded with separate ID or code number for each feature (as Line, Point and Polygon). Later on the survey data will be transferred directly to the GIS database where the feature will be kept in separate layer with specified code or ID. Physical feature survey information will be presented on CS/RS Mauza maps. Physical feature survey format attached in **Appendix-02**. All these outputs will be finally merged with master geodatabase or spatial data bank as a final output discussed in Section 2.44.1.

2.9 Topographic and Drainage Survey

The Topographic database shall be obtained from geo-referenced 3-D (four band) image and further cross-checked and ground truthing by using RTK-GPS and Total Station to obtain and verify 3-D data (X.Y.Z value) on location and alignment of all data obtained from physical feature survey including roads, flood embankments and other drainage divides. Location and alignment of all drainage and irrigation channels/canals showing depth and direction of flow. Closed boundary/outline of homestead, water bodies, swamps, forest etc. junctions, spot heights or land levels at roughly 10.0 m intervals for the whole project area and close interval as and when required such as dyke, embankment, roads, rail-roads, river bank, rail line etc.

The Total Station survey groups/teams will be responsible for measurement of spot levels (Northing, Easting, Elevation or RL) for contour generation. In general the spot levels on the land will be taken at 10m interval in urban area and rural area. In addition, most of the physical infrastructures will also be surveyed by the TS team. The exposed utility pole and alignment of exposed utility lines will be surveyed using both TS & DGPS. The secondary BMs established by RTK-GPS will be used by the Total Station Groups as reference (Station and Back Point). 1.0 m interval contour map (Topographic Map) will be prepared at 1"=330' or 1: 3960 scale. DGPS will be used for surveying the location/alignment of all roads, flood embankments and other drainage divides as well as closed boundary/outline of homestead, water bodies, swamps, forest etc.

DGPS group will measure and store the alignment in x and y co-ordinates of roads, embankment and other line features. The point and closed boundary features also surveyed by the DGPS groups. The optical teams will pick-up the crest level of the road at not exceeding 10m intervals. DGPS group is responsible for taking the position and the information of the structures (hydraulic structures, bridges and culverts etc.). At the end of day's survey, the DGPS data will be downloaded, processed and stored into GIS database. Names of settlements, village, rivers, khals, roads, markers, etc. will be also presented on the topographic map. Topographic survey format attached in **Appendix-03**.

Software Required: MATCH-AT

2.9.2 Deliverable

For the topography survey necessary latitudes, longitudes and land surface level of BMs, TBMs, GCP, etc. and necessary attributes of structures, roads, drains, rivers, canals, etc. as per requirements of the ToR and guideline provided by PMO will record in Log Book for the convenience of the survey. The information cover and record through topographic surveys are follows

- Land levels/spot level for contours at 50m intervals with denser intervals for undulations.
- Alignment and crest levels (not exceeding 50m) of road, embankment, dykes and other drainage divides
- Alignment of rivers, lake, canal and drainage channels etc.
- Outline of bazaars, water body, swamps etc.
- Type, width, length and name of road and name of road above flood level.
- Contour line would be generated at 1.0 m interval
- All these outputs will be finally merged with master geodatabase or spatial data bank as a final output discussed in Section 2.44.1.

2.10 Land Use Survey

Landuse survey basically records the use of land by its smallest units of area and functional activity such as residential, industrial or commercial etc. Total Station and DGPS based topographic and physical features survey data will be used for landuse map preparation. During Topographic and physical feature survey, each survey feature/structure will be recorded with individual ID or code. Later on landuse features will be extracted/identified and classified using the recorded code and separated in different layers during data processing stage, from where the category wise landuse map will be drawn using the identification layers of each landuse feature. Later on the landuse map will be updated through field checking and verification. The landuse map will be prepared indicating the broad categories of landuse described in ToR. Broad categories of landuse described in **Appendix-04**.

Deliverable:As stated before, utilizing the physical features survey overlay on Mauza map the landuse map will be prepared indicating the categories of land (as mentioned in the format of landuse survey in ToR). The Landuse Map will be prepared on RS Mauza base at 1" = 330' or 1:3960 scale. All these outputs will be finally merged with master geodatabase or spatial data bank as a final output discussed in Section 2.44.1.

2.11 GIS Mapping

Geographic information System (GIS) software such as Arc GIS 10.1 will be used for processing of physical survey data. As there is no mention in the ToR regarding the legend, layout and other specification of physical survey maps (layout, size etc.) will be finalized in consultation with the project authority of UDD during map preparation process, The well known Triangulated Irregular Network (TIN) method will be applied to draw contour lines. AS per ToR the consultants will prepare the survey maps incorporating the features of CS/RS Mauza maps and other features as mentioned in the Survey Formats (Physical Feature, Land use, Topographic and Physical Infrastructure Survey Format). Technical Specification of GIS Data is provided at **Appendix-05**.

2.12 Field Verification of Physical Feature Survey and Updating Maps

After preparation of physical survey maps, one set of colored maps (topographic and physical infrastructure, physical feature and land use) will be plotted in 1:3960 scale for field level verification. For the quality of survey and mapping the field level checking will be supervised and monitored by the joint team of UDD and consultants.

2.13 Database Preparation

2.13.1 Data Precession of Digitization of Mauza Maps

In Data Precession of Digitization of Mauza Maps with ARC/INFO version 10.1 the accuracy level will be considered ± 0.002 inches as per ToR and All the outputs will be finally merged with master geodatabase or spatial data bank as a final output discussed in Section 2.44.1.

2.13.2 Map Layout

Table 2-8 shows the tentative map scale for preparation of base map and final maps, on the other hand **Figure 2-6** shows the tentative map layout on which all the features will be plotted.

Table 2-8: Scale for Map Layout Preparation

SI. No.	Description of Map	Scale
1	Mauza Map	Original Mauza Scale
2	Original collected Mauza maps	Original Mauza Scale
3	Study Area Map (for field survey)	1" = 330' or 1:3960
4	Field Survey (Original survey marking)	1" = 330' or 1:3960
5	Physical Feature Survey Map	1" = 330' or 1:3960
6	Land use Survey Map	1" = 330' or 1:3960
7	Topographic Survey Map	1" = 330' or 1:3960
8	Road network Map	1" = 330' or 1:3960
9	Utility Services Map	1" = 330' or 1:3960
9a	Khal/ Drainage/sewerage	1" = 330' or 1:3960
9b	Gas/Electricity/Water Supply	1" = 330' or 1:3960
10	Base Map (for plan preparation)	1" = 330' or 1:3960
11	Structure Plan	1: 10,000
12	Urban Area Plan	1" = 330' or 1:3960
13	Landuse Plan	1" = 330' or 1:3960
14	Drainage & Environmental Management Plan	1" = 330' or 1:3960
15	Risk Map	1" = 330' or 1:3960
16	Population Density Map	1" = 330' or 1:3960
17	Transportation & Traffic Management Plan	1" = 330' or 1:3960
18	Utility Services Network Plan	1" = 330' or 1:3960
18a	Sewerage/ Drainage network Plan	1" = 330' or 1:3960
18b	Gas/Electricity Plan	1" = 330' or 1:3960
18c	Water Supply Plan	1" = 330' or 1:3960
19	Detailed Area Plan	1" = 330' or 1:3960
19a	Road network Plan	1" = 330' or 1:3960
19b	Sewerage/ Drainage network Plan	1" = 330' or 1:3960
19c	Gas/Electricity Plan	1" = 330' or 1:3960

19d	Water Supply Plan	1" = 330' or 1:3960
19e	Landuse Plan	1" = 330' or 1:3960

2.13.3 Thematic Maps

- Water supply: source, distribution line & installations.
- Drainage & flood protection: storm water, rainwater, in-let, out-let.
- Electricity: source, distribution line & installations (primary, secondary, and tertiary).
- Gas: source, distribution lines & installations (primary, secondary, and tertiary).
- Sanitation: source, distribution lines & installations (primary, secondary, and tertiary).
- Household, industrial, clinical wastes collection, dumping, and treatment & sludge disposal.
- Accessibility: circulation, passenger & goods movement (motorized & non-motorized), walkways, station stoppage, waiting & parking facilities.
- Heritage, open space conservation & maintenance
- Land level: Buildable land, landfill (frame 2' and 3' interval).
- Recreation (open, close)
- Housing (High, medium, low income)
- Employment (industry, commerce, informal employment)
- Special area (KPI, military, flood prone, earth quake prone, hazardous industry)
- Social infrastructure (education, health care, community use, religious, bank, post office, police, fire brigade, assembly place)
- Land ownership (private, khas, Govt. acquisition for various agencies, vested)
- Commitment area (Govt. private for development work)

2.13.4 Map Legend

Map legend will incorporate all categories of features (point, line, and polygon) in map layout to give a clear view. The legend item may increase or decrease as per requirement based on physical survey with prior approval from UDD. The palette name/number (both pen and marker) and size need to be finalized with respect to scale of the map at the inception of the project. The final map legend proposed by the consultant is enclosed herewith in **Figure 2-7** to **Figure 2-9**.

North Arrow	Map Heading/Title	Drawing No
Map View Frame		
CLIENT	Name of the Project	CONSULTANT
	Linear Comparative Scale (Meter & Feet)	INDEX MAP
Signature		
	Data Source Reference Bench Mark (BM)	
	LEGEND	

Figure 2-6.: Tentative Map Layout

Map Legend

Category	Symbol	Color and Size
Administrative/Revenue/Project Boundaries		
International Boundaries		True Black, Size 6.0, (Size 4.50 , Color Sector R-255, G-190, B-232)
Divisional Boundaries		True Black, Size 1.65, (Size 4.25 , Color Sector R-255, G-190, B-232)
District Boundaries		True Black, Size 1.50, (Size 4.25 , Color Sector R-255, G-190, B-232)
Upazila Boundaries		True Black, Size 1.30, (Size 4.25 , Color Sector R-255, G-190, B-232)
Union Boundaries		True Black, Size 1.20, (Size 4.25 , Color Sector R-255, G-190, B-232)
Mauza Boundaries		True Black, Size 1.00, (Size 4.25 , Color Sector R-255, G-190, B-232)
City Corporation Boundaries		Blue, Size 6.00, (Size 4.25 , Color Sector R-255, G-190, B-232)
Paurashava Boundaries		True Black, Size 1.20, (Size 4.25 , Color Sector R-255, G-190, B-232)
Ward Boundaries		Blue, Size 1.30, (Size 4.25 , Color Sector R-255, G-190, B-232)
Mauza Sheet Boundaries		Blue , Size 1.20, (Size 4.25 , Color Sector R-255, G-190, B-232)
CS/RS/SA/BS P lot Boundaries		True Black, 1.00
Transport Networks		
National Highway		Red, True Black, Size 4.25, (Size 4.25 , Color Sector R-255, G-55, B-55)
Regional Highway		Red, True Black, Size 3.85, (Size 4.25 , Color Sector R-255, G-55, B-55)
Zila Road		Red, True Black, Size 3.85, (Size 3.70 , Color Sector R-255, G-55, B-55)
Pucca Road		Blue, Size 2.4, (Color Sector R-0, G-112, B-255)
Semi Pucca Road		Size 1.15, (Color Sector R-197, G-0, B-255)
Kutchra Road		Size 1.00, (Color Sector R-185, G-0, B-255)
Footpath		Size 2.60, (Color Sector R-115, G-223, B-255) (Color Sector R-223, G-115, B-255)
Road Island		Size 2.60 (R-255, G-255, B-115) (R-223, G-115, B-255)
Railway Line (Broad Gauge)		True Black
Railway Line (Meter Gauge)		True Black
Utility and Services		
Power Station/Sub-Station		(R-0, G-255, B-0)
Pumphouse		(R-255, G-0, B-0)
Irrigation Wells (Deep & Shallow)		True Black, 15, (R-255, G-127, B-127)(R-255, G-127, B-127)
Refuelling Station (Gas/Petrol Pump)		Size - 15,(R-0, G-255, B-0)
Tower (Radio/T V/Tele-com/Mobile)		True Black, 16
Telephone Exchange		Size - 15,(R-205, G-46, B-49)
Water Treatment Plant		True Black, 15, (R-255, G-127, B-127)
Overhead Tank		True Black, 15, (R-255, G-0, B-0)
National Grid Pole		True Black, 15, (R-56, G-168, B-0)
Electricity Pole		True Black, 25
Telephone Pole		True Black, 25
Primary School		True Black, 15, (R-209, G-255, B-115)

Figure 2-7: Tentative Legend use to Demonstrate the Feature in the Map

Map Legend

Category	Symbol	Color and Size
Utility and Services		
High School		True Black, 15, (R-209, G-255, B-115)
College		True Black, 15, (R-209, G-255, B-115)
University		True Black, 15, (R-209, G-255, B-115)
Madrasa/Fazil/ Kamil		True Black, 15, (R-209, G-255, B-115)
Mosque		True Black, 15, (R-255, G-255, B-115)
Temple		True Black, 15
Church		True Black, 15
Police Station		True Black, 18, (R-255, G-0, B-0)
Fire Fighting Station		True Black, 18, (R-255, G-0, B-0)
Post Office		True Black, 15, (R-255, G-0, B-197)
Bank		True Black, 15, (R-255, G-239, B-164)
Hotel		True Black, 14
Restaurant		True Black, 20
Airport		True Black, 18
Launch Terminal		True Black, 20
Ferry Ghat		True Black, 20
River Port		True Black, 20
Raiway Station		True Black, 18, (R-115, G-0, B-0)
Bus Terminal		True Black, 25
Bus Stop		True Black, 25
National Power Grid		True Black, 1
Electricity Line		True Black, 1, (R-223, G-115, B-255)
Telephone Line		True Black, 14
Drainage Line		True Black, 12
Water Supply		Size 12, (R-0, G-197, B-255)
Gas Pipe Line		Size 12, (R- 245, G-202, B-122)
Structures		
Pucca		True Black, 1, (R-255, G-115, B-223)
Semi Pucca		True Black, 1, (R-115, G-178, B-115)
Kutchha		True Black, 1, (R-255, G-211, B-127)
Tin shed		
Geo-technical Features		
Fault Line		True Black, 14
Physical Infrastructures		
Flood Embankment		True Black, 3, (R-255, G-255, B-0)(R-255, G-167, B-127)

Figure 2-8: Tentative Legend use to Demonstrate the Feature in the Map

Map Legend

Category	Symbol	Color and Size
Physical Infrastructures		
Flood Wall		Size 20 (R-202, G-122, B-245)
Road Embankment (Pucca)		Size 3 (R-205, G-245, B-190)(R-115, G-178, B-255)
Road Embankment (Kutcha)		Size 3 (R-205, G-245, B-190), True Black
Bridge/Culvert		True Black 25
Sluice Gate		True Black 25
Retention Pond/Reservoir		True Black, Size 50
Land Use		
Residential		Size 1 (R-255, G-170, B-0)
Business & Mercantile		Size 1 (R-255, G-255, B-0)
Public Administration		Size 1 (R-209, G-255, B-115)
Industrial and Storage		Size 1 (R-114, G-137, B-68)
Diplomatic		Size 1 (R-223, G-115, B-255)
Mixed (Resi-Com)		Size 1 (R-102, G-153, B-205)
Mixed (Resi-Off)		Size 1 (R-255, G-167, B-127)
Office (Private/Non-Government)		Size 1 (R-56, G-168, B-0)
Agricultural		Size 1 (R-76, G-230, B-0)
Forest		Size 1 (R-168, G-168, B-0)
Educational and Research		Size 1 (R-202, G-122, B-245)
Health Services		Size 1 (R-137, G-68, B-68)
Religious		Size 1 (R-205, G-205, B-102)
Recreational		Size 1 (R-251, G-234, B-81)
Utility and Services		Size 1 (R-0, G-132, B-168)
Assembly		Size 1 (R-232, G-190, B-255)
River		True Black 1 (R-115, G-223, B-255)
Char/Sandy		True Black 1
Canal/Khal		Size 1 (R-115, G-223, B-255)
Lake		Size 1 (R-115, G-223, B-255)
Pond		Size 1 (R-115, G-223, B-255)
Ditch		Size 1 (R-64, G-101, B-235)
Low/Mersh Land		Size 1 (R-115, G-223, B-255)
Open Space		Size 1 (R-168, G-168, B-0)
Security/Defense		Size 1 (R-255, G-170, B-0)
Parks and Play Ground		Size 1 (R-115, G-76, B-0)
Institution		Size 1 (R-200, G-130, B-130)
Drain		Size 1 (R-169, G-0, B-230)
Others		
Bench Mark (BM)		True Black 15 (R-255, G-0, B-197)
Ground Control Point (GCP)		True Black 15 (R-255, G-0, B-197)

Figure 2-9:Tentative Legend use to Demonstrate the Feature in the Map

2.13.5 Development of Textural Database in SPSS

All the surveyed data (qualitative data) will be stored and later will be used for preparing statistical database in SPSS 16.0 system.

2.14 Survey Data Processing (GPS and Total Station Data)

To transfer the survey data to a computer in a usable format. These involve copying the data from the CF cards to a computer's hard-drive. Once on the hard-drive the data can be processed using software provided by the manufacturer. The result is a table which includes information on each point acquired, such as the time recorded, coordinates, elevation, and quality. The table can be copied into a text file or a spreadsheet, ready for further processing.

2.15 Physical Feature Survey

2.15.1 Method

The similar approach will be deployed to conduct Physical Features Survey. RTK-DGPS experts will walk over the both sides of the road or embankment with the DGPS rover unit in a backpack to measure and store the alignment in x and y co-ordinates of roads, embankment and other line features roughly at 1 to 3m intervals. The point and closed boundary features also survey by the DGPS groups. DGPS group will also responsible for taking the position and the information of the structures (hydraulic structures, bridges and culverts etc.). At the end of day's survey, the DGPS data will be downloaded and post-processed in the office using GNSS Solution and MSCAD Software and stored into GIS database.

Software Required: GNSS Solution, MSCAD Software and ESRI ArcINFO 10.1

2.15.2 Deliverable

For existing physical infrastructure survey necessary latitudes, longitudes and land surface level of BMs, TBMs, GCP, etc. and necessary attributes of structures, roads, drains, rivers, canals, etc. as per requirements of the ToR and guideline provide by PMO will record in Log Book for the convenience of the survey. The detail manuscript of GIS database preparation is given in **Appendix-05**. The information covered and recorded through physical features surveys are follows

- Cross section, long section, type, width, length and name of road, road level above datum, flooding lands, slopes, borrow pit.
- Identification of any bridge or culvert on the road their length, width and span of the bridge, condition of abutments, condition of the deck, wing walls abutments.
- Type, size, depth, inlet and outlet location of drain along with flow direction width and depth of the canal, place of encroachment.
- Type of sewer system, size, type and location of sewerage line, location of bins, identification of any other sewerage collection system.
- Identification of the water supply system, location of overhead waters tank and its capacity, catchments area of overhead tank.

- Identification, location and capacity of electric substation, telephone exchange, Titas gas sub station etc. Treatment plant, waste disposal facilities.
- Identification, location and capacity of electricity, telephone, gas waste disposal and treatment system.
- All these outputs will be finally merged with master geodatabase or spatial data bank as a final output discussed in Section 2.44.1.

2.17 Land Use Survey

The methodology undertake the land use survey used a process based upon a ToR defined landuse classification. The following steps will be followed to conduct the survey. General steps in creating landuse survey Plan

- Obtain source data: Mouza map from DLRS
- Create Geo-referenced and digitized Mouza map
- Create Supervised and Unsupervised Landuse Classification Map based on Sattelite image and superimpose with Mouza Maps.
- RTK-GPS and Total Station survey
- Record Landuse data in GIS attribute table with necessary Mouza map information
- Perform various quality control measures such as field checks
- Create maps, tables, reports etc.

2.17.1 Method

Equipment, Computer, and software will use for conducting physical feature, topographic and landuse survey campaign and data processing activities are listed and described below

Equipment and Software Requirement:Number of advanced survey equipment including Real Time Kinematic Global Positioning system (RTK-GPS) and Differential Global Positioning system (DGPS), Total Station (TS) Level Machine and vehicles were deployed in the field for conducting survey activities. The RTK-GPS will use in this survey provide milimeter level accuracy. GNSS Solution and MSCAD software are used for post-processing of RTK and Total Station based survey data. On the other hand, GIS based Arc/Info, Arc/GIS 10.1 are used to perform the survey data management and presentation and preparation of map layout.

Map Preparation:The maps prepared through physical survey have been used as base maps for landuse survey. Landuse features have been identified and classified using the recorded code and separated in different layers during data processing stage, from where the category wise landuse maps were drawn using the identification layers. To derive landuse map it was sometimes necessary to divide plots. This task was carefully done on the basis of extent of structures presented in the plot. If maximum portion of a plot is covered by residential structures then this plot has been identified as residential plot. If only one kind of structures cover a small portion of the plot then that plot has been divided proportionally. And this procedure has been followed for all cases.

2.17.2 Deliverable

Spatial data are characterized by information about the position, connections with other features. These spatial data can be represented as either layers based or object oriented approach. In both approaches the data must be simplified with feature wise separate entities before incorporate in the GIS database. These entities are: point features, polygon features and polyline features.

Attribute is the non-spatial data associated with spatial data i.e. point, line and polygon/area entities. Attributes give additional information about the character of the entities. The all attribute data are managed using GIS software. At the end all these outputs will be finally merged with master geodatabase or spatial data bank as a final output discussed in Section 2.44.1. In the following **Table 2-9** has shown the categories of land use survey,

Table 2-9: Categories of Landuse Survey

SL	Landuses	Illustrated
1	Residential	-Planned,unplanned,averagedensity(high,middleandlow)
2	Commercial	-Establishedmarketsandareasearmarkedformarkets
SL	Landuses	Illustrated
	Industrial / Processing and	
4	Educational & Research	-Primary/ secondary/ other schools
5	Community Services	Association, Auditorium, church and club etc
6	Service Activity	Clinic, Commercial Group Office, Service activity office etc.
7	Recreational Facility	-Parks, play/ sports grounds, indoor facilities, zoological garden
8	Governmental Services	All Types of Governmental Office
9	Non-Governmental Services	International Organization Office and NDOs etc.
10	Urban Green Space	Botanical Garden, Ecological Park, Graveyard etc.
11	Transport & Communication	Airport, Bust-Truck Terminal, Filling Station and Garage etc.
12	Agricultural	-All types of agricultural uses
13	Mixed use	-Mixed areas without a dominant landuse (Residential, commercial,
14	Circulation Network	Foot path, Katcha Road, Pucca Road and Railway etc.
15	Water Body	Beel, Ditch, Pond, Khal and River etc.
16	Forest	Natural and Man-Made Forest
17	Vacant Land	All unused fallow land
18	Miscellaneous	
19	Restricted	Air force, Ansar, Army, BDR, BNCC, and Cantonment etc.

2.17.3 GIS Based (MCDA) Landuse Modeling

Formerly landuse planning in Bangladesh is assumption and consultation oriented and uses of technical modern techniques are very much absent. Digital landuse modeling is a newly emerged concept widely using in developed and developing countries all over the world to apprehend the more accuracy in planning. To introduce few of those technique the consultant is willing to offer some GIS based modeling techniques to carry out the responsibility for detail planning of three Upazilas. Modeling technique will be used for three specific phases

Phase-I: Prediction of future landuses based on existing base scenario.

Phase-II: Identification potential conflicts and most suitable choice of future landuse

Phase-III: Incorporation of stakeholder inputs in the modeling.

To perform phase-I and phase-II the consultant is offering two separate GIS based model as- Land Transformation Model (LTM) and Multiple Criteria Decision Analysis (MCDA) model respectively. For phase-III conventional approach will be followed.

Phase-I: Predicting Land Transformation

The spatial and temporal distribution of land use and land cover is very important in understanding a wide variety of global change phenomenon. Data from remote sensing helps us to monitor such changes but future estimates of change are hard to tell. As such, it is necessary to have reliable information on the land use/cover and an understanding of the changes that occur within them and forecasting it for future estimation.

The Land Transformation Model (LTM), which couples geographic information systems (GIS) with artificial neural networks (ANNs) to forecast land use changes, is offered here by the consultant team. A variety of social, political, and environmental factors contribute to the model's predictor variables of land use change. Although the landuse modeling technique is very much new in Bangladesh specially at urban planning sector. Through modeling the consultant team will explore how factors such as roads, highways, residential streets, rivers, Great Lakes coastlines, recreational facilities, inland lakes, agricultural density, and quality of views can influence urbanization patterns.

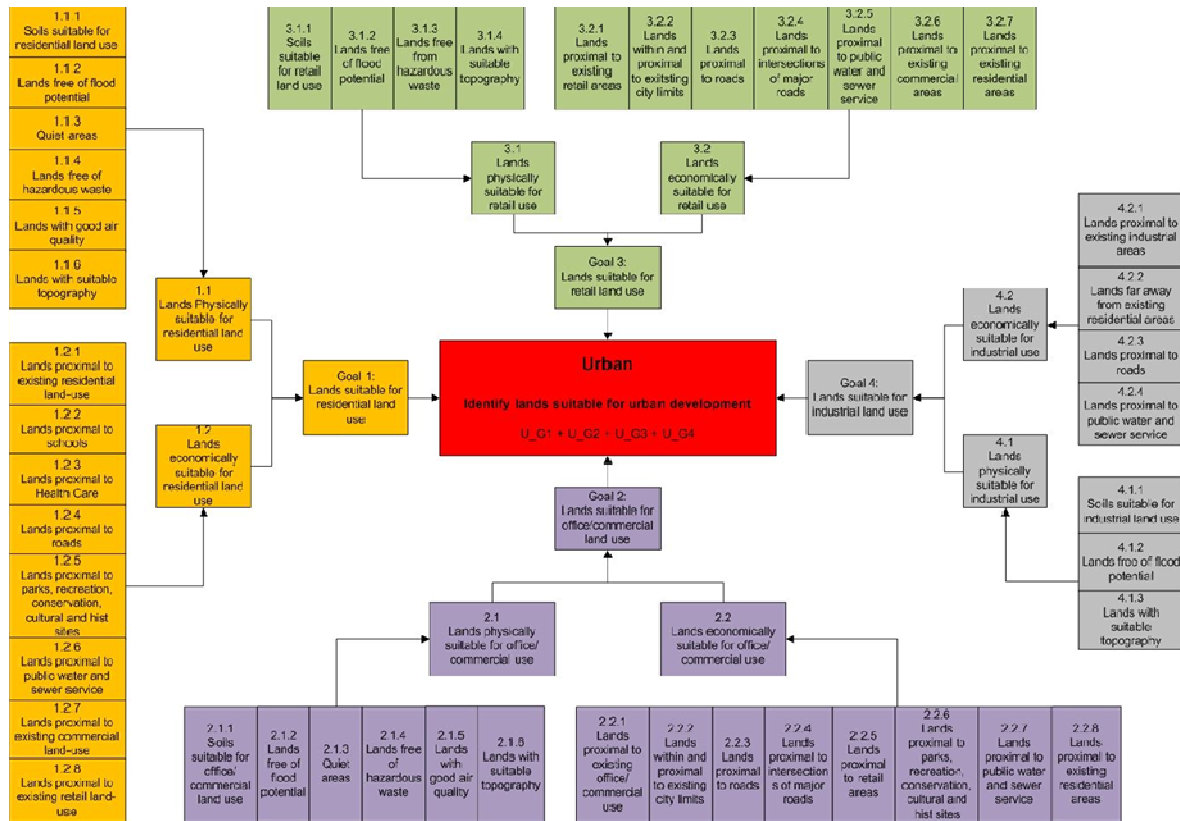


Figure 2-10: Urban land-use model by Considering Different Planning Parameters

Phase-II: Landuse Conflict Identification and Selection of Best Suitable Landuse

Multi-criteria decision aid (MCDA) methods are used to support decision making in case of problems where conflicting economic, environmental, societal, technical, and aesthetic objectives are involved. Basically, MCDA can be subdivided in two parts: Multi-attribute and Multi-objective decision analysis, (MADA and MODA). With Multi-attribute analysis, there are a limited number of predetermined outcomes (option A, B, C or D). Weightings will determine which of the options the best solution is with Multi-objective analysis, however, the possible outcomes are undefined beforehand. Solutions are found using algorithms and standard linear-integer programming. MADA and MODA can be further subdivided by the number of goals of decision makers. MCDA are often integrated in Spatial Decision Support Systems (SDSS). An SDSS is an application that uses analytical methods and models to define alternatives, it is able to analyze their impact, and interpret and select the best option for implementation. Most SDSS focus on a specific field, and are therefore adapted to the characteristics of the problems in this field.

AHP (Analytic Hierarchy Process) is a MCDA approach which was started to be developed in the 70s. This method consists of three distinct phases, which are derived from three principles: 1) the principle of “constructing hierarchies”; 2) the principle of “establishing priorities”; 3) the principle of “logical consistency”.

The LUCIS model

LUCIS stands for Land-Use Conflict Identification Strategy, and was developed at the University of Florida (Department of landscape architecture and department of urban and regional planning). This GIS model is goal driven, and produces a spatial representation of probable patterns of future landuse. There are three major land-use categories: urban, agriculture and conservation. Each of these categories consisted of goals, objectives and sub objectives. Weights were used to assign importance to each of them. The model consists of five general steps, which are shown in **figure 2-11** and some models regarding the schematic process for developing sub-objectives, goals and achieving results are shown in **Figure 2-12** and **Figure 2-13**.

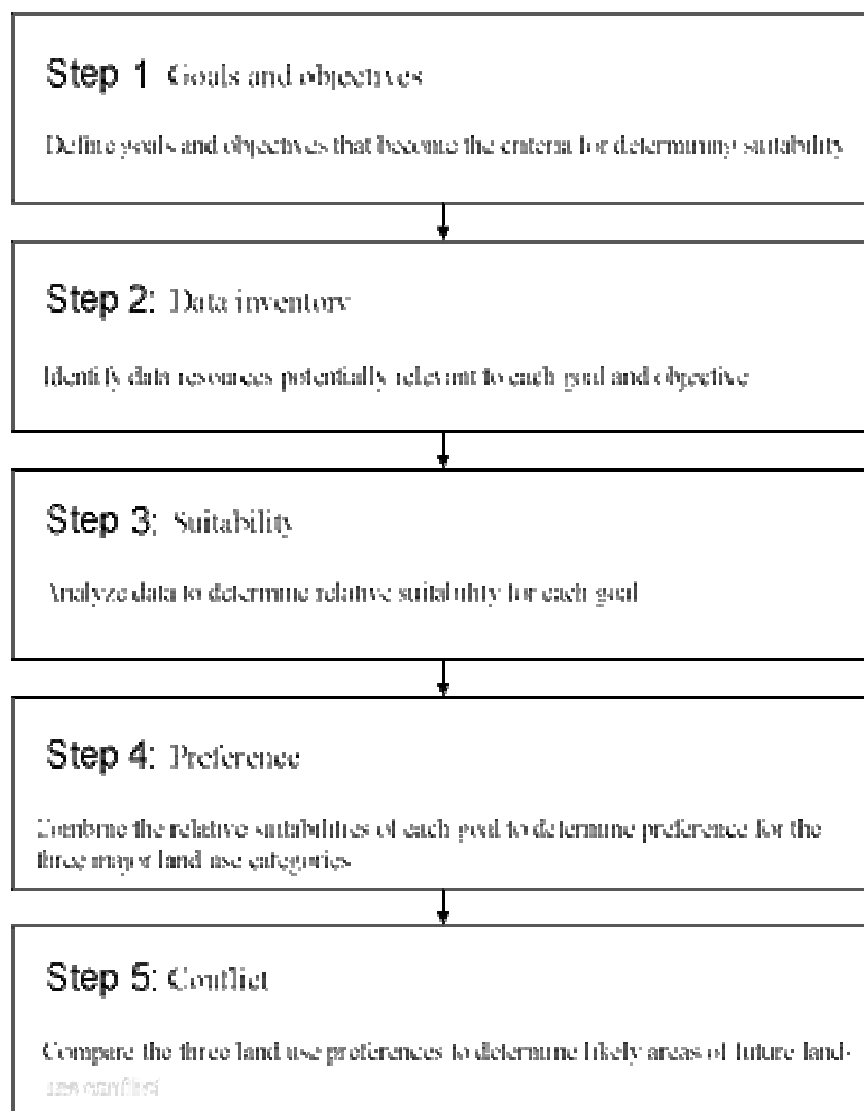


Figure-2-11: The five main steps of the LUCIS model.

The steps to develop a subobjective

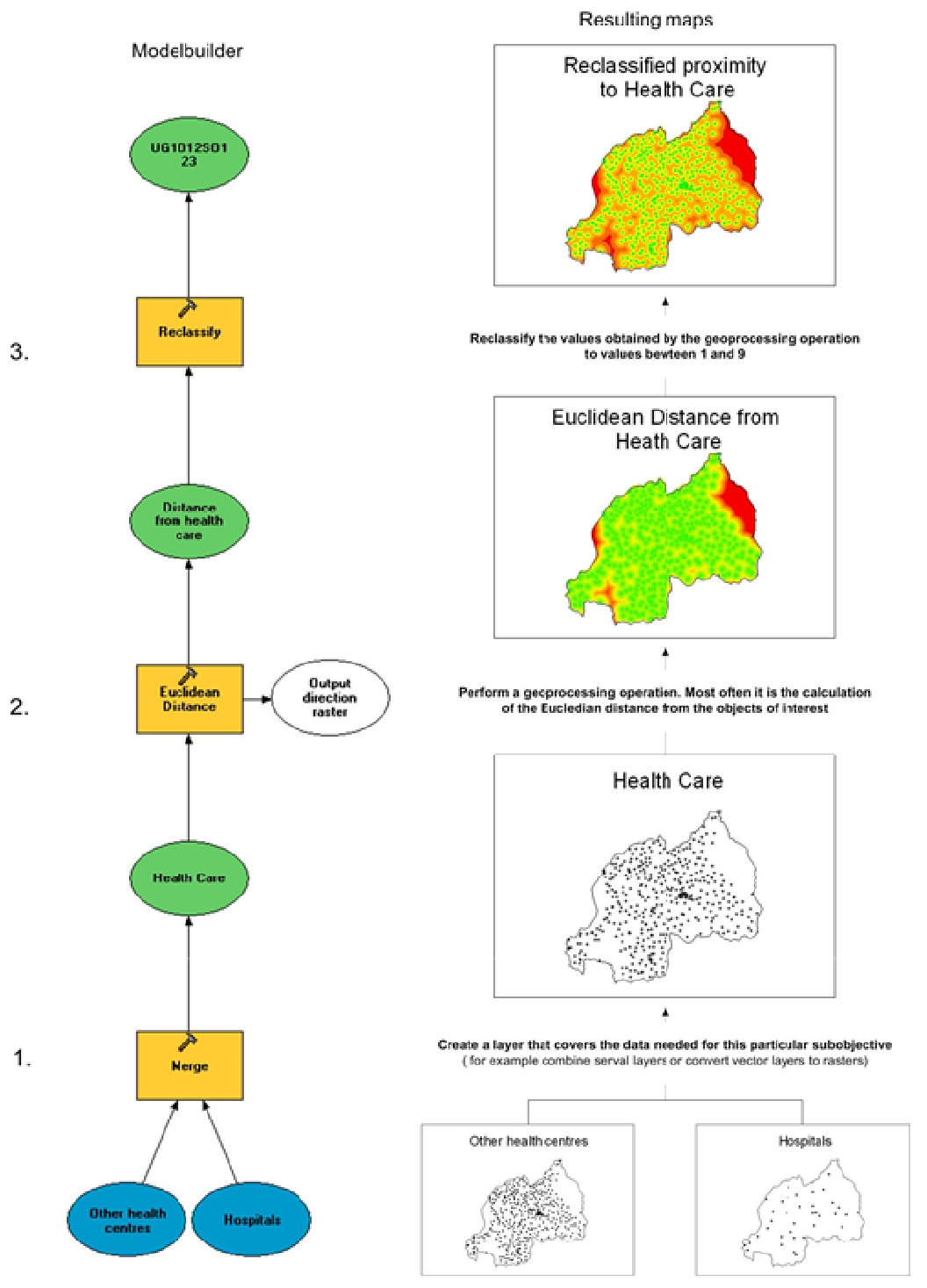


Figure 2-12: Schematic visualization of the steps to create a sub objective in Model Builder. On the right side the maps of the geo-processing results are shown as a demo model.

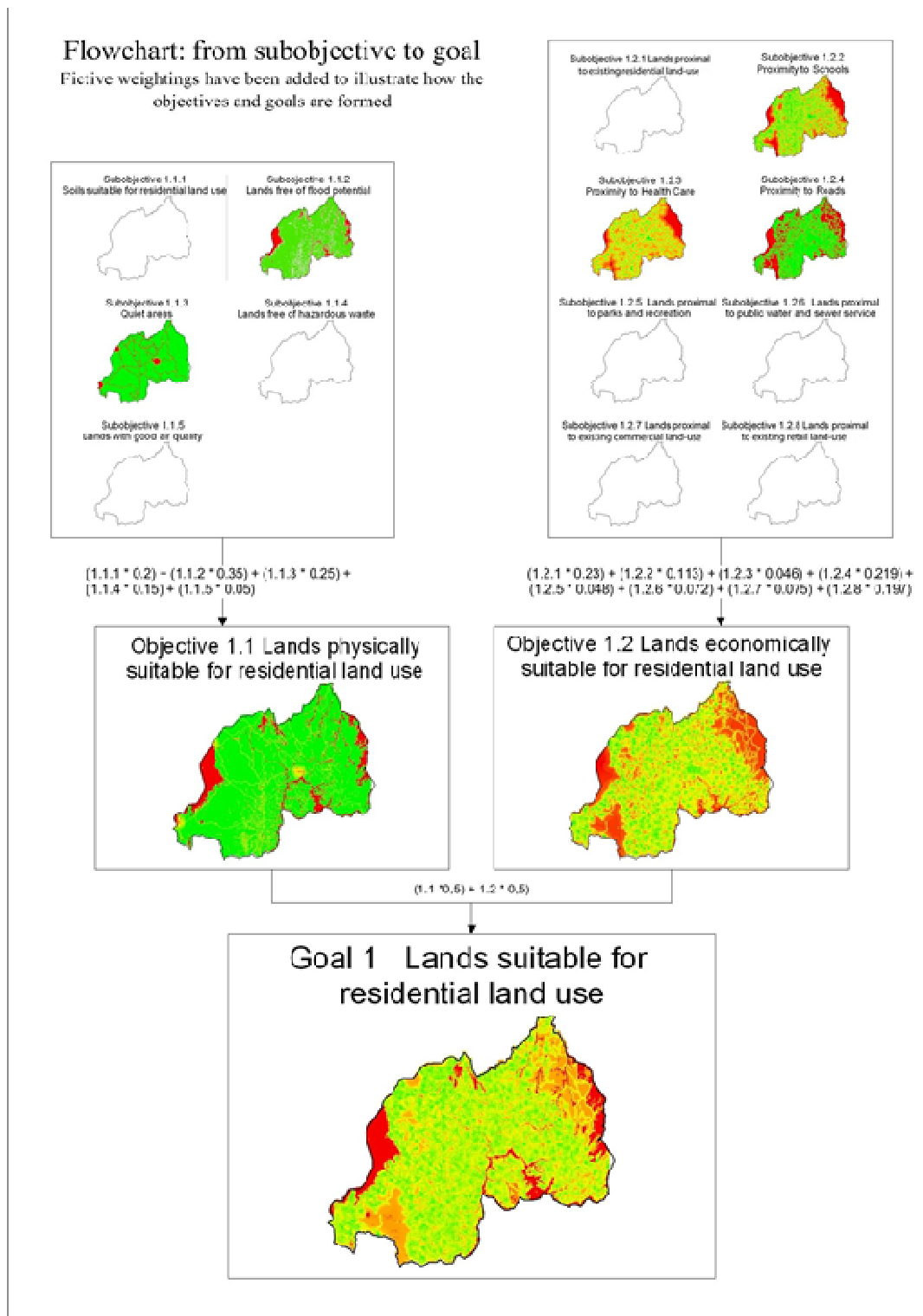


Figure 2-13: Flowchart showing the creation of objectives and goals. Fictive weights have been added to illustrate the demo method.

An important part of the model is the weighting of the sub objectives, objectives, goals and preferences. Weights will significantly influence the results of the model. AHP will be used as the base method for the weighting process. The program will be used for the weighting process was Right Choice DSS.

This program will be used to produce the final weights that are used in the model. In addition, schemas for the pair-wise comparisons concerning goals and preferences were produced to investigate the stakeholders' wishes. The same design will be used to obtain pair-wise comparison values from the consultants, who will weigh the subobjectives and objectives. All schemas will be gathered, and results will be inserted in Right Choice DSS, which then produces the final weight for every sub objective, objective, goal and preference.

Figure 2-14 shows the input screen for the pair-wise comparisons of a demo urban model.

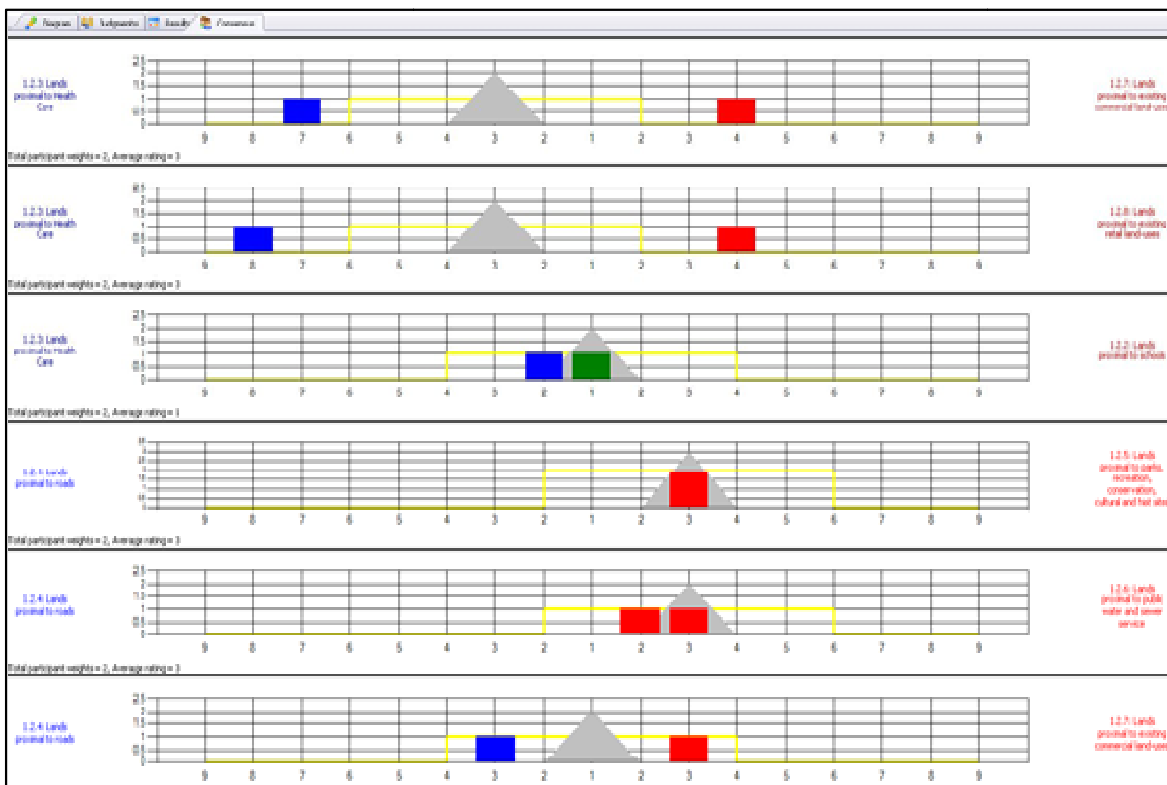


Figure 2-14: Pair-wise comparison results of multiple participants

Figure 2-14 will provide pair-wise comparison results of multiple participants as shown, including the calculated average of all participants. Based on these analysis a number of conflicts between different types of land uses will be arisen (both potential and preference based) which can be also simulated. The planner or policy maker will take these conflicts into account before formulating the detail plan. Figure 2-15 and figure 2-16 Shows two demo model for potential based and preference based land use conflict that can be simulated by applying GIS based MCDA method.

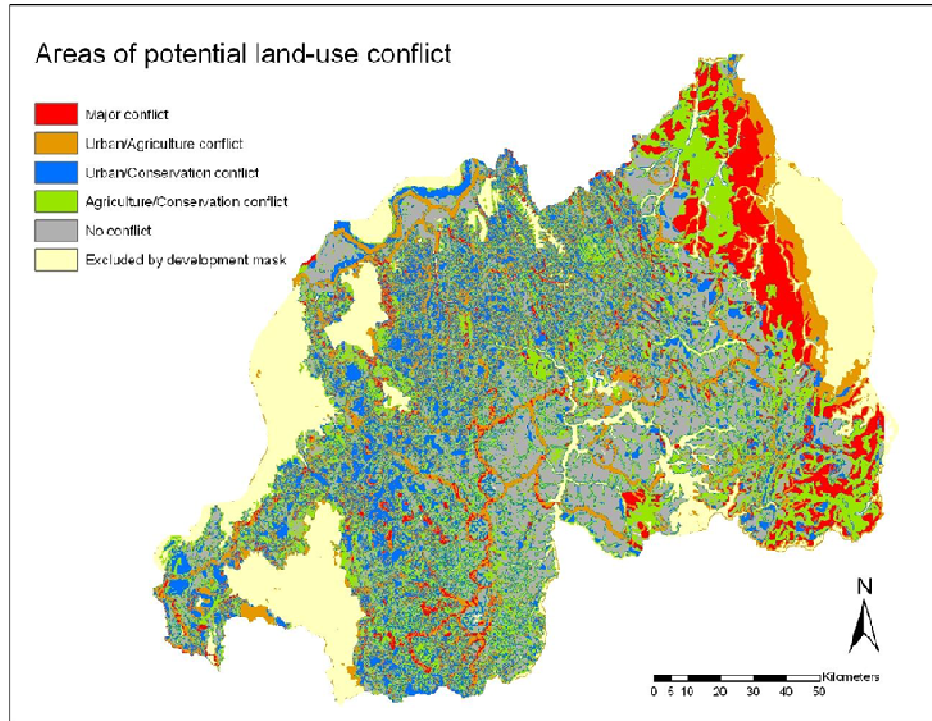


Figure 2-15: Map showing areas of potential land-use conflicts.

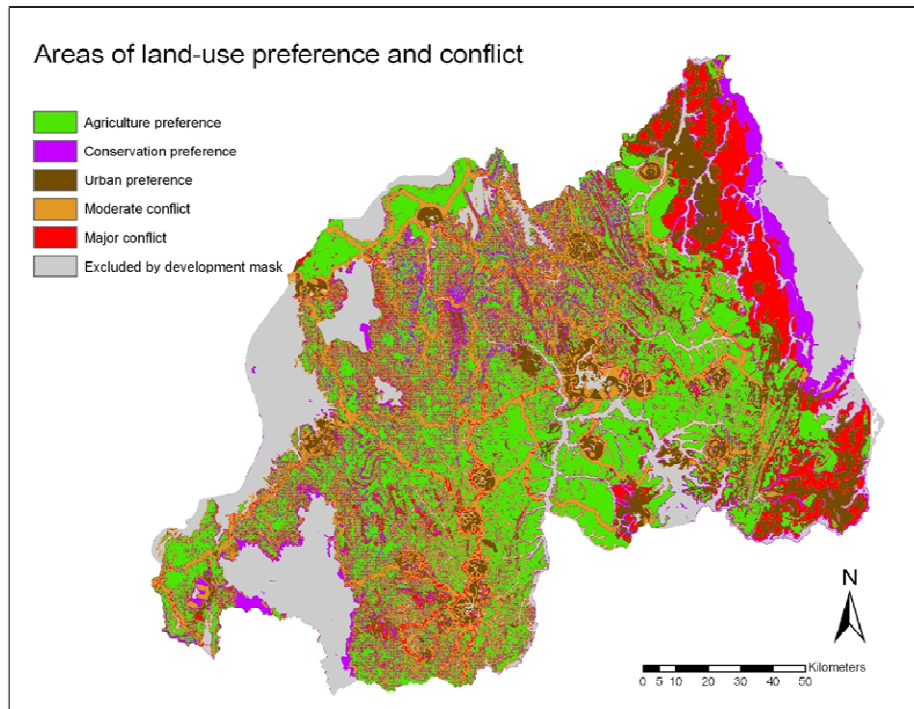


Figure 2-16: Map showing land-use preferences of the three land-use categories.

Phase-III: Participatory Landuse Development (PLUD) Approach

Apart from MCDA analysis and landuse modeling the consultant team will take participatory landuse development (PLUD) approach into for formulating effective plan formation and decision making. In the land use development context this means placing the people who are concerned with a particular territory at the centre of the decision making process regarding the use of the resources in that territory. Such people are referred to as stakeholders. The concept of stakeholder is central to the PLUD concept and is defined by the FAO as: "anyone or any institution who has interests in, or is affected by, an issue or activity or transaction and, therefore, has a natural right to participate in decisions relating to it."

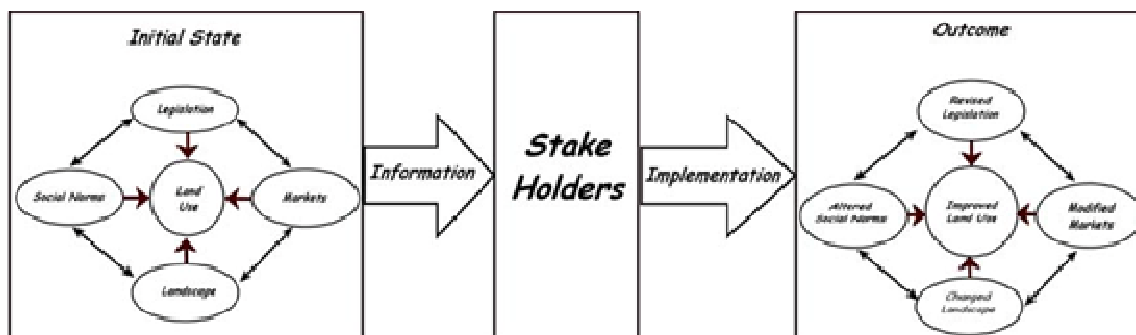


Figure 2-17: The Participatory Land Use Planning Model

The modification to the Land Use Development model introduced by this concept is shown in Figure 2-17. The box labelled stakeholder now replaces the arrow in the previous diagram, indicating the central role this element has in the participatory process.

Finalization of GIS based Landuse Model and Deliverable: After completing the above mentioned three steps of integrated GIS based Landuse Model (MCDA model) accompanying with stakeholder discussion and post investigating field visit Team Leader and Senior Urban Planner will cross check each and every conflict of landuse and tentative landuse suggested by the model in real. After gathering real field information of those conflicts Team Leader and Senior Urban Planner will finally make some necessary corrections in the model and finalize the most effective landuse.

2.18 Population and Migration Survey/Study (Census Based)

2.18.1 Method

The consultants are required to generate and analyze demographic and household level data to trace on the past growth rates and current trends of migration for the district and the study area. These analyses are required to consider likely growth factors affecting upazila level in particular, and estimate broad population within the district over the next 20 years. The methodology to be followed to carry out these tasks is discussed below.

Data from both the secondary and primary sources will be generated and utilized to accomplish the above specified objectives of the study. The 2011, 2001 and 1991 census publications (the volumes on District and community series) can provide valuable information on demographic structure, migration and other data related to this study. In addition, purposive survey may be conducted to fill in the gaps if necessary with the help of a pre coded questionnaire (with socio-economic survey) to facilitate easy processing by computer.

For these purposes the study area can be divided as established urban, newly urbanized, newly growing area, and rural areas. The localities in the study area will be identified depending on this classification. Depending on the actual number of units, some areas from each of these 4 categories will be selected for the PRA frames. A complete list of households will be prepared for these selected units, which will be our sampling frame.

All relevant data collected through questionnaire survey will be presented in appropriate tabular form. Any change in the trend to that of 2011 census report will be analyzed. The survey is also expected to produce evidence on fertility rate in the study area. The population projection will be made both at the aggregate level by time series analysis and at the disaggregate level by cohort survival method. However, monthly national level assumptions regarding survival and fertility rate will be used for disaggregate projections.

There are several methods of projecting population. Normally, population increases either at a arithmetic, geometric or exponential rates. Our experience in Bangladesh shows that the geometric growth of population suits in most of the rural population growth. Exponential growth rate may be applicable for very high rates of growth. On the other hand arithmetic rates are quite slow in adding population. Thus, we prefer to follow geometric growth rate for calculating the growth of population and thus for projection.

2.18.2 Deliverables

The secondary data and those will be collected from primary sources will then be transformed into attribute layers (by assigning data into areal format) for analyzing using GIS tool. All these outputs will be finally merged with master geodatabase or spatial data bank as a final output discussed in Section 2.44.1.

2.19 Socio-Economic Survey (Household Based)

The inception report is developed with reference to the survey described under 'Other Surveys and Studies' (p 64) of the TOR of Package 3. The titled is 'A. Socio-Economic Survey, Study of Urban Economy and Social Infrastructure'. Under this three distinct surveys are included namely, a-1 Socio-Economic Survey, a-2 Study of Urban Economics, a-3 Study of Social Infrastructure (Education, Religious, Sports, Recreation, Community and Socio-Cultural Services/Facilities. This report entails two of the three surveys - a-1 Socio-Economic Survey, a-3 Study of Social Infrastructure

The project

The ultimate intent of the project is preparing separate development plans for 14 selected Upazilla in different parts of Bangladesh. Package 3 includes three Upazilla located each in separate district: Bagmara Upazilla under Rajshahi; Faridpur Sadar Upazilla under Faridpur; and Gangni Upazilla under Meherpur. The initial phase of the project includes various types of studies and surveys with a view to create necessary base information for the development of the expected plans in the followings phases.

As pointed out, the present report contains detailed methodologies, work schedule and related information on Socio-Economic Survey (a-1), and Social Infrastructure (a-3), while a-2 will be dealt separately.

Objective of the inception report

The main objective of this short report is to describe the area, stakeholders (parties to involve), approach, methodologies and details about data collection tools, analysis, documentation process - in conducting the socio-economic and social infrastructure surveys.

Geographical unit under the study

Table 2-10 reveals that the study will have to cover 36 Wards (4 Pourashava) and 36 Unions under three Upazilla.

Table 2-10: Geographical units to cover under this survey

Serial	District	Upazilla	Units	Number	
1	Faridpur	Faridpur Sadar	Pourashava	01	
			Ward	09	
			Union	11	
			Village	324	
2	Meherpur	Gangni	Pourashava	01	
			Ward	09	
			Union	09	
			Village	137	
3	Rajshahi	Bagmara	Pourashava	02	
			Ward	18	
			Union	16	
			Village	332	
4				Total Village	793
				Total Union	36
				Total Pourashava	04
				Total Ward	36

The area and population statistics of three Upazilla are presented in Table 2-11.

Table 2-11: Area and population statistics of three Upazilla

Upazilla	Area (Sq. Km)	Population				
		Total	Urban	Rural	Male	Female
Faridpur Sadar	412.86	469,410	122,425	346,985	235,762	233,648
Gangni	363.95	299,607	30,239	269,368	148,250	151,357
Bagmara	366.46	354,664	38,214	316,450	177,157	177,507
Total	1143.27	1,123,681	190,878	932,803	561,169	562,512

Domain of the Survey

The IR describes the methodologies, tools of the following surveys:

- A. Socio-Economic Survey (a-1)
- B. Study of Social Infrastructure (Education, Religious, Sports, Recreation, Community and Socio-Cultural Services/Facilities (a-3)

Approach and central process of Socio-economic Information collection

A people-centered, participatory approach will be adopted at all stages and all levels of information collection ensuring presence of representative participants and their active participation in the generation, development and sharing information to the study team. Guideline by the UDD about participants will be followed.

Stakeholders

District and Upazilla level Officials, elected representative, local elite, teachers, religious leaders, members of different committees, grassroots level people from all walks of life including ethnic community, persons with disability, destitute, women among others.

Methods and tools to gather information

Appropriately approaches, techniques, tools will be applied to capture specific information at field level. The followings will constitute the major elements of information collection from the field level.

- A. Participatory Rural Appraisal (PRA)
- B. Socio-Economic Survey
- C. Survey of Social Infrastructures

A. Participatory Rural Appraisal (PRA)

The strength of applying PRA tools for information generation in a project area lies in the fact that it creates genuine scope for participation, sharing of experience about the existing situation by the people who live there to outsider, and that PRA empowers both the parties through sharing, dialogue and real life experience. Use of PRA tools has been a common practice in Bangladesh to generate information through mutual discussion and understanding. Decision has already been reached to apply three PRA tools for information generation from the stakeholders of the project area. The tools are: a) Social Mapping, b) Chapati (Venn) Diagram and c) Modeling.

A1. PRA Organizing

One PRA will be organized in each Pourashava and union. So, the number of PRA to be organized covering the three Upazilla would stand at 40 (4 Pourashava, 36 Union).

Date, venue, convenient time will be set in consensus with the Pourashava and UP authorities and participants. Registration of participants, attendance will be taken. Appropriate banner will be used. PRA facilitation team will disseminate information about organizing the PRA through individual contact, using UP communication channel, motivating common people from all walks of life; at least three days prior to commencement of the event. Participation of people from all walks of life including farmers, women, youth, person with disability, professional groups, teachers, elite among others will be emphasized and encouraged. However, presence of the participant-category indicated by UDD will be ensured.

Affords will be taken to having presence of UNO, Pourashava, Upazilla and Union Chairmen as suitable. Presence of elected Counselors and Ward Commissioners will be ensured. A big enough place will be arranged having sufficient space and facilities so that participants can roam, walk around and have comfortable seating preferably in a circle or semi-circle. Working period of one PRA will be four to five hours.

An informal, trusting, coercion free environment will be created in the venue so that participants can share their opinion freely.

A1.2 PRA Facilitation

A four (4) member team will facilitate the event in close cooperation and maintaining harmony. The senior consultant will remain vigilant and take part in facilitation at least in a few places. The team will be composed of following members: Facilitator (2), Organizer (1), Repertoire 1 to compile output and record keeping.

All logistics and supplies will be procured and prepared well ahead of the event so that facilitation of the event not hampered. The team will chalk out a tentative plan of facilitation with scope and flexibility to change to cope with the prevailing situation and environment at the venue. It may be restated that facilitation will not be stiff rather will have high elasticity. The elected representative, UNO and other dignitaries will be inviting to share their opinion at the beginning and closing of the event. However, a formal opening session will be avoided. Common norms including those set by UDD will be introduced to enhance participation and smooth facilitation, at the on the set of the session.

A2.1 Work session

Preference of the facilitation team will be to engage all participants working together. In case, presence is quite large small groups may be formed to work with different tools in separate places. However, the outcome will be presented in plenary to reach a consensus by all.

A2.2 Social Mapping

As PRA will be organized to represent certain geographical unit Community mapping will include the area as determined e.g. union, Pourashava area. UP demographic map, Risk Assessment Map, and Pourashava maps if available will be collected. LGED map of the area will be collected and used as reference.

The mode of facilitation would be so designed so that participants work by themselves; facilitators will take assisting role including moderation as needed.

The concept, importance, objective and use of Social Mapping in this project will be described at the beginning with demonstration by the facilitator. A few elements to consider during mapping will also be indicated to ease their work. Then, the participants will develop map, while the facilitator(s) will observe the situation, assist and make sure that all opinion is heard. Union Map if available will be collected earlier and be given to the group to use if they need.

It will be ensured that the Social map spots the infrastructure, roads, river, canals, mobility, land patterns, cropped area, forest, affect of natural hazard, community meeting place, growth centres, water reservoirs, places where minority and ethnic communities reside among others.

Attempt will made to spot all Social infrastructures including religious, educational institutions, madrasha, market places, recreation facilities, clinics, hospitals, places for sports, playground, cultural institution, industries, service provider institutions among others. By doing this, it will be easy to find and conduct the survey on Social institutions (infrastructure) in later stage.

A2.3 Chapati (Venn) Diagram

The concept, importance, objectives and importance of using Venn Diagram in information collection of this project will be explained to the working group, by the facilitator at the initial stage including demonstration of working procedure with the tool.

The tool (Chapati Diagram) will be used to understanding the causal relation of the major existing problems. To achieve this, 'Core Problems' of the delineated area will be identified on consensus. Quite some time will be spent to finalize the list of core problems. However, if new ones come later; will be included on consensus.

Once core problems identified, the Venn Diagram-group will be subdivided into smaller group of 2-3 participants to work further with (say) one core problem to identify the secondary and tertiary level (root) causes.

The output will give the cause-effect relationship between the successive tiers of problems by placing (round paper-circles) Chapati of lower order around the successive 'main' problems. In this way, the 'main' problems and 'root' causes of each problem become evident within hours. Potential solutions, remedies will also be listed.

A2.4 The Action/Strategic Planning Method (TOP)

The Action or Strategic Planning is widely applied in a participatory situation. As the name denotes through this, participants dawn a plan of action or a future looking (strategic) plans of their interest. The process is highly interactive and gives output that really depicts future strategies for effectiveness and improvement.

At the beginning of the Action or Strategic Planning the importance, objective, process of exploiting the tool will be explained to the participants. The participants will work in group(s) talking out develop dreamed development model of their own area.

As starter, one or two elderly persons will describe the gradual changes (development) that took place over the past 20 years or so. Then, the facilitator will request participants to develop model of the dreamed development for immediate (5 year), mid-term (5-10 year) long-term (20 plus years). Participants may be divided in small groups to develop model(s). The immediate, mid- and lone-term development models will be shared in plenary to chalk out the final model(s) in consensus.

Diagrammatic Presentation of organizing PRA

Three main PRA tools will be used to generate information by the participants to use in future development planning. Use of Time Line may optional during modeling if time permits. The PRA tools are(see Figure 2-18):

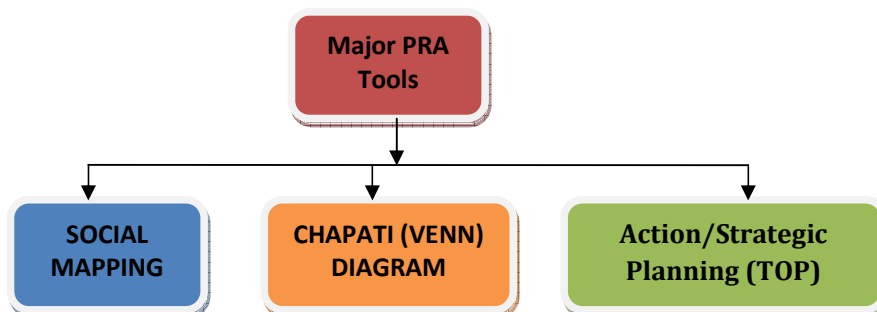
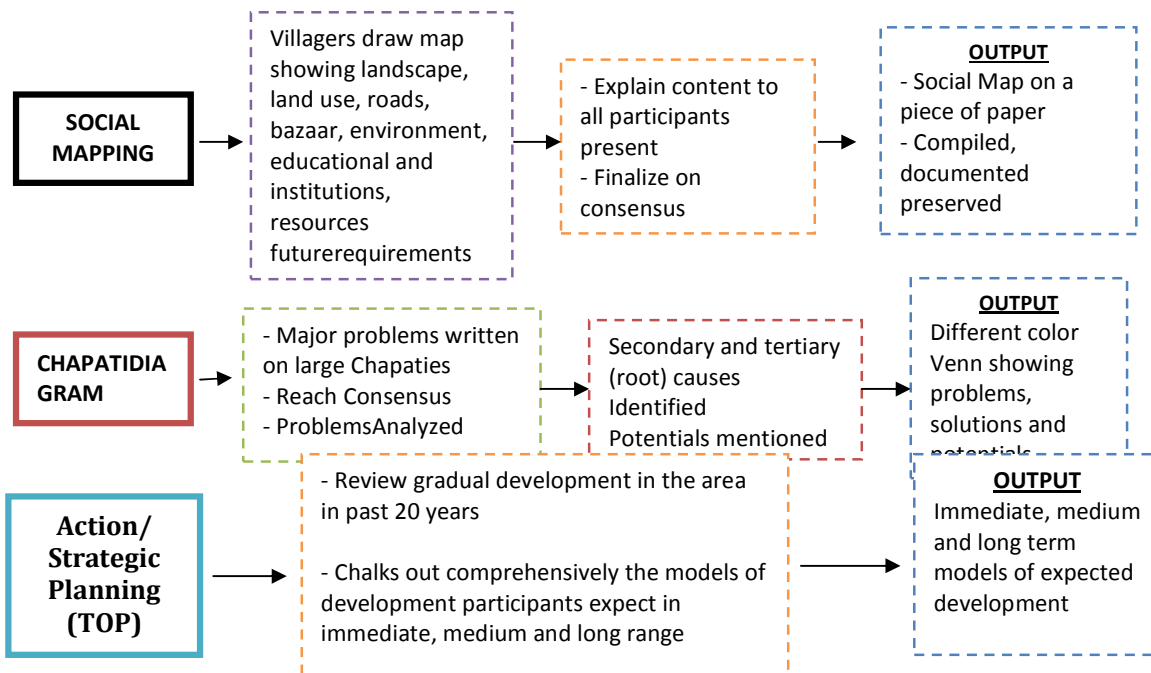


Figure2-18: Major Tools to be applied for Participatory Information Collection

Major steps and expected output from the PRA

A few major steps and major outputs of three PRA tools are shown below.



A2.5 Documentation and Record keeping

Photograph/Video of group output will be taken and preserved. All output of the PRA in each location will be documented and saved in file folders. Information from the working sheets will be compiled, documented within the shortest possible time, so that ideas don't get lost. The original group output will be preserved and submitted to the UDD in suitable folders.

A2.6 PRA Deliverables

The major deliverables from Participatory Rural Appraisal are the followings among others:

- Separate 63 Social Maps of selected Wards of Pourashava and Unions under three Upazilla
- Output of Chapati (Venn) Diagram from 63 PRA exercises having the identified Main problems and their causal elements worked out in Cause-Effect relationship
- Proposed potential solutions to overcoming the constraints in all geographical units mentioned above
- Short (5 year), medium (10Yr) and long-term (20 Yr) development models of 63 places as put forwarded by the participants
- Filed and compiled copies of all documents mentioned above

B. Socio-Economic Survey

All the major steps for socio-economic survey is shown in Figure 2-19.

B.1 Survey Design

An extensive Socio-Economic survey will conducted in Upazilla covering the urban and rural areas following the PRA exercise for household information gathering. As already mentioned the Simple Random Sampling design will be applied to selecting the households.

B1.1 Sampling Method

Simple Random Sampling will be followed for selection of HH using BBS 2011 Census data. Total sample HH will be proportionately selected from all geographical units of the Upazilla.

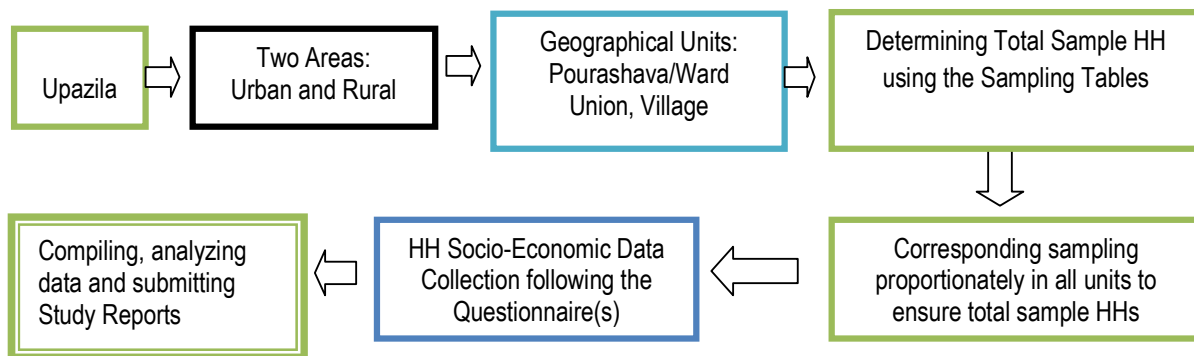


Figure 2-19: Depicting main steps of the HH Socio-Economic Survey

B1.2 Sampling considerations

In order to ensure a normal distribution of the sample households and making the survey findings statistically acceptable, representative and sound there is a need to pre-set some statistical parameters in determining the sample size of the study. Acceptable level of three statistical parameters is determined as follows:

- Precision or acceptable margin of sampling error $\pm 3\%$,
- Confidence level 95%,
- Degree of variability 0.5 (50%)
- So, household sample size will determined considering the above mentioned elements.

B1.3 Strategies to determining sample size

In a socio-economic study, size of sample can be determined in a number of ways for example, i) the whole population (census), ii) imitating sample size of similar studies, iii) use of published tables for sample size determination, and iv) using formula.

In this study the sample size will be determined following the published tables according to Glenn D. Israel (2013). The sample size determined following the table requires considering the precision, confidence level and degree of variability. For our study these factors have already been determined as in the above section.

And that, use of table for determining sample size following simple random sampling design, as we have decided.

Most important to note here is that, sample size given the tables denotes that response must be received from all sample HH. In other words, there is little scope to miss response of the sampled HH. To avoid the risk of missing additional sample (10%) has been drawn over the required number to compensate non-response if any, and making the sample size reasonably large enough.

B1.4 Household sample Size

The rural and urban household statistics is presented in table 2. The data represents the household statistics in BBS Census (2011) document. The HH numbers will be the base for drawing sample following the table proposed by Glenn (2013).

As indicated earlier, for this study, HH sample size has been determined separately for rural and urban areas based on the total households of the Upazilla and given in the table 2 below. It may be mentioned again that the sample size is valid for a 3% precision, 95% confidence level and 50% (0.5) degree of variability.

Sample size Calculation from the table

Sample size for urban and rural households determined exploiting the figures cited by Glenn (2013) in the sampling table. When the population size cited in the table matched with that of the study (Upazilla) sample population the cited sample (number) is adopted immediately.

However, when there was no match, several of the given population size in the table were added to create match with the study HH population. Average of all the corresponding sample size(s) was taken as the sample size. However, during determining sample size there was positive bias to making the sample size large. (see Table 2-12)

Table 2-12: Household sample size for urban and rural area of three Upazilla under Package 3 including 10% additional

Upazilla	No. of Household			Household Sample Size with 10 additional		
	Total	Urban	Rural	Urban	Rural	Total U & R
Faridpur Sadar	103,535	27,574	75,961	297 + 30 = 327	815 + 82 = 897	1,224
Gangni	77,580	7,651	69,929	100 + 10 = 110	860 + 86 = 946	1,056
Bagmara	94,050	9,603	84,447	109 + 11 = 120	959 + 96 = 1,055	1,175
Total	275,165	44,828	230,337	506	2,634	3,455

The calculated total HH sample will be selected proportionately from all the geographical units and sub-units under the Upazilla including village (Union level) and Wards (Pourashava) as given in table 1. Then survey will be conducted.

The estimated total number of HH sample for Household Socio-Economic survey in three Upazilla; stands at 3,455; of which 506 urban and 2,634 rural households and that includes a 10% additional.

B2. Conducting Household Survey

In order to know the existing socio-economic condition and facilities available in the project area, the consultant will carry out socio-economic survey through engagement of a team of experienced field enumerator.

The terms of reference of the project specified several items listed table below; will be included the socio-economic survey. The survey will collect qualitative and quantitative data/information on the following main items including others and information will be collected in places of the project area.

- Holding information: area of holding, number of houses, structure of houses;
- Housing size, structure, age, sex composition, educational, employment and occupational status, income, expenditure, etc;
- Cultivable land, land utilization and income from land,
- Services and utilities: electricity, gas, water supply etc;
- Sanitation information, type of latrine, sewerage, drainage system, etc;
- Communication: road, telephone, mobile, internet use
- Health facilities such as hospital, clinic, community center, etc.
- Employment opportunity
- On and off-farm income by members

B2.1 Survey Questionnaires

Detailed questionnaires for Household Socio-Economic and Social Infrastructure data collection will be used. The areas that directly and/or indirectly influence socio-economic condition of the household will be included in the survey (a few listed above). However, attention will be attached to limit data collection on areas that would have overlapping with other surveys and/or studies of this project. The consultant team will reach a consensus on delineation at questionnaire development stage. The proposed questionnaire for Socio-Economic Survey is annexed with the IR.

B2.3 Data/Information Collection

After completion of sampling of required households data collection will be started as per plan. Data will be collected at the household levels by the male and female enumerators Enumerator (data collector). Data collection may go on in one or two Upazilla simultaneously to curtail survey time.

B2.4 Training of Facilitators and Enumerators

All PRA Facilitators will be given orientation on the tools and techniques of facilitating PRA and the Enumerators will be trained on the questionnaires so that they understand the intent of the questions, objectives of the survey and mode of placing survey questions politely and appropriately.

B2.5 Deliverables from the HH Survey

The followings are the major ones

- Compiled raw data as collected from the field
- Separate Survey Reports of three Upazilla covering all geographical units

C. Study of Social Infrastructure (institutions)

A survey study will be conducted on all the social institutions (for instance education, religious, sports, recreation, community and socio-cultural service providers) of the Upazilla. As already mentioned the first step towards identifying these institutions will be initiated during the PRA. List of institutions will be collected from the relevant department at Upazilla (e.g. social welfare) and UP.

C1. Questionnaire

An extensive questionnaire based survey will be conducted on all the identified social institutions to get idea about the effectiveness of services provided by the institution, its arrangements, space availability, accommodation facilities, environment, communication among others.

C2. Data compilation and Reporting

All the data generated will be compiled and analyses developing and using appropriate programme (SPSS). Report on the Survey and PRA studies will also be developed and submitted to UDD.

2.20 Housing Survey

2.20.1 Method

As per ToR, a separate survey on housing, slums and squatter settlements will be carried out. The main purpose of this study is to prepare an inventory of housing in the study area. For each major housing area, a summary of population, density, housing conditions, provision of services, sanitation, drainage, employment, and tenure and income levels will be determined to facilitate residential planning and addressing housing needs and related issues.

Data from both the primary and secondary sources will be utilized for this study. General conditions regarding housing structure, sanitation and provision of services are available from census data. However, most of the information will have to be collected from the primary source through a specially designed household questionnaire survey. The questionnaire will be designed to capture all the required information in a coded form suitable for fast processing by computer. The questionnaire will focus on housing needs and demands of the households at rural and urban levels so that the problems of housing can be scientifically addressed.

A stratified weighted random sampling method will be used to conduct the household level sample survey. Similar to the population and migration study will be carried out in some representative area which will be selected on discussion with clients. After discussion with PD, UDD a suitable housing typology will be developed for each of the broad types of area. The purpose of these sub-classifications is to ensure that the samples are drawn across the broad classification, and no important type is left out, and also duly represented in the sample size according to their number.

For the slums and squatter settlements survey, first the locations and settlement sizes will be collected from a reconnaissance survey in the study area, supplemented by information collected from secondary sources such as recent survey by BBS.

2.20.2 Deliverable

After their identification on a map, sample survey will be conducted. A stratified weighted random sampling method may be suitable for household level survey of the selected slum and squatter settlements. The questionnaire will be similar to the housing study but will be more elaborate and will include additional information on socio-economic characteristics, demographic characteristics, employment, migration, community organization, attitudes, priorities for development etc. Similar type of analysis as that of housing study will be carried out for the slum and squatter settlements. Most of the results will be presented in tabular form along with cross checking and comparing with Master Geodatabase and will be converted in to geo data where it is applicable.

2.21. Housing, Slums and Squatters Settlement Study

2.21.1 Method

Preparation of Questionnaire

In order to conduct the socio-economic survey, a compact and extensive pre-coded structured questionnaire will be prepared. The questionnaire intends to capture information according to the provided format in the ToR. The Team Leader (TL) along with other consultants will review the questionnaire. The draft questionnaire containing questions relating to socioeconomic information will be translated into Bangla. This questionnaire will be pretested among few respondents to check the appropriateness of the questions, the issues with words/phrases and then final version will be made.

The survey will include information on: household information, occupation and income, migration, land ownership and use, housing type, sanitation use, drainage, water use, accessibility to physical and social infrastructural facilities (education, healthcare, recreation, market etc.), travel pattern, disaster, local problems, development needs, suggested development schemes and so on. The team leader will integrate socioeconomic survey data and PRA findings with other spatial topographic, hydrogeological, and environmental, land use, transport and other planning survey data during the comprehensive development planning stage.

Sample Selection

The sample will be selected according to the sample selected for Socio-economic Survey from the Population Census 2011. As the unit of analysis for socioeconomic survey is household and since there is no sampling frame of all households of the target population, non-probability sampling strategy will be adopted.

For representation of all socioeconomic groups, quota sampling technique will be used. Among the criteria for quota sampling, housing characteristics (kutcha, tin-shed, or pucca), location of settlements (char/plan land), type of settlements (planned, unplanned or informal settlements), distance to growth center, dominant occupational groups (agriculture or non- agriculture), economic activity (formal or informal), and area of residence (rural or urban) etc. will be maintained to represent the target project area. Before selecting sample

households to include proportionally for the socioeconomic survey, the profile and detailed maps of the upazila, municipality/union, population composition, risk and asset maps, and the number of existing land use/built environment data by location (educational, hospitals, roads, agriculture, rivers, slums and squatters, encroached settlements, etc.) will be made available from official sources (local government / administration) and other sources (NGOs, etc.).

The sample size will be determined based on the sample size of socio-economic survey that is considered the total number of households provided by the 2011 Population Census (BBS).

The household head will be requested to be interviewed, in case of his/her absence, the next available person related to the HHH of 18 years or older will be interviewed. If any person from a purposively selected household is not found after third visit, the next household will be selected for the survey.

2.21.2 Deliverable

After completing the survey work in field level, a detail database will be prepared following the questionnaire surveyed. The database will be prepared using SPSS and Excel software. To make the data input process easier, coding system will be used in the necessary fields. Few data will be stored in Excel software. At the end of all data input, a detail database will be prepared for analysis. Finally, all the data will be linked with spatial data.

2.22 Investment and Employment Study

As per the ToR requirement, the questionnaire for studying the urban and rural economic covering the trade, commerce, shopping and related activities will be prepared. Due to collect data of the area, the economic activities of this area will be divided in two sectors. One is formal sector which will be identified from the physical feature survey in this study. Other is informal sector playing a very significant role in urban economics as such major portion of employment. The growth, nature and characteristics of this sector are significantly different from those of the formal sector. While most of the required information on the formal sector can be obtained from the secondary sources, information activities has to be collected from the primary source through sample surveys of the major centers of employment.

2.22.1 Method

Preparation of Questionnaire

In order to conduct the socio-economic survey, a compact and extensive pre-coded structured questionnaire will be prepared. The questionnaire intends to capture information according to the provided format in the ToR. The Team Leader (TL) along with other consultants will review the questionnaire. The draft questionnaire containing questions relating to socioeconomic information will be translated into Bangla. This questionnaire will be pretested among few respondents to check the appropriateness of the questions, the issues with words/phrases and then final version will be made.

The survey will include information on: formal and informal sector economy both in urban and rural areas covering trade, commerce, shopping and other related activities in SPSS and other compatible format, editing, piloting, finalization and printing of questionnaire and other planning survey data during the comprehensive

development planning stage. The attribute data of surveyed commercial and industrial enterprises shall be linked with spatial data collected from physical feature and land use survey.

Sample Selection

The sample will be selected according to the population census 2011. The sample will be selected according to the guidance of the PMO of UDD. As the unit of analysis for socioeconomic survey is household and since there is no sampling frame of all households of the target population, non-probability sampling strategy will be adopted.

For representation of all socioeconomic groups, quota sampling technique will be used. Among the criteria for quota sampling, housing characteristics (kutcha, tin-shed, or pucca), location of settlements (char/plan land), type of settlements (planned, unplanned or informal settlements), distance to growth center, dominant occupational groups (agriculture or non- agriculture), economic activity (formal or informal), and area of residence (rural or urban) etc. will be maintained to represent the target project area. Before selecting sample households to include proportionally for the socioeconomic survey, the profile and detailed maps of the upazilla, municipality/union, population composition, risk and asset maps, and the number of existing land use/built environment data by location (educational, hospitals, roads, agriculture, rivers, slums and squatters, encroached settlements, etc.) will be made available from official sources (local government/ administration) and other sources (NGOs, etc.).

The sample size will be determined based on the sample selected for socio-economic survey from the total number of households provided by the 2011 Population Census (BBS). The household head will be requested to be interviewed, in case of his/her absence, the next available person of 18 years or older will be interviewed. If any person from a purposively selected household is not found after third visit, the next household will be selected for the survey.

2.22.2 Deliverable

After completing the survey work in field level, a detail database will be prepared following the questionnaire surveyed. The database will be prepared using SPSS software. To make the data input process easier, coding system will be used in the necessary fields. Few data will stored in Excel software. At the end of all data input, a detail database will be prepared for analysis. Trade encompassing banking and other financial institutions, shopping centers and shop, and commercial establishments differentiated into wholesale and retail shopping should be recorded. Growth or decline in economy during the last 10 years should be collected and presented in a report with explanatory notes on the causes for growth or decline covering a possible quality of existing and future trade, commerce and shopping facilities for the project area with tentative pedestrian linkage (missing link) considering manmade and natural disasters for the Project area. All the collected attribute and spatial economic data shall be linked with other spatial database.

2.23 Urban and Rural Economic Study

The most densely populated country Bangladesh is moving ahead in the context of development circling a few major cities. But urban-rural and within urban and rural imbalances of wealth is increasing day after day. So, balanced uplifting the socio-economic condition of the rural and urban people in a coordinated way, a comprehensive development plan is required. For preparing detailed development plan three upazilas have

been selected in this regards among the initially identified 14 upazilas. Faridpur Sadar under Faridpur district of 407.02, Bagmara under Rajshahi district of 363.30 and Gangni upazila under Meherpur district of 341.98 sq. km. i.e total 1112.30 sq. km. area is considered for this planning process. In the meantime, mobilization report has been submitted. In the action plan an estimation of trends and changes likely in future for the next 20 years would be shown.

2.23.1 Method

a. Economic Study

Formal and informal sector of the study areas are to be considered for primary and secondary data collection. Rural and urban areas are also to be treated as different units. Both the rural and urban areas have formal and informal sectors.

Formal Economic Sector

Different economic activities are there in urban and rural areas that are important for assessing the economic position of the locality. Formal economic activities are more visible and data regarding the study is easy to collect. Different economic group, professional NGOs, bank, insurance company and their economic activities, potentialities, businesses, industry, registered business institution etc. represent formal economic group. Shopping centers, wholesale markets, different retail markets also represent the economic group of formal sector. Data regarding formal sector like, bank, financial institute, shop, market etc. will be collected from secondary sources. Chamber of commerce, employers, trade organizations, owners' associations, and labor unions will need to be interviewed. Local level offices such as pourushava offices, local statistical offices also will be visited for information collection. Upazila level other offices also preserve data completely or incompletely. Moreover, primary level data will be collected using structured questionnaires. It is hoped that local pouroshava office, local statistical office, upozilla office maintain different information. Year wise information are available there. These information would be collected as secondary data regarding economic activities of the local people.

Primary data would be collected using structured questionnaires by the enumerators. Different professionals would be covered.

Informal Economic Sector

Means of livelihood are diversified in the context of Bangladesh. Most of the economic activities in the rural area, even in the urban area are unregistered. Informal trade, retailers, mobile hawkers, can be treated as informal sector activists. To identify the nature of informal sector activities in the study area is a prime necessity. Service sectors and manufacturing units are primarily identified. It can be assumed that secondary data regarding informal sector are not available. Sample survey method will be adapted for collecting information covering different subsectors. Structured questionnaires will be designed for this purpose.

Formal and Informal Industrial Survey

Details of location, present size and capacity, details of labour statistics with the housing conditions and their quality of life, other relevant data and information will be collected through questionnaire and FGD. The consulting firm will be prepared report on the basis of output of the surveyed data showing industrial prosperity and recommendation for Project area.

Different formal and informal industries are there in the municipality area, near to the municipality and rural areas. These industrial units change their location and shift to the better location considering transportation facilities, banking facilities ect. It would be considered.

b. Initial Activities

Primary visits to the study areas have already been done. Basic information regarding study areas has been collected. Population pressure on the urban areas is increasing due to the availability of modern facilities in the urban areas than rural. This is also one of the causes of rural to urban migration. If income of any urban or satellite people increases tries to shift family to the urban area. Due to population pressure, urban areas are expanding in unplanned way and land characteristics are also changing. Planning development can reduce this process. Study plan is now under preparation. Two sets of questionnaires, one set for rural area and another set for urban area are under preparation which will cover every economic issue regarding the growth and changes of the rural area. Data collectors and the supervisors of the selected areas will be briefed accordingly for understanding the questionnaires.

Questionnaires will be tested in the field. FGD, PRA and KII will be done according to the necessity of the study.

2.23.2 Analysis and Deliverables

Collected data through questionnaires will be tabulated and analyzed using proper statistical tools such as SPSS. Data, collected by others way will be used in the time of analysis. Suitable software as per requirement obviously will be used in this regard. Study findings will be used in thematic map preparation and will be reflected in area development planning. finally, data will be linked with other spatial data.

2.24 Agricultural Study

2.24.1 Method

The agricultural land demarcation survey would be based on the levels of land, cropping pattern, cropping type, one coped land, double coped land, land utilization and flood level. Change of agricultural land during the last 10 years should be collected and presented in a report with explanatory notes on the causes for growth or decline covering a possible quality of existing and future agricultural land for the project area. All the collected attribute and spatial transportation data shall be linked with other spatial database by the consulting firm.

Bangladesh has three crop seasons which are commonly termed as a) Rabi (November - February), b) Kharif I (March - June) and c) Kharif 2 (July - October). Ideally there could be only three crops that can be grown in a year. The main crops are local aman, kawn, oil seeds, jute and chili. Due to lack of knowledge, appropriate crop timing, duration, profitability and suitability of crops these farmers often under-utilize their lands.

According to ToR it will be a prime responsibility for the assigned consultant is to prepare a detail inventory on agricultural activities are present within the project area including identification of existing problems, threats, potentials and prospects. In order to do that, the consultant will perform the following activities sequentially.

Collection of Secondary Data: At preliminary level the consultant will collect all possible secondary data from relevant and agriculture oriented organizations. Consultation with project officials and other UDD officials will

play a signatory role for selecting data type and data source organization. The possible secondary data sources may include Bangladesh Agriculture Research Center (BARC), Bangladesh Rice Research Institute (BRRI), Bangladesh Bureau of Statistics (BBS), Local/Upazila Agriculture Office etc. Block supervisors of the office of Deputy Director, DAE has got all sorts of agricultural data like – cropping pattern, types of crops, potentials of cash crops, potential threats etc. Besides this, the bottlenecks (like- flooding depth and duration, types of seasonal crops, diseases, etc.) of growing crops are widely known by the block supervisors. All these data will be collected and linked with spatial data.

Analysis of Collected Data

Data analysis will be done from the secondary data that will be collected from different sources like- height of land, cropping pattern, cropping types, land utilization, flooding depth etc. From the analysis we can find out Productivity Zone of each study area. This productivity zone analysis for the past ten years can determine the growth or decline of productive agricultural land area and that will help rural area planning for concern Upazila. An explanation will come out from the FGD, interview of Block Supervisor, farmers and other stakeholders for growth and declining of agricultural areas.

2.24.2 Analysis and Deliverables

Agricultural Land demarcation Survey: As per ToR, the consultant has to demarcate pattern and typology of lands via field survey works, where key defining factors will be height of land, cropping pattern, cropping type, land utilization and flood level. To perform this survey in a very organized way the consultant is intend to follow the below mentioned procedures.

- a) **Identification of Cropping Pattern:** As built secondary database is supposed to be available in local agriculture office by block wise defining cropping pattern for the concerned command area. In case it doesn't, then it can be collected from BARC office. Based on this data the consultant will prepare a geo-database and cartographical map by demarcating single, double and triple cropped lands exists within the intending project area. During field investigation these maps will be extensively used for cross checking the data via consultation with local farmers and relevant people.
- b) **Application of PRA Approach:** Number of PRA tools can be applied by the consultant such as "Social & Resource Mapping", "Seasonal Diagram" etc. for identifying the boundary of agricultural lands, extent and seasonal variation that could exists within the project area. Intensive focus group discussion, interviews and social mapping session by combining local people is the most expected way to perform this. Although choice of PRA tools and extent of its application will be finalized through mutual consultation with client and other project related officials/people.
- c) **Demarcation of Land based on Height Factor:** Spot level extracted from primary survey works (Topographic Survey) and secondary database (extracted DTM and DEM from highly resolated satellite image) will be superimposed on the declared boundary of agricultural activities on GIS platform and classify the lands based on elevation level. Detail Topographic survey will mainly fulfill the cross-checking purposes of those data extracted from photogrammetry works, which are supposed to be done before by the mobilization of resource in real field.

- d) **Identification of Flood prone Areas:** During hydrological study the consultant is supposed to assess the flood levels for 10 years, 50 years or 100 years by hydrological modeling. By using that estimation and spot level database the consultant can identify those agricultural lands which are susceptible to flood for different time periods. By producing cartographical maps the consultant will use it during consultation with local farmers which will assure the relevancy of the data. Again through participatory approach local farmers will also contribute their knowledge to identify threatened lands for flooding during monsoon and any other reason.
- e) **Transformation of Agricultural Lands:** Both satellite imagery and historical secondary database are collected from the reliable sources will be used for preliminary assessment to convey the transformation of agricultural lands for last 10-20 years to client and others. These data will be cross checked and the salient reason for the transformation will be revealed by field survey and consultation with local land owners and other people. Consultation with agricultural experts will also play a signatory role during this investigation. All these findings will be presented to the client both in geo-database format and explanatory descriptive format.
- f) **Identification Land Utilization Potentiality and Hazard Proneness:** From Bangladesh Agriculture Research Center (BARC) agricultural potentiality of lands lies within the intending project area can be collected and via consultation and field investigation can be crosschecked. Again, hazard prone areas specially on account of drought the consultant will, collect drought map of Bangladesh from BARC and cross checked again by consultation with local farmers and agriculture experts. After conducting all these, a combined **geo-database** will be prepared by the consultant and handed it over to the client.

2.25 Transport Sector Study

2.25.1 Method

a. Traffic and Transportation Survey

In transport plans preparation for the study area, the project will conduct the traffic survey to know the transport system and traffic flow in study area. Primary data from field survey and secondary data from BRTA and BRTC will be collected. Present traffic situation and future trends will come out from the data analysis. The data will be employed to build traffic and transport models for evaluation of the proposed plans and projects. The primary data is the basic traffic and transport data that will be conducted in the field. The data includes travel demand, traffic volume, occupancy, travel time and delay on main roads, physical of roads and intersection, and road inventories etc. To measure the travel characteristics and trip making, the data such as population, employment, student enrollment, govern ownership, household size, income, private vehicles; number of worker land use distribution will be collected from the socio-economic and physical feature survey. The LGED and RHD will provide information about future road projects in and around the area and also provide the past trend in growth on the basis of types and number of different vehicles.

b. Statistical Analysis:

The pressure on urban transport systems is increasing in most cities. Ownership of motor vehicles is also increasing day by day. In major cities of the country, this growth exceeds the ability of the road space to accommodate the increased load. Like other areas of the country the number of motorized transport has also increased over the last decade in the project area.

The secondary data regarding the past vehicle information will be collected from the BRTA, BRTC, BIWTA, BIWTC and Bangladesh Railway. The statistical analysis of study will be analyzed through SPSS, Network Analyst of GIS etc. and it will be shown to the trend in growth of past vehicles in according to types and numbers.

c. Traffic count for Traffic flow

Traffic flow is complex phenomenon. To estimate the traffic flow of this area, three primary parameters will be selected. Those are a) Speed b) Volume and C) Density.

i) Speed and delay

Speed is defined as a rate of motion, as distance per unit time. Speed and delay survey will be done at three points in major roads, local roads and junction of the national highway. Data on road pattern and condition of roads and also their problems, road length and width will be collected from the physical feature survey and verified through field checking. The speed and delay will be calculated following the equation

$$\text{Running Speed} = \text{Length of Course} / \text{Length of Time}$$

ii) Traffic Volume and Movement Pattern

Volume is the actual number of vehicles observed or predicted to be passing a point during a given time interval. During day time, night time, and peak and off peak time, Traffic volume study can be done by manually. To determine traffic volume in highway, important roads and junction point, Rail station(s) and River port(s) within the project area and at entry with exit points. A traffic survey will be carried out by applying traffic count for different modes of transport method where Tally sheet will be used.

iii) Passenger Car Units (PCUs) Equivalency Factors

One of the fundamental measures of traffic on a road system is the volume of traffic using the road in a given interval of time. It is also termed as flow and it is expressed in vehicles per hour or vehicles per day. But the traffic is normally composed of a number of types of vehicles, offering different degrees of interference to other traffic. So, it is necessary to bring all types to a common unit and the normal practice to convert the flow into equivalent passenger car units (PCUs) is by using certain equivalence factors. The flow is then expressed as PCUs per hour or PCUs per day. In determination of the equivalence factors of different types of vehicles, it will be reviewed the different studies and practice guides, such as, Dhaka Integrated Transport Study 1994 (DITS), Road Materials and Standards Study 1994 (RMSS), Rajshahi Development Authority Structure Plan Studies 2007 (RDSPS), British and Indian Practices. The value of the PCU factor considered for the Project and the value recommended by the above mentioned study /practices is given in **Table 2-13**.

Table 2-13: The Value of the PCU factor considered for the Project

Vehicle Type			DITS	RMSS	RDSPS	British Practice	Indian Practice	PCU Factors for the Project
		Motorized						
1. Bus / Truck / Minibus			2.50	3.00	3.00	3.00	3.00	3.00
2. Car/Jeep/Microbus/Pickup			1.00	1.00	1.00	1.00	1.00	1.00

Vehicle Type				DITS	RMSS	RDSPS	British Practice	Indian Practice	PCU Factors for the Project
3. Tempo				0.5	0.75	-	-	1.00	1.00
4. Auto rickshaw				0.5	0.75	1.00	-	1.00	0.75
5. Motor Cycle				0.3	0.75	0.25	0.75	0.5	0.75
B. Non- Motorized									
1. Rickshaw/Van				0.80	2.0	0.50	-	2.00	0.80
2. Bicycle				0.20	0.50	0.15	0.33	0.50	0.20
3. Push Cart				4.00	4.00	3.00	-	3.00	3.00

Density or concentration

Density is defined as the number vehicles occupying a given length of lane or roadway over time. From the speed and volume data in a particular place, the measurement of density can be obtained.

$$\text{Average density} = \text{Rate of Flow} / \text{average travel speed}$$

The rate of flow is calculated from the Traffic volume and travel speed data will be collected from the traffic through secondary sources from BRTA or any other survey conducted by other government agencies.

d. Origin Destination (O-D) Survey

A comprehensive O-D survey extended to the whole of the study area will be carried out. For this purpose, the whole survey area will be divided into a suitable number of traffic zones depending on the homogeneity of activities in the zone.

Two types of interview method will be conducted in O-D survey. One is Road side interview and other is Home based traffic study.

Road side Interview:The road side interview method will be followed. With the assistance of traffic police, vehicles of all types will be stopped and questioned regarding their origin and destination and other journey data. The surveyors will enter all this information in a preceeded form approved by the PD. PD will assist to inform the ministry of home affairs for the involvement of traffic police if necessary.

The interview sites will be located as near as possible to the traffic zone boundaries. Each interview team will be consisted of at least 8 members (exact number will depend on field condition) two members for each direction and a team leader. In each direction one member for making a classified count of all vehicles and pedestrians passing and the other member conducting the actual interviews. Manual hand-held counters will be used for traffic counting purpose. Sampling procedure will be used for taking interviews- Sample size and survey hours will be determined from field conditions. Depending on field conditions in most locations, survey hours will be between 12-18 hours.

Home Based Traffic Study: Home based traffic study will be carried out during household survey incorporating modal choice and purpose of the trips. It will include the information about different socio-economic attributes of the traveler. It will be used a standard O-D survey format for traffic volume survey. The designed standard of O-D survey format has broadly classified the motorized vehicles in to 8 categories,

namely; (a) Bus (b) Truck (c) Car, Pick-up, Micro-bus & Jeep (d) Auto Rickshaw (f) Motor cycle and the non-motorized vehicles in 3 categories namely: (a) Cycle (b) Rickshaw, Rickshaw Van & (c) Push Cart. The following Figure 8.10 shows the O-D survey framework.

Origin Destination (O-D) Survey will be designed mainly to gather the following information and covered all modes of transport which are passing through the intersections;

- The origin of the trip
- The destination of the trip
- The trip purpose
- Origin-Destination Data
- Household characteristics
- number of person who live there
- number of cars
- number of non-motorized vehicles
- occupation of the head
- Income etc.
- Spatial Location of the origin and destination of the trip (where trips begin & end)
- Time at trip started & ended (when trips begin & end)
- Mode & route of travel
- Purpose of trip

Detail Flow diagram for O-D Survey and analysis is given at Figure 2-20

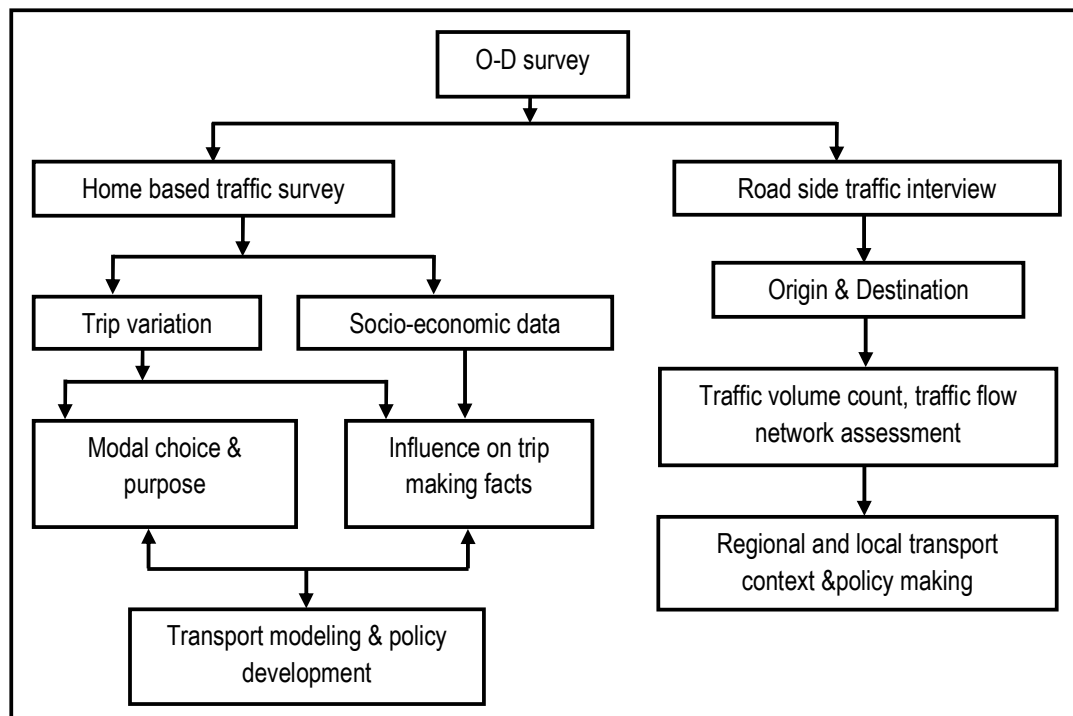


Figure 2-20: Flow Diagram Stating the method for Conducting O-D Survey.

e. Trip Generation survey

Trip generation is the process of determining the number of trips that will begin or end in each traffic zone within a study area. In the first step, the total number of trips produced by the residents in the model area will be calculated using demographic and socio-economic data. Similarly, the numbers of trips attracted by different types of land use such as employment centers, schools, hospitals, shopping centers etc., will be estimated using land use data that will be collected from land use survey and socio-economic survey. Trip generation rates obtained from travel surveys. All of these calculations will be addressed at the TAZ level.

f. Survey of intersection and links

All of the intersections and links selected are the most important and busiest half in respect of the present and future transportation network of the area. Mayor, Councilors and other stakeholders will be involved in the selection of the intersections and links for survey. Video camera will be used to conduct this survey. As a result, it will easily be found out the actual scenario and traffic characteristics in a particular junction.

Evaluation of the Level of Service of Road Intersections

The service which a roadway offers to the road user can vary under different volumes of traffic. The Highway capacity Manual has introduced the concept of "Level of Service" to denote the level of facility one can derive from a road under different operating characteristics and traffic volumes. The operating conditions for the six levels of service selected by the Manual are given below, Level 'A' representing the highest and Level 'F' representing the lowest:

Level of Service (LOS)	Volume/Capacity Ratio Cut off
A	Less than 60%
B	60% to Less Than 70%
C	70% to Less Than 80%
D	80% to Less Than 90%
E	90% to Less Than 100%
F	100% or Greater

g. Traffic Congestion Study

Nodes and intersections are usually used as bus stops and thereby loading and unloading of man and materials take place. Moreover these sections are also used for parking of both motorized and non-motorized vehicles. Informal economic activities also often encroaches road space. All these factors together results generate in traffic congestion and jams. In order to ascertain the cause of traffic congestion following survey has been conducted:

- ✓ On street parking
- ✓ Informal business

h. River/inland water survey

Direct counting of arriving and departing passengers in the study area will be made at the ghats and river terminals. These data will be supplemented by data collected from the service operators (public and private). For goods traffic, a destination survey will be made between traffic in relatively large and small units. In case of

large mechanised units, inquiries will be made with the shippers, BIWTC, jute, tobacco and other bulk commodity traders. For small units, like country boats, direct surveys will be made at the ghats/loading and unloading points. Similar techniques like interview method for road traffic will be applied for the boat or river traffic survey.

i. Transport forecasting Model

The Four Step Model set for forecasting travel demand is based on procedures and data that have been evolved over many years. The model set to be used to simulate existing travel conditions and to forecast future year travel on the entire transportation system spanning most of the region, for the transit, auto, and walk/bike modes.

The model set simulates the modes and routes of trips from every zone to every other zone.

Population, employment, number of households, vehicle ownership, highway and transit levels of service, parking costs, vehicle operating costs and transit fares are some of the most important inputs that will be used in applying the model to a real world situation. These inputs will constantly be updated so that the model set simulates current travel patterns with as much accuracy as possible. Some important features of the model set are listed below:

- The surveyed area will be divided into several internal Transportation Analysis Zones (TAZ's).
- The model set will be estimated using data from a Household Travel Survey, Traffic Volume data, employment database from secondary source like BBS
- Walking trips will also be examined and presented in the non-motorized mode.
- The model is set up to examine travel on an average weekday. The base year needs to be fixed according to the availability of data and in consultation with PD.

Four Step Model

Urban Transportation planning is followed traditionally Four Step Model that includes Trip Generation, Trip Distribution, Mode Choice and Assignment. Trip Generation deals total number of trips produced by the residents of the project area is calculated using demographic and socio-economic data. Numbers of trip attracted by landuse data (like- Shopping centres, schools, hospitals, business area etc.) and data generated from travel survey. All the calculation will be performed at the TAZ level. The second step Trip Distribution determines how the trip produced and attracted would be matched throughout the region. Trips are distributed based on Transit and Highway travel time between TAZ and the relative attractiveness of each TAZ. The attractiveness of a TAZ is influenced by the quality and quantity of jobs available and the spatial size of attractive landuse. Third step Mode Choice is about the different types of modes like- motorized, non-motorized, walk, transit etc. After determining the total number of trips between all combinations of TAZ, this model splits the total trips among the available modes of travel. This model takes into account travel times, number of transfers required and cost associated with those options determines the proportion of trips receive each mode. Last step Assignment assigns the respective networks after estimating the number of trips by each of all possible combinations of TAZ.

The forecast year is 2035.

The model set is based on the traditional four-step urban transportation planning trip generation, trip distribution, mode choice, and trip assignment. This process is used to estimate the daily transit ridership and highway traffic volumes, based on changes to the transportation system. The model set takes into consideration data on service frequency (i.e. how often trains, buses, rail, boat/Ferry arrive at any given transit stop), travel time and fares for all transit services. The highway network includes all the regional highways and local roadways. Results from the computer model provide us with detailed information relating to transit ridership demand. Estimates of passenger boarding on all the existing and proposed transit lines can be obtained from the model output where the forecast year is 2035.

j. Pedestrian Facilities

Pedestrian facilities of all types of peoples will be studied and reflected in the planning. Physical feature survey will cover to inventory the existing pedestrian facilities and demand will be addressed during survey, FGD and meeting with different stakeholders.

2.25.2 Model Outputs and Deliverables

The travel model produce several important statistics related to the region’s transportation system.

Some of these are listed below.

- Average daily transit ridership by transit sub modes
- Average weekday station boarding by mode of access
- Average mode split by geographic region
- Average trip length for transit and auto trips
- User benefits (travel time savings) associated with different market segments
- Total vehicle miles and vehicle hours of travel, made by all vehicles on a typical weekday in the model area and by sub-region
- Average speed of traffic in the region
- Daily traffic volumes on major freeways, highways and arterials
- Volume to capacity ratios on major freeways, highways and arterials
- Amount of air pollution produced by the automobile traffic, locomotives and buses

Different Database from the survey will be analysed through Excel, SPSS etc. software whichever is required (see Table 2-14).

Table 2-14:Format for Traffic & Transportation Study

SI	Items	Activities	Output
1	Statistical analysis	Desk analysis with Secondary data	Past trends in growth of different types of vehicles
2	Traffic counting	Tally system	Traffic volume and discharge in a particular point
3	Trip generation survey	Land use survey, socio-economic survey, travel survey	.Number of trip produce from a particular zone

4	Intersect and junction survey	Video Camera Setup	Traffic movement and characteristics of particular points
5	Transportation forecasting model	Four Step model	Future(2035) transportation system
6	Transportation forecasting model	Four Step model	Future(2035) transportation system
7	Spatial data base	Input in arcgis	Data attribute will be digital format

Finally, database of different transport study will be linked with other Spatial data and will help to prepare a comprehensive Transportation plan. Besides this, a comprehensive out-put (Table 2-13) will assist concern department to prepare a bankable project for Transport sector and that will lead the regional development of the concern Upazilas.

2.26 Study on Solid Waste Management

2.26.1 Method

The Consultants will conduct separate study on the scenario of solid waste management in the project area. This issue may not be of same importance for the whole project area but is very important for the built up areas and the areas that are likely to be developed within short time. This study requires identification of formal and informal system of waste type, waste generation rate, solid waste collection, location of dustbins and waste transfer station, formal and informal waste dumping site as well dumping grounds.

Both Secondary and primary database (based on dumping site amount) will be used as well as assumption based demographic and socioeconomic condition (Thumb rules).

Internal and external solid waste management will be the centre of collecting primary and secondary data. Primary, secondary data of waste management study including other database of geological and agricultural study will be analysed to get the potential spatial distribution of solid waste dumping ground (External) and internal space for dumping for the waste collection from individual household.

2.26.2 Deliverables

- Current Impact and Management of Solid waste System in the project areas
- Projection or forecasting the waste generation for definite periods.
- Identification of internal and external waste dumpinghotspots
- Spatial Database Creation that will be linked with other spatial data.

2.27 Environmental Survey

2.27.1 Scope of the Study

The alarming growth of population is one of the most formidable problems of the environment which is threatening the sustainable development and national economy of the country. Population is intimately related to environment. Rapid population growth will overstress the earth's natural resources and as people consume these resources, they produce waste that is released back into the air and land. The greater amount of waste

from the larger population puts more stress on ecosystems. Therefore, population growth significantly contributes to the degradation of the environment. On the other hand, due to urbanization, the shifting of rural population to the cities has severely overstrained infrastructure and the environment of the urban areas. It is difficult for the government to provide adequate roads, water supply, drainage, sewage treatment plants, schools, hospital, emergency service and recreational places. So, population growth and urbanization lead to water, air and land pollution causing a host of environmental problems.

The objectives of environmental baseline survey are to provide comprehensive information about the study area. In order to identify the environmental condition in designated place the following issues should be considered in the study area, it includes air quality, surface water body (wetland, river, canal pond etc.) distribution and quality, ground water occurrence and quality, soil classification and quality, climatic condition, landscape evaluation, ecosystems types and function, biodiversity (flora and fauna), noise situation, land use pattern, waste (solid and liquid) management, potential natural and anthropogenic hazards, cultural heritages (Archaeological evidence), social and economic activities, visual and aesthetics resources etc.

The study team will assess and conduct survey on the above mentioned environmental issues of the project areas. The data will be gathered from previous record by GO and NGO, published report and journal, physical observation, in-situ measurement by potable equipments, laboratory test through sample collection, Focus Group Discussion (FGD) and individual interview of local people.

2.27.2 Methodology and Technical Aspects of Individual Environmental Issues

2.27.2.1 Sampling Plans and Selection of Sampling Location

Based on pre-defined sampling plan, well-trained field officers will collect samples from various locations of the project area to analysis the various parameters according to the standard methodology. All the equipment which will be used will be calibrated and a chain of custody will be maintained starting from sample collection, preservation, transportation to the laboratory testing.

Selection of representative sampling location plays an important role in the initiation of any developmental activity as it provides an outlook on the type of environmental compliance. The project proponent will select the sites for sampling with the help of literature review, expert consultation and map of project area for environmental assessment in designated project area.

2.27.2.2 Air Quality

The air pollution may be defined as qualitative and quantitative changes in the atmospheric constituents due to addition or contamination of such substances as may be harmful to man and his environment.

It is necessary to identify the air pollution sources and cause; and find its controlling measures.

A number of pollutants are known to occur in air but for the purpose of assessment of the air quality of a particular place, the following five pollutants are considered to be important. These are (i) Suspended Particulate Matter (SPM), (ii) Nitrogen Oxides (NO and NO₂), (iii) Carbon Monoxide (CO), (iv) Sulphur dioxides (SO₂, SO₃), (v) Hydrocarbons (HC). Recently lead has also been added to this list in view of its increasing content in the atmosphere and corresponding health effects.

Air quality data source can be primary or secondary. Primary data will be produced by consulting farm as sampling procedure which mentioning below. If DOE has air quality data base of the study area than it can be possible to collect air quality data as secondary source from them and analyzed data to determine the air quality index value and compare with the different standard of air quality as per our DOE guideline.

The Air Quality Index (AQI) is a useful tool as it helps in rating the overall air quality based on the observed values of different air pollutants. In this study, AQI is determining by ORAQI (Oak Ridge Air Quality Index). The polluted air attains an index value between 10 and 100. ORAQI categories are as follows Table 2-15 and Table 2-16.

Table 2-15: Categorization of Air Quality

<i>Categories</i>	<i>Index</i>
1. Non-polluted	0 —10
2. Excellent	10—20
3. Good	20—39
4. Fair	40—59
5. Poor	60—79
6. Bad	80—99
7. Dangerous	100 and above

Table 2-16 : Standards of Air

Standards for Air [See Rule 12]					
Density in microgram per cusec meter					
Sl. No.	Categories of Area	Suspended Particulate Matters (SPM)	Sulphur-dioxide	Carbon Monoxide	Oxides Nitrogen
a.	Industrial and mixed	500	120	5000	100
b.	Commercial and mixed	400	100	5000	100
c.	Residential and rural	200	80	2000	80
d.	Sensitive	100	30	1000	30

Air Quality sampling procedure: The height of the ambient air quality sampler will be about 1-1.5 meters height. The impinger or others pipes will be pre-cleaned and dried before they are used for sampling. For the sampling of SO_x, NO_x, SPM, and O₃ all the pipes connections will be checked to prevent leaking. Data will be taken during day and night time. Representative samples of ambient air quality will be collected through high volume sampler at selected locations along the project area. The duration of sampling time will be one hour for each of the location. Odour and wind direction of air also be collected for air quality analysis.

2.27.2.3 Water Quality (Surface and Ground Water Body)

The evaluation of water quality is done in terms of several parameters such as alkalinity, dissolved oxygen, Biochemical oxygen demand (5 days), number of coliform bacteria, color, hardness, odor, pH, salinity, temperature, total solids, turbidity, salts-chlorides, fluorides, nitrates, phosphates and sulphates, presence of trace elements like Al, As, Ba, Cd, Cr, Fe, Pb, Mn, Hg, Se, Ag, Sn, Zn and B, pesticides and radioactivity. Among these attributes, the amount of dissolved oxygen, biochemical oxygen demand and total coliform counts are good indicators of the quality of water.

- The modern approaches to the description of water quality utilize three approaches
- Quantitative measurement, such as of physicochemical parameter of water.
- Biochemical/ biological test (including BOD estimation, toxicity testing, etc).
- Semi-quantitative and qualitative description involving biological indicators and
- species inventories.

Sampling procedure: Hand gloves, sterilizing agent and other water sample collection equipments will be used for water sampling. Personal protective equipment will also be used during sampling of both surface and groundwater. For physicochemical analysis (pH, BOD, COD, TSS, TDS) samples will be collected in pre-cleaned plastic bottles and will be sent to the laboratory within 6 hours. For metal analysis samples will be collected in pre-cleaned plastic bottles where 10% Nitric Acid will be used to preserve the samples. Total and fecal coliform sampling bottles will be sterilized in autoclave. All the samples will be stored immediately at 4°C in cooler box and transported to the analytical laboratory directly from the field.

The surface and groundwater samples will be collected from the project area for physical, chemical and biological quality assessment. Three types of parameters will be analyzed for water quality assessment. They are- i) Physicochemical analysis (e.g. pH, Temperature, Turbidity, TSS, TDS, DO, BOD5, COD). ii) Elemental analysis and iii) Microbial analysis (e.g. Total coliform and fecal coliform).

Water pollution: Water is said to be polluted when its quality or composition is changed either naturally or as a result of human activities and it becomes unsuitable for drinking and less suitable for domestic, agricultural, industrial, recreational and other uses.

Water pollutants: The dissolved or suspended substances which deteriorate the quality of water and make it unfit for human consumption are called water pollutants. In other words, water pollutants are those physical, chemical or biological factors which are harmful to aquatic life and to those who consume water. Water pollutants include several chemicals in dissolved or suspended state, some physical factors such as heat, radiations, and some bio-pollutants such as aquatic microorganisms particularly pathogens.

Regarding the water pollution an inventory survey will be conducted to identify the water body and its pollution perspective (sources and causes) of the study area. Finally find the controlling or management procedure or developing guideline for maintaining sustainable water quality.

2.27.2.4 Soil Quality Analysis:

Soil is defined as a shallow body of material formed on the surface of the land that warps the surface of the earth and where biological activities take place. The best quality soil provides water and nutrient for growth of

plants and also gives the mechanical support to the plant root. The formation of one inch of fertile topsoil takes about 500 to 1000 years. Typical soil that is suitable for agriculture contains about 5% organic matter and 95% inorganic matter. The main constituents of soil are minerals, humus, water, air and microorganisms.

Soil pollution is the addition of any chemical substance in an indefinite proportion to the soil which reduces the fertility and changes the characteristics of soil. The substances which are capable of reducing or changing the fertility of the soil are called soil pollutants.

So, it is very much important to identify the soil type with their characteristics of the study area. It is also important to determine the degradation factors of soil environment, identify the soil pollutants and their sources.

Sampling procedure: The soil sample will be collected from predefined locations. A pre-cleaned and disinfected spade or hand augur will be used to collect the soil sample and will be stored in pre-cleaned zipper bag. Hand gloves and all necessary PPE (Personal Protective Equipment) will be available during sampling. One composite soil sample will be collected from designated area and the coordinates of the sampling location has to be recorded with a hand held GPS. The physical properties of soil (colour, texture etc.) will be noted in field note book. The collected sample was investigated to observe the soil properties and investigation will be carried out into reported laboratory.

2.27.2.5 Landscape Evaluation

Geomorphology of the study area is very much important regarding environmental issues. Morphological diversity determines the ecosystem functions and its dynamics. Methodologically geomorphology of the study area will be studied from satellite image interpretation and through field visit. From this study, identify the morphologically diverse elements (elevated land, low land, river, canal, lake, ditch area etc.) with their characteristics.

2.27.2.6 Climatic Condition

Climatic condition of an area is a dynamic phenomenon of the environment. This factor influences the whole living creature and over the time climatic condition has been changes which impacts on biodiversity (flora and fauna), agriculture activities and socio-cultural activities. So, climate change issues are very much important to consider for any kind of sustainable development. In this regard, climatic condition of the study area has to know. The following climatic elements for example temperature, humidity, rainfall, wind direction and speed, sunlight etc. will be collected from local and regional weather station or Bangladesh Meteorology Department (BMD). From the analysis of climatic data, trend of climatic changes over the time will be determined and which will help to design the future development project for their sustainability.

2.27.2.7 Ecosystems Types and Function

The living community of plants and animals in any area together with the nonliving components of the environment – such as soil, air and water- constitute the ecosystem. An 'ecosystem' is a region with a specific and recognizable landscape form, such as a forest, grass land, desert, wetland or coastal area. The nature of the ecosystem is based on its geographical features like hills, mountains, plains, rivers, lakes, coastal area or islands. It is also controlled by climatic conditions- the amount of sunlight, the temperature and the rain fall in

the region. An inventory survey will be conducted to identify the individual ecosystem and their components with functional aspects.

2.27.2.8 Biodiversity (Flora and Fauna)

A brief terrestrial and aquatic ecological survey will be conducted in the project area to determine the habitat characteristics, species composition and distribution, important floral and faunal compositions. Review on existing literatures will be undertaken with a view to gather information on the local biodiversity and other local ecological settings. Primary data sources include physical observation, Focus Group Discussion (FGD), Key Informant Interview (KII) and questionnaire survey. Secondary data analysis includes available background material related to wetland ecosystem from government and nongovernment sources including journals, books and reports.

2.27.2.9 Noise Situation and Noise Map

Noise is defined as unwanted sound. Sound has a range of different physical characteristics, but only becomes noise when it has an undesirable physiological or psychological effect on people. Environmental Noise refers to noise that can affect our surroundings, and includes construction noise, machinery noise, transportation noise, as well as domestic noise. (*gtz, module 5c, 2002*).

Noise maps of an area are valuable derivative maps that show quantitatively or qualitatively certain characteristics of the urban environment that determine vulnerability of sound pollution. Noise maps are particularly useful for planning, regulatory, managerial and decision making purposes and it has already been proved to manage environmental noise pollution in many countries efficiently.

A Noise map is rather like a weather map for noise but it shows the hotspots (where it's noisy) and the cooler areas (where it is quiet). Just as a weather map might have isobars joining points of equal air pressure, a noise map can have contours (iso-phons) joining points having the same noise level. Alternatively a noise map can be made up of a set of small colored dots – which can show the overall picture of noise across the area mapped. Noise mapping has been proved to be effective in controlling noise pollution in many European cities such as London, Birmingham, Stockholm, Zurich, and many other cities. (*defra, England, 2005*).

Sound level data has been collected in the study area along the main road and outside the building by traverse method. Data has been taken in every location at three specific times of the day, which are 9am – 12pm, 2pm - 4pm and 6pm-8pm and it was taken for working day and holiday situation. By this manner it was taken for seven weeks to cover the whole study area. Different location IDs have been used to identify the location of sampling in the map. A digital sound level meter was used to record the sound level. A-weighted sound levels were measured during the study. The roadside sound level data was collected 1.5 meter above the ground and the data was taken by standing on the roadside. Any kind of noise barriers, bad weather, unusual situation etc. were avoided for measuring the actual sound level. There was 12 meters gap between each data point.

Table 2-17: Noise level standards in Bangladesh

Sl. No.	Category of areas	Sound levels dB (A)	
		Day time	Night time
1	Silent zone	45	35
2	Residential area	50	40
3	Mixed area (mainly residential area, and also simultaneously used for commercial and industrial purposes)	60	50
4	Commercial area	70	60
5	Industrial area	75	70

(Source: Department of Environment, Bangladesh, 2002).

2.27.2.10 Landuse Pattern

Existing land use pattern will be studied through field visit and satellite image interpretation. From this study, identify the important infrastructure and its activities, segregate the residential, commercial, industrial, educational, waste dumping place, water body, recreational place etc on map. Identify the problem of the existing land use pattern regarding environmental concern. Make some recommendations on present situation and future development plan for their sustainability.

2.27.2.11 Waste (Solid and Liquid) Management

In the study area, a field survey will be carried out to identify the sources of all sorts of waste (solid, liquid, gaseous and un weighted), present management system and there dumping place, pollution phenomena due to mismanagement, identify the vulnerable site etc. From this inventory survey, give some recommendation and alternative options for improvement of present management system and also provide a sustainable waste management plan for future development plan.

2.27.2.12 Potential Natural and Anthropogenic Hazards

A field survey will be carried out among the inhabitants to identify the potential hazards through individual interview, FGD and also collection of secondary data from different GO and NGO organization. From this survey it can be possible to ranking the hazards as per their severity, segregate the vulnerable group peoples and resources as per hazard. So, it will be very easy to take some measures against them in a integrated way which will reduce risk phenomena among the inhabitants and maintain the sustainable environment.

2.27.2.13 Cultural Heritages (Archaeological Evidence)

A inventory survey will be carried out in the project area for listing the cultural and ethnic heritage sites, to determine the areal extension of it and functioning aspects with its quality. From this survey, it will be possible to know areal extension of these valuable archaeological places, present condition of their infrastructure, ethnic or cultural history and their social activities. Finally, it is also possible to make some recommendations to acquire the land area of this important site as government properties, store the archaeological evidence and there preservation, increasing the strength of infrastructure through retrofitting, exhibits the all sort's cultural heritages among the visitors under the guidance of proper authority. On the basis of this study, produce a plan for ecotourism which will incorporate in the future development plan of the study area.

2.27.2.14 Social and Economic Activities

Social and economic activities are important controlling factors of environmental changes and a field survey will be conducted to know the scenario of social and economic activities. The survey will be conducted through peoples interview and FGD; and also collect related information from GO and NGO of the study area. From this survey report, it will be possible to make some recommendations regarding this aspect, which can introduce into the future development plan for sustainable environment of the study area.

2.27.2.15 Visual and Aesthetics Resources

Now a day, visual scenic value and aesthetics of an area is considering as important ingredients to judge the environmental quality. In this concern, a field inventory survey will be conducted to know the land morphology and existing infrastructure. In this survey, all sorts of information's including infrastructure development will be gathered. From this survey report, make some recommendations for improvement of existing environment of the study area visually and aesthetically; and also provide a guide line for future development plan where visual and aesthetic values will be practised individual or organizational level.

2.27.3 Deliverable

In order to identify the environmental condition in designated place the following above issues should be considered in study area and from these study deliverable product will be produced which are air, water and soil quality database with their present status; noise condition with noise map; landscape evaluation report with present land use pattern; present climatic condition and future climate change report of the study area; produce a database of present ecosystem and biodiversity (flora and fauna) of the study area; present waste management condition report and future waste management plan; get some recommendations or guideline for future developing plan regarding cultural heritages (Archaeological evidence), social and economic activities, visual and aesthetics resources; and finally get hazard scenario map and management tools how to control it.

2.28 Pollution Study

2.28.1 Method

Environment is the aggregate of conditions affecting the existence or development of life and nature. The overall global environment is declining fast and for Bangladesh it has been doing so more rapidly during the last few decades because of many obvious reasons. In the project areas, apart from fossil fuel combustion, the

other sources of air pollution are the brick kilns, fertilizer factories, jute and textile mills, spinning mills, biscuit factories, saw mills and dust from ploughed land. These sources produce an enormous amount of smoke, fumes, gases and dust, which create the condition for the formation of fog and smog. In this way indoor air pollution can be five to ten times that of the dirtiest air outside. This may cause headache and other health problems.

The mostly contributing industries for water pollution are pulp and paper, pharmaceuticals, metal processing, food industry, fertilizer, pesticides, dyeing and painting, textile, tannery etc. Water pollution creates serious health hazard for Bangladesh. The dumping of municipal wastes, hospital wastes and toxic environmental discharges from mostly industries pollute both surface and ground water sources. The most dangerous threat emanating from environmental degradation is the arsenic contamination of ground water. The river water is polluted by food industry, fertilizer, pesticides, and textile industries in the project areas.

In Bangladesh noise pollution (also termed as sound pollution) is a major health hazard. In fact due to noise pollution millions of people in Bangladesh are exposed to a number of health risks -from deafness to heart attack. On city streets noise pollution can be caused by hydraulic horns of vehicles, microphones and cassette players. The hydraulic horns used by buses, trucks and scooters in the crowded city streets are dangerous for human being. This is also how noise pollution is affecting the hearing power of thousands of children every day. The horns especially cause serious damage to children. Experts say, if a child below three years of age hears a horn emitting 100 dB of noise from a closerange, he or she mightlose his or her hearing power. A child's health may also be adversely affected by loud sounds from the radio, television, cassette players and microphones, the sound of mills and factories and loud noise.

According to a survey of the Department of Environment (DOE), noise causes mental and physical illness among the people. It causes high blood pressure, tachycardia, headache, indigestion, peptic ulcer, and also affects sound sleep. Anyone may become deaf for the time being if 100 dB or more noise pollution occurs for half an hour or more in any place. Working in an atmosphere of loud noise for a long period can cause complete deafness to any person. Any sort of noise pollution seriously affects expecting mothers. It has been observed that pregnant mothers living near big airports give birth to more crippled, deformed and immature children than those living in other places.

One of the directly related consequences of population growth is the increase in waste generation. With the conventional system of collection, transportation and crude dumping of solid waste, areas of Bangladesh are generally faced with rapid deterioration of environmental and sanitation condition. As such, urban solid waste management has become a major concern for the cities and towns of Bangladesh. Municipal services in most cities and towns are already over-burdened, and simply cannot meet the growing demand for municipal services, resulting in unhygienic and filthy living condition in the neighborhoods. Ultimate disposal of urban solid waste is done crudely in open dumps, lowlands or water bodies in an unsanitary manner. As a result, the surrounding environment of the dumpsites is barely hygienic.

2.28.2 Deliverable

Pollution hotspot spatial mapping as well as database generation and these outputs will be finally merged with master geodatabase or spatial data bank as a final output discussed in Section 2.44.1.

2.29 Drainage Improvement Study or Modeling

2.29.1 Method

The main objectives of the drainage study are to assess the existing condition and prevailing drainage form and pattern in the area and to identify the future requirements of the drainage system improvement to ensure flooding and water logging free environment as well as required control over environmentally critical and vulnerable areas and living things. The development objectives of the drainage improvement works are to provide new drain (Primary, Secondary and Tertiary), cleaning and re-excavation of the existing natural canal/khals and drains for increasing their discharge capacity and to repair and rehabilitate the existing drains up to their full capacity.

Data Acquire: The information regarding drainage survey will collect both by using physical feature survey and checklist comprised of drainage types and nature (brick, RCC, earthen), dimensions (length, width, and depth), outfall point and condition of the drains. To identify the spatial position of these drains and other features, GPS based advanced survey technique will use. Preparing the Contour map and identifying the slope from topographic survey by using Real Time Kinematic Global Positioning System (RTK-GPS), Total Station etc. The position of other drainage features e.g. bridges; culverts, etc. will also surveyed using Total Station. Secondary data from previous studies and data of municipality will be also collected and merged with primary data to cross check and make the input model data more authentic.

Software and Equipment Required: For conducting Drainage Improvement plan the consultant will perform Hydrologic and Hydraulic by using Bentley SewerGems combined with infoSWMM technique, the most updated one at the current time. This purpose can also be served by using EPA-SWMM tool also, decision further dependent on resource management. For the time being detail modeling methodology in SewerGems platform for drainage improvement is discussed below by turns. Additionally ArcINFO 10.1 with four extensions ArcSWAT, ArchYDRO tools, HEC-geoRAS and HEC-geoHMS will be used for model input and output map preparation.

Model Construction

The InfoSWMM model platform is based within ArcGIS and allows for direct import of existing GIS data using the GIS Gateway. The gateway allows the user to select the existing data to import and map the necessary data fields in GIS to the corresponding field in InfoSWMM. The critical element when using the gateway is having a unique identifier, in this case the Model ID, for every element within GIS. Otherwise, InfoSWMM will create a unique model identifier and the connectivity between GIS and the model is lost. The unique identifier allows for data to be transferred from the model back to GIS and for model maintenance updates as additional information becomes available.

Basin Delineation

The stormwater basins will be delineated for each inlet and drainage ditch in the model using arials and 1.0 m contour data. InfoSWMM has the capability to create the basins; however, due to topographic data limitations (i.e. lack of curb and gutter shots, etc) the basin boundaries had to be created manually. The land use for each basin was then defined using existing GIS data for use with future pollutant loading.

Hydrologic Model Development

Hydrologic models are simplified, conceptual representations of a part of the hydrologic cycles are primarily used for hydrologic prediction and for understanding hydrologic processes. This model includes precipitation, evaporation, infiltration, and surface runoff.

Hydraulic Model Development

The hydraulic portion of the model begins once surface water flow from individual basins enters the conveyance system following a storm event. The hydraulic model includes the flow characteristics of the stormwater system such as flow, velocity, depth over diameter (d/D), hydraulic grade line, inlet / ditch flooding, and pond storage capacity. Conveyance and storage consisted of drainage ditches, inlets, piping, and ponds imported directly from GIS and supplemented by additional field work. The hydraulic model analysis was a result of the runoff generated from the hydrologic portion of the model. The hydrologic model was based on theoretical storm events and not actual measured rainfall.

Water Quality Model Development

Stormwater runoff has both a quantity and quality component. Quantity is related to runoff volume and duration of a storm event. Quality is related to the potential contaminants contained within the runoff (water pollution).

System Flood Analysis

Following completion of the model development process, the simulations were completed and the results reviewed to determine the extent of flooding up to and including the 100-yr storm events. The flooding during the critical storm event occurred in several areas within the city limits and was not isolated to any particular location. The majority of the flood areas were located in the southeast and central sections of the city.

Design Alternative Development: System Improvements Methodology

The most practical method to reduce flooding was determined to be increasing capacity within the conveyance system (ditches and pipes). This method involved increasing pipe sizes, removing negative slope pipe sections, increasing pipe slopes, and widening ditches. Each flood area during the critical storm event was individually numbered and analyzed for potential flood reduction. The conveyance system capacity was then increased in each identified problem area until flooding was eliminated or reduced as much as possible. The downstream section of each identified problem area was checked to make sure additional flooding was not created as a result of the proposed improvements.

2.29.2 Deliverables

- Develop a large scale hydraulic and hydrologic model of the existing stormwater infrastructure.
- Analyze the existing infrastructure during the 10, 25, 50, and 100 year critical storm frequencies to identify areas prone to flooding.
- Develop design alternatives, where practical, for the areas prone to flooding to determine necessary improvements required.

- All these outputs will be finally merged with master geodatabase or spatial data bank as a final output discussed in Section 2.44.1.

2.30 Hydrologic and Hydrodynamic Study or Modeling

2.30.1 Method

Two types of Analysis or physical and statistical model will be done under this package for this study area as Hydrologic Model and Hydrodynamic Model. HEC-RAS technique will be used for hydrodynamic modeling purpose where as HEC-HMS will be used for hydrological modeling. EPA-SWMM is capable for performing the both functions and this will be used frequently to validate those models and special model preparation for urbanized areas within the study areas. Apart from these, extensions of ArcGIS such as Arc Hydro tools, Hec-GeoRAS, Hec-GeoHMS and ArcSWAT will be extensively used for model input preparation and output mapping.

2.30.1.1 Model Data and Software Requirements

Various types of supporting maps and datasets are essential for the development, update, use, and proper understanding of hydrologic and hydraulic models. This section outlines the required datasets, provides information on how to obtain each relevant dataset, and provides specific guidance on the use of each.

HEC-HMS requires landuse, soils and topography along with rainfall data (will be acquired from topographic survey, secondary data on rainfall and other necessities). The input data of HEC-RAS consists of cross-sectional geometry and characteristics, bridge and culvert information, steady or unsteady flow data and plan information. For simulations of a complete drainage network in EPA-SWMM, the required data include weather, surface, subsurface, channel/pipe, storage, sedimentation and surface quality.

Primary Data Collection: Topographic Survey, Geological Survey and Physical Feature Survey including processed satellite image data.

Secondary Data Collection Source: BMD Weather and Rainfall Data and other required secondary data will be collected from SoB and DoE.

Software: EPA-SWMM, HEC-RAS, HEC-HMS and ESRI ArcINFO 10.1

2.30.1.2 Development of Hydrological Model

Hydrological models are simplified, conceptual representations of parts, if not all, of the hydrologic cycle. They are primarily used for estimation and prediction as well as for understanding rainfall-runoff processes. Two major types of hydrological models can be distinguished as follows:

Stochastic Models: Stochastic models are black box systems, based on data and using mathematical and statistical concepts to link a certain input (for instance rainfall) to the model output (for instance runoff). Commonly used techniques are regression, transfer functions, neural networks and system identification.

Process-Based Models: Process-Based models try to represent the physical processes observed in the real world. Typically, such models contain representations of surface runoff, subsurface flow, evapo-transpiration

and channel flow, but they can be far more complicated. These are also known as deterministic hydrology models, which can be further subdivided into single-event and continuous simulation.

In this study a Process-Based Model, HEC-HMS is being used to simulate the hydrological processes of the fringe area and to estimate the surface run off due to the combined effect of rain fall and evaporation. At the same time EPA-SWMM model has been selected to analyze the hydrology of urban areas.

2.30.1.3 Development Sequence of Hydrological Model

Separate hydrological algorithms are being developed for rural and urban areas in this study, i.e. HEC-HMS is utilized as a rural model while EPA-SWMM is the model for the urban basin.

For HEC-HMS, developed by the Hydrologic Engineering Center (HEC) of the US Army Corps of Engineers, the simulation of flood hydrographs and discharges requires the following steps in sequence, also furnished in Figure 2-21:

Creating project and Preparation of time series data needed by the basin or meteorological model

- Define the physical characteristics of the watershed by creating and editing a basin model
- Select a method for calculating sub-basin precipitation and enter required information.
- Define the control specifications
- Simulation of model by combining the created basin model, meteorological model and control specification
- Assessment of model result for calibration by improving the basin model, meteorological model and control specification as needed

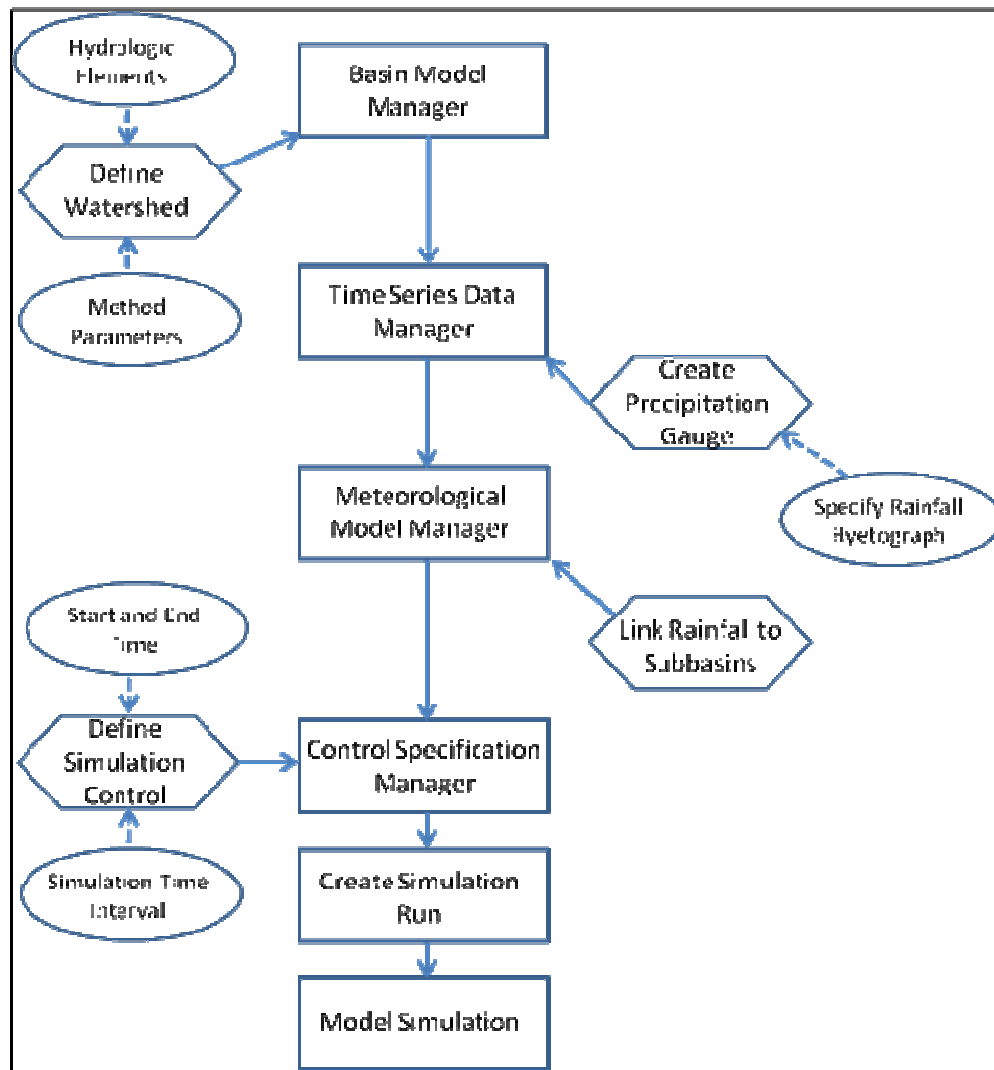


Figure 2-21: Schematic Diagram for Developing Hydrological Model

Input Data and Analysis

Data input is the vital step during the development of hydrological model. Time-series, paired and gridded data are often required as parameters or boundary conditions in the basin and metrological models. The HEC-HMS platform has all the facilities to incorporate these data. Rainfall time series data form the inputs while landuse patterns are used to fix the pervious and impervious regions for this study.

HEC-HMS Basin Model

The basin model represents the physical watershed or basin. An in-depth knowledge on the drainage systems is needed to create an accurate basin model. The most essential part for this development is to delineate the whole study area into number of sub-basins. This was done based on the Digital Elevation Model (DEM) of the study area, drainage networks, flow patterns of the existing river systems and discussion with the professionals. Once the basin model was created, hydrological elements have been added and connected in the basin map to reflect the drainage of the real world watershed. There are a number of hydrological elements

and calculation methods available in this model, of which the Clark Unit Hydrograph was employed for HEC-HMS simulations. The hydrological parameters of basin model are as follows:

- Sub-basin - rainfall-runoff computation on a watershed
- River reach - routing of flows from one end of a reach to the other
- Reservoir - routing of flows through a level-pool reservoir
- Junction - combination of flows from upstream reaches and sub basins
- Diversion - abstraction of flow from the stream
- Source - inflow of water from a stream crossing the boundary of the modeled region
- Sink - outflow of water in a stream crossing the boundary of the modeled region (basin outlet)

EPA-SWMM Model

The EPA Storm Water Management Model (SWMM) is a dynamic rainfall-runoff simulation model used for single event or long-term (continuous) simulations of runoff quantity and quality from primarily urban areas. The runoff component of SWMM operates on a collection of sub-basin areas that receive precipitation and generate runoff and pollutant loads. The routing portion of EPA-SWMM transports this runoff through a system of pipes, channels, storage/treatment devices, pumps, and regulators. EPA-SWMM tracks the quantity and quality of runoff generated within each sub-basin, and the flow rate, flow depth, and quality of water in each pipe and channel during a simulation period comprised of multiple time steps.

EPA-SWMM is widely used throughout the world for planning, analysis and design related to storm water runoff, combined sewers, sanitary sewers, and other drainage systems in urban areas, with many applications in non-urban areas as well since its development. It provides an integrated environment for editing study area input data, running hydrologic, hydraulic and water quality simulations, and viewing the results in a variety of formats. These include color-coded drainage area and conveyance system maps, time series graphs and tables, profile plots, and statistical frequency analyses.

Hydrological features of EPA-SWMM that produce runoff from urban areas comprise a wide range of options. These include:

- Time-varying rainfall
- Evaporation of standing surface water
- Rainfall interception from depression storage
- Infiltration of rainfall into unsaturated soil layers
- Percolation of infiltrated water into groundwater layers
- Interflow between groundwater and the drainage system
- Nonlinear reservoir routing of overland flow
- Capture and retention of rainfall/runoff with various types of low impact development (LID) practices.

Elements of Sub-Basins- Loss Method:

While a sub-basin element conceptually represents infiltration, surface runoff, and sub-surface processes interacting together, the actual infiltration calculations are performed by a loss method contained within the

sub- basin. The Initial and Constant Loss method was used under this study which conserves mass. That is, the sum of infiltration and precipitation left on the surface will always be equal to total incoming precipitation.

The initial and constant loss method is very simple but it is appropriate for watersheds that lack detailed soil information. The initial loss specifies the amount of incoming precipitation that will be infiltrated or stored in the watershed before surface runoff begins. There is no recovery of the initial loss during periods without precipitation. The constant rate determines the rate of infiltration that will occur after the initial loss is reached. The same rate is applied regardless of the length of the simulation. The percentage of the sub-basin which is directly connected impervious area has been calculated with available land use data. No loss calculations were carried out on the impervious area. All the precipitation on that portion of the sub-basin becomes excess precipitation and subject to direct runoff.

Surface Runoff Co-efficient or Percentage of Imperviousness:

The percentages of imperviousness will be calculated based on the available landuse data for the zones within the model area. Percentage of Imperviousness for different types of landuse will be derived from the available data and these are used to calculate the average impervious percentage for each zone based on a report “Estimating Impervious Cover and Its Impact on Water Resources, 2002”. According to the report, the imperviousness percentages for different land types are listed in Table 2-18 and 2-19.

Table 2-18: Average Imperviousness Percentage for Different Land Use-I

SL	NJDEP95 Landuse/Land Category	Avg Impervious%
1	CONFIROUSWOODENWETLANDS	0.0
2	CROPLANDANDPASTURELAND	0.5
3	DECIDOUS BRUSH/SHRUBLAND	1.2
4	DECIDOUSFOREST(10-50% CROWNCLOSSURE)	0.9
5	DECIDOUSFOREST(>50%CROWNCLOSSURE)	0.6
6	DECIDOUSSHUBS/SHRUBWETLANDS	0
7	DECICOUSWOODED WETLANDS	0
8	DISTURBED WETLANDS(MODIFIED)	0.5
9	EXTRACTIVE MINING	1.9
10	FORMER AGRICULTURALWETLAND-BECOMINGSHRUBBY, NOT BUILT-UP	0.1
11	HERBACEOUSWETLANDS	0
12	INDUSTRIAL	61.3
13	INDUSTRIAL/COMMERCIALCOMPLEXES	85
14	MANAGED WETLAND INBUILT-UP MAINTAINED REAREA	3.2
15	MANAGED WETLANDINMAINTAINEDLAWNGREENSPACE	0.3
16	MILITARYRESERVATIONS	83.3
17	MIXEDBRUSHANDBOGWETLANDS,CONIFEROUSDOMINATE	0
18	MIXEDDECIDOUS/CONIFEROUSBRUSH/SHRUBLAND	0.8
19	MIXEDFOREST(>50%CONIFEROUSWITH10%-50%CROWNCLOSSURE)	0.9
20	MIXEDFOREST(>50%CONIFEROUSWITH >50%CROWNCLOSSURE)	0.4
21	MIXEDFOREST(>50%DECIDOUSWITH10%-50%CROWNCLOSSURE)	0.8
22	MIXEDFOREST(>50%DECIDOUSWITH >50%CROWNCLOSSURE)	0.3
23	MIXEDFORESTEDWETLANDS(CONIFEROUSDOM.)	0
24	MIXED FORESTEDWETLANDS(DECIDOUSDOM.)	0

SL	NJDEP95 Landuse/Land Category	Avg Impervious%
25	MIXEDRESIDENTIAL	30
26	MIXED SHRUB/SHRUBWETLANDS(DECIDOUSSDOM)	0
27	MIXEDURBANORBUILTUPLAND	46.1
28	NATURAL LAKES	0
29	OLDFIELD(<25%BRUSHCOVERED)	1.3
30	ORCHARD/VINEYARDS/NURSERIES/HRTICULTURE AREAS	4.5
31	OTHERAGRICULTURE	15.5
32	OTHERURBANORBUILT-UPLAND	4.2
33	PLANTATION	0.8
34	RECREATIONALLAND	22.1
35	RESIDENTIAL, HIGHDENSITY,MULTIPLE DWELLING	55.2
36	RESIDENTIAL,RURAL,SINGLEUNIT	12.9
37	RESIDENTIAL,SINGLE UNIT,LOWDENSITY	20.8
38	RESIDENTIAL,SINGLEUNIT,MEDIUMDENSITY	30.5
39	STREAMSANDCANALS	0
40	TRANSITIONALAREAS	3.5
41	TRANSPORTATION/COMMUNICATIONS/UTILITIES	30.6
42	UNDIFFERENTIATED BARREN LANDS	0.3
43	WETLANDSRIGHTS-OF-WAY(MODIFIED)	0.1

Table 2-19: Average Imperviousness Percentage for Different Land Use-II

SL	NJDEP95LandUse/LandCategory	AvgImpervious%
1	AGRICULTURALWETLANDS(MODIFIED)	0
2	ALTEREDLANDS	7
3	ARTIFICIAL LAKES	0
4	ATHLETICFIELDS(SCHOOLS)	9.1
5	ATLANTIC WHITECEDARSWAMP	0
6	BAREEXPOSEDROCK,ROCKSLIDES,ETC	21.6
7	COMMERCIAL/SERVICES	59.9
8	CONFINEDFEEDINGOPERATIONS	20.4
9	CONIFEROUSBRUSH/SHRUBLANDS	0.6
10	CONIFEROUSFOREST(10-50%CROWNCLOSSURE)	1.1
11	CONIFEROUSFOREST(>50%CROWNCLOSSURE)	0.5
12	CONIFEROUSSHRUB/SHRUBWETLANDS	0

Transform Method:

While a sub-basin element conceptually represents infiltration, surface runoff, and subsurface processes interacting together, the actual surface runoff calculations are performed by a transform method contained within the sub-basin. In this study, the Clark Unit Hydrograph, a synthetic unit hydrograph procedure, was used as the transform method in this modelling exercise. That is, the user is not required to develop a unit hydrograph through the analysis of past observed hydrographs. Instead, a time versus area curve built in to the program is used to develop the translation hydrograph, upon which it is routed through a linear reservoir to

account for storage attenuation affects across the sub-basin. The two important parameters of this method are time of concentration (Tc) and storage coefficient(R).

The time of concentration (Tc) defines the maximum travel time in the sub-basin. It is used in the development of the translation hydrograph. The time of concentration was calculated for each sub-basin based on the catchment area, stream length and weighted slope. The equation for time of concentration is furnished below:

$$T_c = 2.32 A^{-0.1188} L^{0.9573} S^{-0.5074}$$

where, Catchment area in km²
L Main stream length in km
S Weighted slope of

The storage coefficient(R) is used in the linear reservoir that accounts for storage affects, with the following equation:

$$R = 2.976 A^{-0.1943} L^{0.9995} S^{-0.4588}$$

where, Catchment area in km²
L Mainstream length in km
S Weighted slope of

Base flow Method:

While a sub-basin element conceptually represents infiltration, surface runoff, and subsurface processes interacting together, the actual subsurface calculations are performed by a base flow method contained within the sub-basin. In this study, Recession Base flow method was adopted which is designed to approximate the typical behavior observed in watersheds when channel flow recedes exponentially after an event. This method is intended primarily for event simulation. However, it does have the ability to automatically reset after each storm event and consequently may be used for continues simulation. Two different methods are available for specifying the initial condition: initial discharge and initial discharge per area. In this study the initial discharge was calculated for model simulation using the following equation.

$$Q = 0.11 A^{0.85889}$$

where, A = catchment area in km²

Calibration and Validation

Finally, hydrological simulations were performed using the control specifications in the HEC HMS and EPA-SWMM modelling tool. The control specification is the place to set the time span of the simulation run. Information in the control specifications includes a starting date and time, ending date and time, and computation time step.

2.30.4 Hydrodynamic Modeling

Hydrodynamic (HD) modelling is a simulation module which is capable of simulating unsteady flows in open channels (rivers and estuaries). The result of a HD simulation consists of time series of water levels and discharges, with hydrological models utilized to generate inflows.

Software or Tools: In this study, HEC-RAS is going to be used to develop the hydrodynamic model for the rural area, while EPA-SWMM is the urban model. The major steps for establishing HEC-RAS are preparation as well as development of required data and boundary conditions. All these steps are furnished in the following sections.

Data Required and Analysis

Data such as water levels, flows/discharges, satellite images (**procured and USGS free images**) and river cross-sections, acquired from authentic secondary sources and primary field measurements, were used for setting up the hydrodynamic models. River cross-sections were the basis for configuring bathymetry/hydrography of all major and minor river systems as well as khals, along with network delineation on satellite imagery. Recorded water levels and flows form the model boundary conditions and are also utilized for the calibration and validation process. Further processing and analysis of collected water level and flow data is discussed in the following section.

The two major steps of hydrodynamic modelling with HEC-RAS are development of geometric data and establishment of flow data. Before importing the geometric data, the river network was prepared using acquired satellite imagery and recently surveyed data in this study. All the rivers, khals and drainage channels will be incorporated.

After establishing the river systems, all surveyed and obtained cross-sections were incorporated as required, with floodplains defined accordingly. A sample model and cross-section are shown in Figure 2-22 and Figure 2-23.

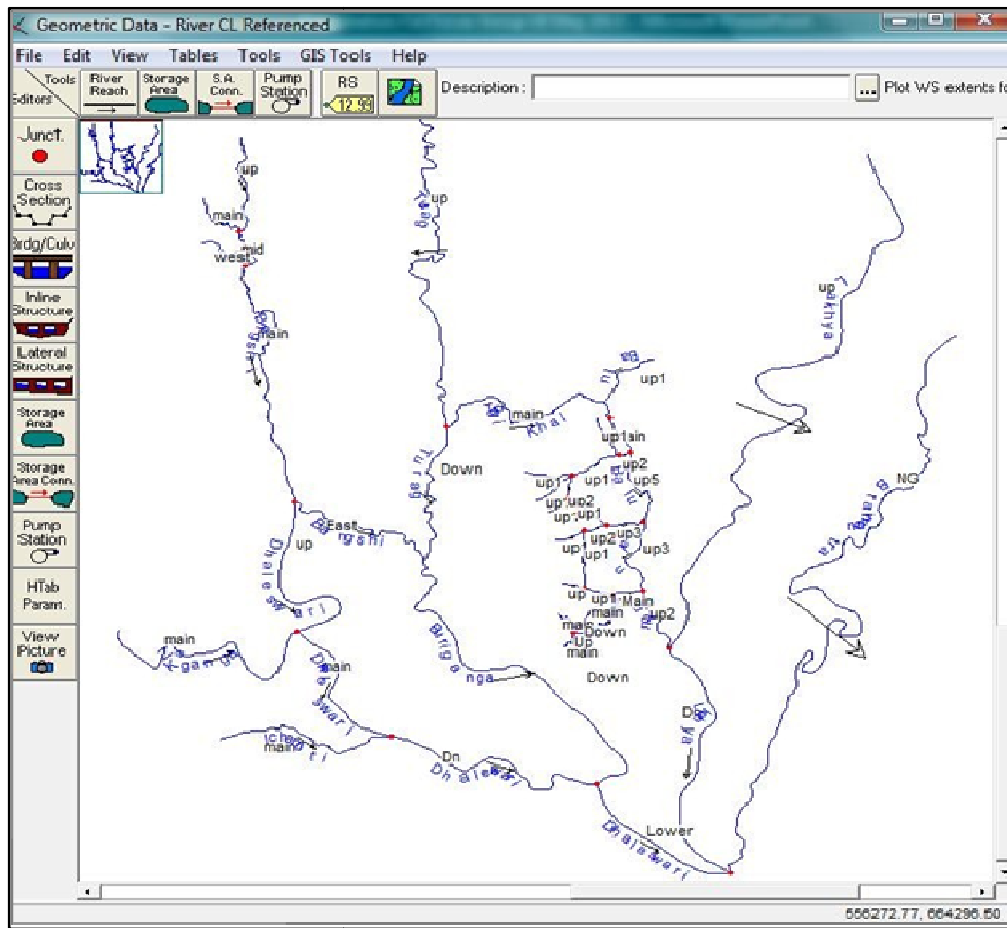


Figure 2-22: A Sample River Network developed in HEC-RAS

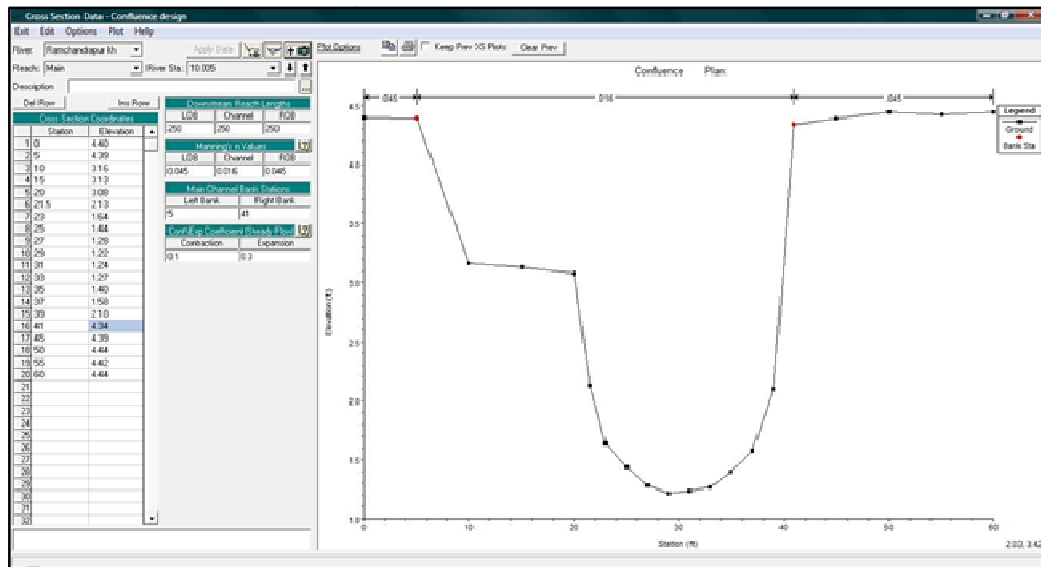


Figure 2-23: Sample Geometric Data of Stream Network

Flow Data

As the setting-up of boundaries is necessary for a hydrodynamic model, data at the identified locations must be acquired and made available. At all upstream and downstream boundaries, the times-series required are provided by BWDB river levels, simulated discharges from the hydrological models as well as EPA-SWMM water levels and flows (see sample boundary condition in Figure 2-24).

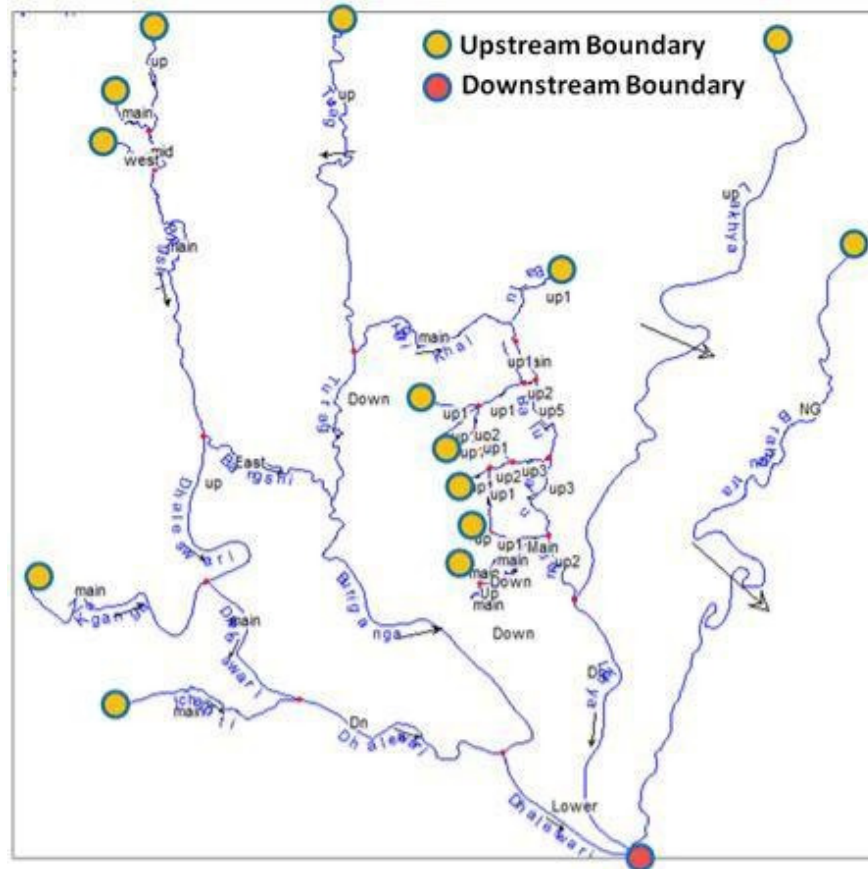


Figure2-24: Sample Location of Boundaries of Stream Networks developed in HEC-RAS

Simulation and Calibration of HEC-RAS

Upon full development, the HEC-RAS rural model of the study area is invoked to simulate flows, with the entire boundary and calibration data available during this period. A sample plot of calibration at Demra on Balu River is plotted in Figure 2-25. As indicated, the model over estimates discharges during high flow period but generated lower flows during dryer conditions. The calibration and validation exercise is on-going to refine the parameters and improve model performance.

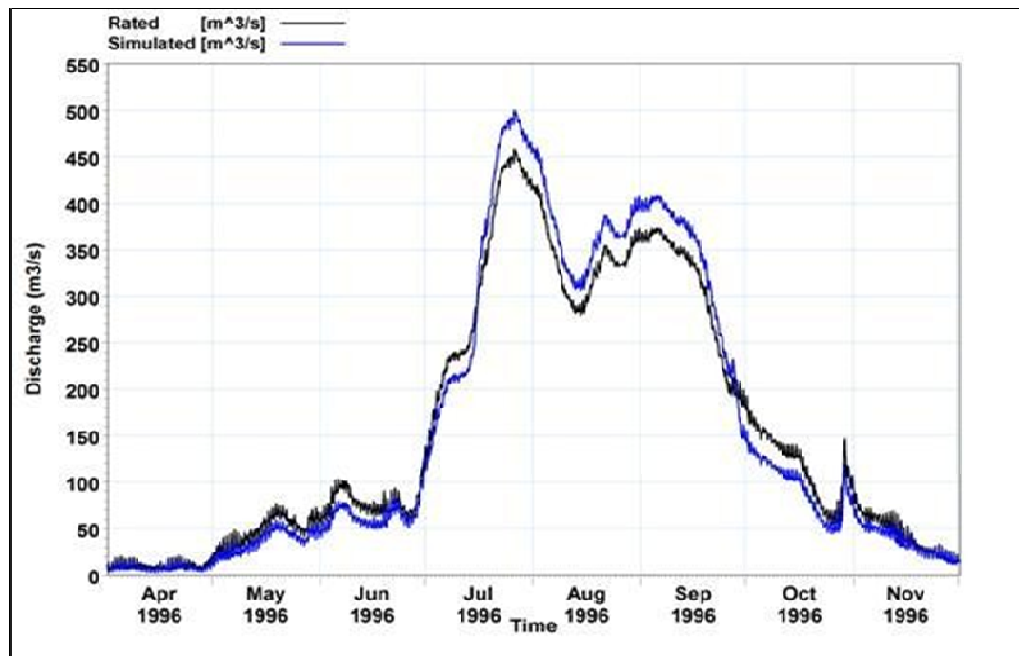


Figure2-25: Sample Observed and HEC-RAS Simulated River Flows

2.30.5 Potential Options and Deliverables

The main objective of the study is to improve the drainage flows and systems for the existing as well as future conditions considering different types of structural and non-structural measures. The future condition must also be based on the future landuse and committed development plans. Tentative options are furnished below considering the existing landuse patterns, future development, as well as proposed structural and non-structural measures.

x Existing Conditions

Condition1:

2yrELu-ED1and/or5yrELu-ED1

Condition2:

2yrELu-ED2and/or5yrELu-ED2

x Future Land Use Conditions with No Improvement

2yrFLu-ED,5yrFLu-ED,10yrFLu-ED,25yrFLu-ED,50yrFLu-EDand100yrFLu-ED

x Future Land Use Conditions with Non-structural Measures

Version1:

2yrFLu-NS1,5yrFLu-NS1,10yrFLu-NS1,25yrFLu-NS1,50yrFLu-NS1and100yrFLu-NS1

Version2:

2yrFLu-NS2,5yrFLu-NS2,10yrFLu-NS2,25yrFLu-NS2,50yrFLu-NS2and100yrFLu-NS2

x Future Land Use Conditions with Structural Measures

Version1:

2yrFLu-S1,5yrFLu-S1,10yrFLu-S1,25yrFLu-S1,50yrFLu-S1and100yrFLu-S1

Version2:

2yrFLu-S2,5yrFLu-S2,10yrFLu-S2,25yrFLu-S2,50yrFLu-S2and100yrFLu-S2

x Future Land Use Conditions with Combination of Non-structural and Structural Measures

Version1:

2yrFLu-NSS1,5yrFLu-NSS1,10yrFLu-NSS1,25yrFLu-NSS1,50yrFLu-NSS1and100yrFLu-NSS1

Version2:

2yrFLu-NSS2,5yrFLu-NSS2,10yrFLu-NSS2,25yrFLu-NSS2,50yrFLu-NSS2and100yrFLu-NSS2

Simulations of Selected Potential Options

This is the final step for the all the models developed in this study. Both the calibrated-validated HEC-RAS and EPA-SWMM will be simulated individually for all the selected potential options. Inundation depths for all these options will be acquired from the model results will be used as a basis for the selection of best option(s). All these outputs will be finally merged with master geo-database or spatial data bank as a final output discussed in Section 2.44.1.

2.31 Flood Plain Mapping or Modeling

2.31.1 Method

The primary goal of this exercise is to introduce you to automated floodplain mapping using **HEC-RAS and ESRI ArcInfo 10.1 GIS**. By the end of this exercise, we should be able to:

- Import HEC-RAS output into ArcView
- Create a digital stream representation
- Combine HEC-RAS and DEM data to develop a three-dimensional terrain model
- Delineate and analyze the HEC-RAS floodplain

Software and Data Requirements

The data required for this exercise consist of an HEC-RAS output data file, ArcGIS shapefiles, and digital imagery. The data will be used to construct a digital floodplain map of the selected study areas and adjacent. Specifically, to serve the modeling purpose following data will be required:

- waller.rep - HEC-RAS output text file
- floodmap.apr - ArcGIS project containing the scripts and menus needed for the floodplain mapping
- roads.shp, roads.shx, roads.dbf - ArcGIS shapefile of roads and streets
- digitize.shp, digitize.shx, digitize.dbf - ArcGIS shapefile of Strea centerline
- polyclip.shp, polyclip.shx, polyclip.dbf - ArcGIS shapefile of study area boundary
- orthophoto.tif, orthophoto.tfw - at least 1.0 meter resolution digital orthophotography of the Study area

- auseast.e00 - Digital elevation model in Arc/Info export format
- land.avl, water1.avl, water2.avl - Theme color schemes

Detail Procedure for Flood Plain Modeling

A. Data Import

Import HEC-RAS Data - Translates HEC-RAS output data from text file to ArcView format.

B. Terrain Modeling - These steps are used to produce a triangular irregular network (TIN) terrain model of the channel and floodplain.

- Format Digital Stream - The digital stream centerline shapefile must be formatted in order to be used in the subsequent steps.
- Map HEC-RAS Cross-Sections - Map coordinates are assigned to HEC-RAS cross-sections.
- Resample Cross-Section Elevations - Resamples cross-section elevations to incorporate digital elevation model (DEM) elevations data.
- Stream Centerline and Banklines - Forms a three-dimensional line theme of the stream centerline, right banks, and left banks.
- Convert Grid to Points Performs a raster to vector conversion on a DEM.
- Cross-Section Bounding Polygon - Forms a polygon representing the outer boundary of the mapped cross-sections.

C. Floodplain Mapping

- Map Water Surface Profiles - HEC-RAS computed water surface profile at each cross-section is assigned map coordinates.
- Delineate Floodplain - Areas inundated by flooding are determined.

D. Utilities

- Flip Polyline - Reverses the direction of a line theme.
- Compare Cross-Section Profiles - Creates a text file containing cross-section coordinate data that can be used to create profile plots.
- Clip Grid by Theme - Clips a DEM based on a given polygon theme

Stream Centerline Representation

The overall goal of mapping HEC-RAS output is to take cross-sectional and water surface profile data from a one-dimensional model, and transform it into two-dimensional map coordinates. In the previous step, importing HEC-RAS output, the model data was brought into ArcView /ArcINFO. What is needed now is the basis for which to assign map coordinates to these data in geographic space. This basis is a GIS representation of the stream centerline. There are four primary sources from which to obtain a digital representation of the HEC-RAS stream:

Survey Data - Data representing the stream centerline may be available from field surveys. If so, this is perhaps the quickest way to generate a vector GIS representation of the stream.

Reach Files - Reach files are a series of national hydrologic databases that uniquely identify and interconnect the stream segments or "reaches" that comprise the nation's surface water drainage system.

DEM-Based - A program such as CRWR-PrePro can be used to derive a vector stream representation using a DEM as the sole input.

Digitize the Stream - Using either a digital orthophotograph or digital raster graphic (DRG) as base map, the stream can be digitized using tools in ArcView/ArcINFO.

Cross-Section Mapping

The first step in assigning map coordinates to the cross-sections is to compare the reach lengths according to HEC-RAS and their counterparts on the digital stream centerline. It is possible, for example, that the digital stream is defined to a point farther upstream than the RAS stream, or vice versa. Hence, it's necessary to delineate the upstream and downstream boundaries of the RAS stream on the digital stream. Intermediate stream definition points corresponding to important RAS cross-sections such as bridges or culverts can also be defined.

Terrain Modeling

Creating a TIN terrain model from two different data sources presents its challenges: the DEM and HEC-RAS data have different collection times, methods, and resolutions. So at the point where the HEC-RAS data ends and the DEM data begins, called the transition zone, some elevation differences are expected. A method to smooth the transition zone is applied. For each cross-section, between the stream banks and the ends, the elevations are resampled using elevation values from the DEM. To initiate this process, add the 1.0-meter DEM to the view. We'll need to do some work on the DEM before continuing. Next we will develop the data that will serve as TIN break lines: the three-dimensional stream centerline and bank lines. Break lines indicate significant terrain features that represent a change in slope; TIN triangles do not cross break lines. Select Flood map/Stream Centerline and Bank lines

Floodplain Delineation and Output

Areas inundated by flooding occur wherever the elevation of the floodwater exceeds that of the land. To delineate these areas, we'll create surface models of the floodwater and land surface, and then compare the elevations. HEC-RAS represents the floodplain as a computed water surface elevation at each cross-section. During the data import step, these elevations were brought into ArcView/ArcINFO, along with the distance from the stream centerline to the left and right floodplain boundaries. Hence, two things are known about the floodplain at each cross-section: water surface elevation and width on each side of the centerline. Select Flood map/Map Water Surface Profiles to map the water surface info. The data inputs are the original cross-section line theme and the HEC-RAS geometry table.

The water surface line theme can be used to create a TIN model of the floodwater surface. If the HEC-RAS model was set up correctly, the water surface extent will not exceed the cross-section extent. As such, the cross-section bounding polygon will serve as the outer boundary of our water surface TIN (see Figure 2-26).



Figure 2-26: Water Surface TIN extracted During Floodplain Modeling

The three-dimensional floodplain view is quite useful for floodplain visualization. But the view shown in the graphic doesn't appear much like the actual landscape. To remedy this, 3D Analyst allows the addition of themes of roads, buildings, railroads, etc., that can be draped over the landscape to more closely approximate reality.

For detailed analysis, the floodplain can be viewed from a planimetric perspective, using a basemap such as a digital orthophotograph. The HEC-RAS water surface profiles used to create the water surface TIN were determined using the original cross-sections and not the resampled cross-sections.

2.31.2 Deliverables

Hydrology and hydrodynamic modeling services include:

Data assimilation and model selection

- data acquisition and database construction
- ArcGIS analysis of input parameters (land use, precipitation, ET, pervious/impervious cover, stream routing)
- model selection based on project objectives, conceptual model, and client budget and schedule

Statistical modeling of hydrologic data

- data reconstruction (filling data gaps)
- time series analysis

- spatial statistics (geostatistics)
- explanatory statistical model development
- artificial neural network model development

Hydrologic modeling

- watershed water budget analysis
- stream-aquifer interaction
- land-use impacts on stream flow
- evaluation of water supply alternatives

Hydrodynamic modeling

- stream/river flows and stage levels
- surface water quality modeling (salinity, temperature, nutrients, TMDLs)
- stormwater management/flood protection studies
- surface water reservoir flows and loads (DO, TOC, nutrient loading)

Uncertainty analysis

- H&H model input-parameter uncertainty characterization
- uncertainty propagation using Monte Carlo, FOSM or PEM techniques
- data mining to assess parameter importance
- H&H model output confidence analysis

All these outputs will be finally merged with master geodatabase or spatial data bank as a final output discussed in Section 2.44.1.

2.32 Morphological Study

2.32.1 Method

Historical satellite images will be used to evaluate the morphological characteristic features of channel shifting and to estimate erosion of the major rivers and water bodies exists within the intending project area. Thematic image (e.g. Landsat Image captured at different time periods) will be collected in this concern and geo-referred properly thereafter.

Planform analysis method will be to identify the extent and scale morphological change. By using this method and make comparison between different time periods TM image, author can easily identify the change for both stream centerline and bank line. Amount and extent of river erosion can also be perceptual zed through this method. The shifting rate of these stream lines and features will be incorporated with plan preparation thereafter by the consultant.

Data and Software Requirements: LandSAT TM image (historical image) will be collected from USGS which is free of cost. ESRI ArcINFO 10.1 platform and Imagine Photogrammetry -2014 technique will be applied to analyze the scenarios.

2.32.2 Deliverables

The following figure 2-27 show application of Planform analysis to identify morphological change of PadmaRiver as a sample definition which the consulting is intending to conduct. All these outputs will be finally merged with master geodatabase or spatial data bank as a final output discussed in Section 2.44.1.

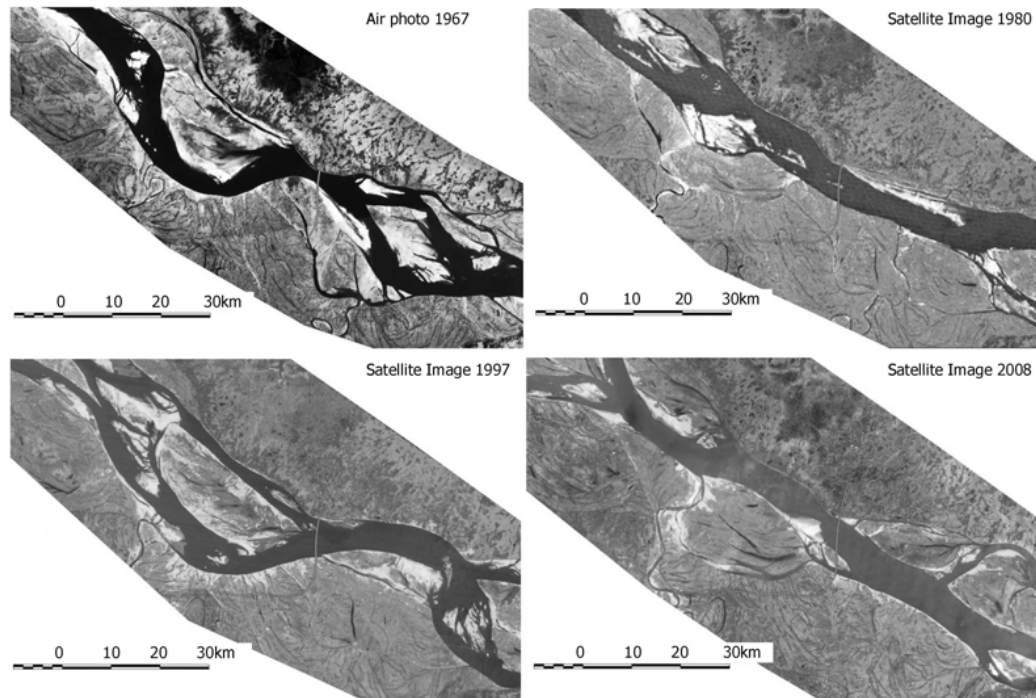


Figure 2-27: False color composite of Landsat TM image of Padma River to Conduct Morphological Study

2.33 Study on Unauthorized Encroachment

A study of unauthorized encroachment of different place as like on the bank of the river, on govt. khas land, beside the railway and major highway road and any other place of this upazila will be identified through physical feature and socio economic survey. These encroachment of this area will locate in GIS maps and these outputs will be finally merged with master geodatabase or spatial data bank as a final output discussed in Section 2.44.1.

2.34 Geological Study

2.34.1 Scope of Study

Prime objectives of this work is to determine subsurface soil condition of the project area and evaluating of natural geological and hydro-meteorological hazards such as earthquake, landslide and ground failure and integrate the consequence into the design of the infrastructure. To ensure the sustainable development of the project area, following investigations are required:

- Interpretation of remote sensing image and photo by GIS for geological and geo-morphological mapping.

- Drilling of boreholes and preparation of borehole logs.
- Collection of undisturbed and disturbed soil sample as per standard guide line.
- Conducting standard penetration tests (SPTs).
- Laboratory testing of soil samples such as Grain Size Analysis, Natural moisture Content, Atterberg Limits, Specific Gravity, Direct Shear Test, Unconfined Compression strength, and Triaxial test
- Drilling of boreholes and casing by PVC pipe for conducting PS logging test (Down-hole seismic test)
- Conducting PS logging test (Down-hole seismic test)
- Conducting Multi-channel analysis of surface wave (MASW)
- Conducting single micro-tremor measurement
- The evaluation of natural geological and hydro-meteorological hazards such as earthquake, liquefaction and soil-erosion
- Based on the above available investigations, risk sensitive micro-zonation maps will be prepared.

2.34.2 Technical Approach and Methodology

The following methodology will be used to investigate the engineering geological works, which are given bellow-

2.34.2.1 Preparation of Geomorphological and Neotectonic Mapping:

Preparation of geomorphologic map

- Using digital elevation model (DEM) will be prepared through the analysis of satellite and different image data such as Spot images, Landsat images, Satellite images etc. The geomorphologic map is verified by field auger test and collecting of relevant existing data.
- Regional tectonic map
- Using the published reports and data from different sources, compilation of all the collecting data and maps in library and laboratory work.
- Using the aerial photographs, landsat images, satellite images, spot images etc. in laboratory work. Study the lineament, land forms, structures and drainage pattern from signatures and other features of aerial photos and different images. Required field visit for ground truth studying in the area will be performed.

These maps will provide all background information for the preparation of the hazard maps and environmental aspects of the project site

2.34.2.2 Preparation of sub-surface lithological 3D model of different layers through geo- technical investigation

- Based on the geomorphic units of the study area, fixed grid method or random location point of drilling will be selected for Standard Penetration Test (SPT) and by this drilling, identifying the geological characteristic of sub-surface soft sedimentary rocks. Description and information of different layer of the soil, its sedimentary characteristics, structure, lithology etc will be reflected in 3D model.
- Description of engineering properties of different soil layer: SPT value, soil strength and foundation layer etc.

- Collection of bore hole soils sample from different sub-surface units and analyses the samples in sedimentary and engineering laboratory.

GIS and others software will be used to develop a 3D model of subsurface geotechnical environment of different layer by using all the results of soil properties, geomorphologic and geotechnical properties of sub surface information. This 3D subsoil modeling will illustrates the sub-soil condition and behavior when over-burden pressure and dynamic load are given in a specific site.

2.34.2.3 Preparation of engineering geological mapping based on AVS30

- Preparation of engineering geological map is to develop the geotechnical and geophysical characteristics of the soft sub-surface sedimentary deposits. In this investigation, geophysical data will be collected by using PS Logging, Multi-channel Analysis of Surface Wave (MASW), Small Scale Microtremor Measurement(SSMM) and Microtremor test/survey in the field and analyses those data for identifying average shear wave velocities (V_s) in a project area.
- The purpose of identifying average shear wave velocities (V_s) is to generate AVS30 maps for the targeted areas. These information's are often used for foundation engineering and seismic hazard assessment.

2.34.2.4 Preparation of Seismic Hazard Assessment Map

For preparation of seismic hazard map, historical earthquake data and damage information are needed. The response of the soil layers in-term of the amplification factor of the soft-soil need to be developed based on the engineering properties of the sub-soil. The main outcomes of the seismic hazard assessment are:

- Calculation of Peak Ground Acceleration (PGA), Peak Ground Velocity (PGV), Response Spectrum $S_a(T)$ of 5% damping at 0.3 and 1.0 second periods values of 10% exceedance probability during next 50 years for upper soft local soil by using these amplification factor which is very important for designing a new engineering structure.
- Liquefaction and Ground Failure Map is also conducted from PGA, PGV, water level and triaxial test. Liquefaction is address by high-moderate- low zone in round from 100m*100m to 500m*500m grid size.
- Finally intensity map is prepared and also the vulnerable zones for high rise and low rise building will be identified.

The purpose for the preparation of localized seismic hazard map is to make the structural design and to address other mitigation options following seismic intensity.

2.34.2.5 Vulnerability and Risk assessment:

The main objective of vulnerability and risk assessment is to focus the seismic vulnerability characteristics of the existing building stock, essential facilities and lifeline facilities and regarding this objective, there need to develop the base map, building stock database, lifeline and essential database considering the vulnerability factors associated with them. According to CDMP-I Project Level -1, Level-2, and Level-3 inventory surveys will be needed to conduct for this purpose but in reality, the settlement nature of the project areas are in semi urban type and most of the houses are comprises with semi-paka or tinshed

except Faridpur Sadar Upazila, where some buildings are multistoried within the Paurashava area. That's why, level-2 and level-3 inventory survey will not much necessary and on the other hand, this task also contain some sort of expensive laboratory test which is unbearable for consulting firm within the budget.

Level-1 Survey: In this steps, following necessary information's of building will be collected which are number of stories, occupancy class, structural type, number of occupants during the day and the night, age of the building, presence of soft story (yes/no), presence of heavy overhangs (yes/no), shape of the building in plain view (rectangular, narrow rectangular, irregular, shape of the building in elevation view (regular, setback, and narrow tall), pounding possibility (yes/no), building in slope land (yes/no), visible ground settlement (yes/no), presence of short columns (yes/no), visible physical condition (poor/average/good).

Based on Seismic Hazard and Vulnerability assessment, Risk assessment can be easily estimated. For Risk assessment the basic equation will be followed to calculating risk-

$$\text{Risk} = \text{Hazard} \times \text{Exposure} \times \text{Vulnerability}$$

Hazard = Aggregated PGA of the study area, Exposure = Number of different structures existing in the area, Vulnerability = Hazard to Damage state relationship of different types of structures.

2.34.2.6 Detail Description of Different Test Procedure and Their Instrumentation

2.34.2.6.1 Standard Penetration Testing

One of the oldest and most common in-situ tests is the Standard Penetration Test or SPT. It was developed in the late 1920s and has been used extremely in North and South America, the United Kingdom, Japan, and elsewhere. Because of this long record of experience, the SPT is well-established in engineering practice. It is performed inside exploratory boring using inexpensive and readily available equipment, and thus adds little cost to a site characterization program. The ASTM standard D1586 will be followed to carry out SPT. N-values will be obtained at intervals no closer than 500 mm (20 in). In this project these tests will be performed at 1.5m intervals up to depth 30m (see Figure 2-28).

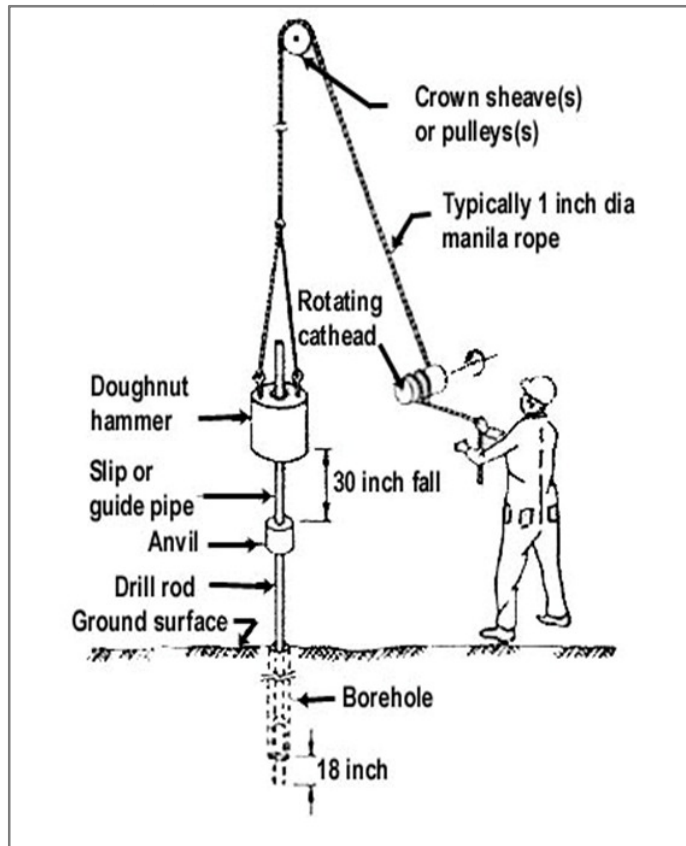


Figure 2-28: The SPT sampler in place in the boring with hammer, rope and cathead (Adapted from Kovacs, et al., 1981).

2.34.2.5.2 Laboratory Testing

The Purpose, Standard Reference and Significance of the laboratory tests are mention in below table 2-20.

Table 2-20: Purpose, Standard Reference and Significance of the Laboratory Tests

SL No	Name of Test	Purpose	Standard Reference
1	Grain Size Analysis (Sieve and Hydrometer Analysis)	This test is performed to determine the percentage of different grain sizes contained within a soil.	ASTM D 422 - Standard Test Method for Particle-Size Analysis of Soils
2	Natural Moisture Content Determination	This test is performed to determine the water (moisture) content of soils. The water content is the ratio, expressed as a percentage, of the mass of "pore" or "free" water in a given mass of soil to the mass of the dry soil	ASTM D 2216 - Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures

		solids.	
3	Atterberg Limits Determination	This lab is performed to determine the plastic and liquid limits of a fine grained soil.	ASTM D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
4	Specific Gravity Determination	This lab is performed to determine the specific gravity of soil by using a pycnometer. Specific gravity is the ratio of the mass of unit volume of soil at a stated temperature to the mass of the same volume of gas-free distilled water at a stated temperature.	ASTM D 854-00 – Standard Test for Specific Gravity of Soil Solids by Water Pycnometer
5	Triaxial test (Undrained Unconsolidated)	To determine the shear strength of Silts and Clays	ASTM D2850-70- standard test method of Unconsolidated Undrained Tri-axial Compression Test without pore pressure

2.34.2.5.3 Down-hole Seismic Test (PS Logging)

Field measurement of shear wave velocity profile (V_s profile) will be carried out by seismic down-hole test. Seismic down-hole test is a direct measurement method for obtaining the shear wave velocity profile of soil stratum.

The seismic down-hole test aims to measure the travelling time of elastic wave from the ground surface to some arbitrary depths beneath the ground. The seismic wave is generated by striking a wooden plank by a sledge hammer. The plank is placed on the ground surface at around 1m in horizontal direction from the top of borehole. The plank is hit separately on both ends to generate shear wave energy in opposite directions and is polarized in the direction parallel to the plank.

The shear wave emanated from the plank is detected by a tri-axial geophone. The geophone is lowered to 1 m below ground surface and attached to the borehole wall by inflating an air bladder. Then, the measurement is taken at every 1.0 m interval until the geophone is lowered to 30 m below ground surface. For each elevation, 6 records are taken and then used to calculate the shear wave velocity (see Figure 2-29 and 2-30).



Figure 2-29: Data logger for PS Logging test

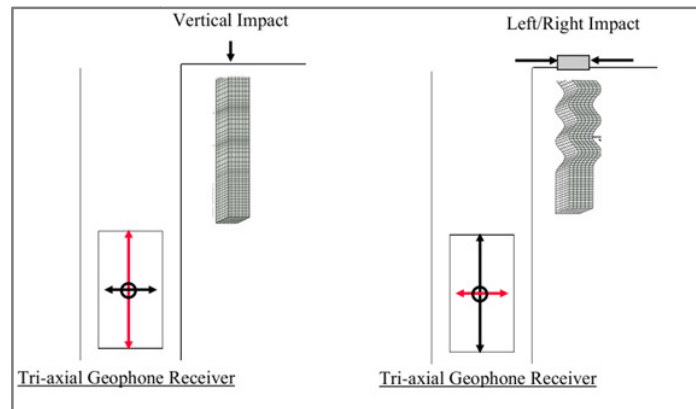


Figure 2-30: Triaxial geophone behave

In Down hole Seismic Test (PS logging), this method will be used to calculate shear wave velocity for this project.

2.34.2.5.4 Multi-channel Analysis of Surface Wave (MASW)

This is the most common type of MASW survey that can produce a 2D VS profile. It adopts the conventional mode of survey using an active seismic source (e.g., a sledge hammer) and a linear receiver array, collecting data in a roll-along mode. It utilizes surface waves propagating horizontally along the surface of measurement directly from impact point to receivers. It gives this VS information in either 1D (depth) or 2D (depth and surface location) format in a cost-effective and time-efficient manner. The maximum depth of investigation (z_{max}) is usually in the range of 10–30 m, but this can vary with the site and type of active source used.

Seismic energy for active source surface wave surveys can be created by various ways, but we use a sledgehammer to impact a striker plate on the ground since it is a low-cost, readily available item. To signal to the seismograph when the energy is generated, a trigger switch is used as the interface between the

hammer and the seismograph. When the sledgehammer hits the ground, a signal is sent to the seismograph to tell it to start recording (see Figure 2-31).

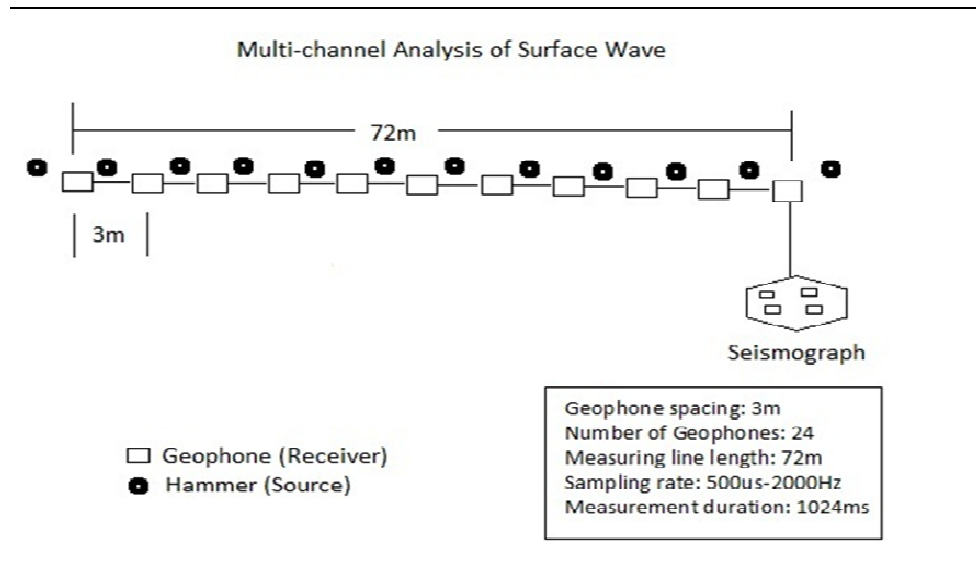


Figure 2-31: Schematic of linear active source spread configuration.

In this project field work we will use 12-24 channels with 3m interval, source are used at ever 3m interval between two geophones, 0.125 ms sample interval, 2 seconds record length and auto trigger option.

2.34.2.5.5 Single Micro-tremor Measurement

Micro-tremors are the phenomenon of very small vibrations of the ground surface even during ordinary quiet time as a result of a complex stacking process of various waves propagating from remote man-made vibration sources caused by traffic systems or machineries in industrial plants and from natural vibrations caused by tidal and volcanic activities. Observation of micro-tremors can give useful information of dynamic properties of the site such as predominant period, amplitude, peak ground acceleration and shear wave velocity (see Figure 2-32).

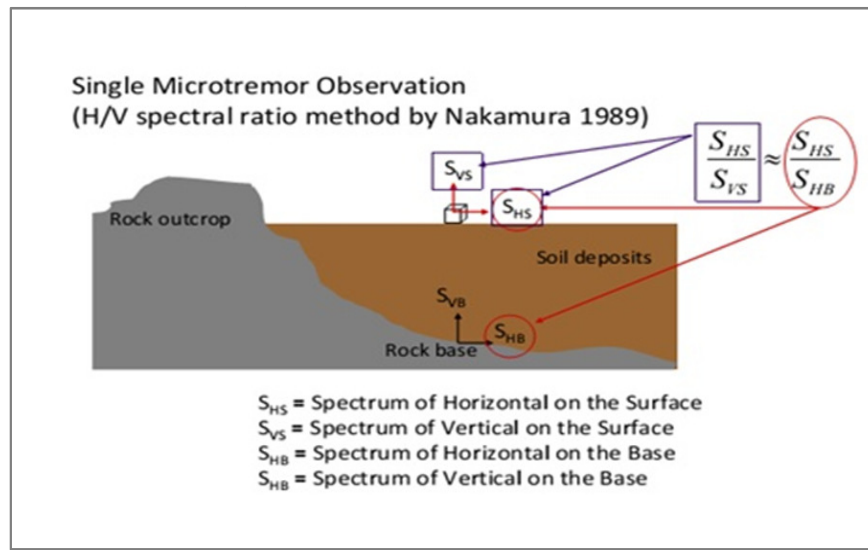


Figure 2-32: Fundamental of Single Micro-tremor observation

The microtremor equipment is set on the free surface on the ground without any minor tilting of the equipment. The N-S and E-W directions are properly maintained following the directions arrowed on the body of the equipment. The sampling frequency for all equipments is set at 200Hz. The low-pass filter of 40Hz is set in the data acquisition unit. Like the seismometer or accelerometer, the velocity sensor used can measure three components of vibrations: two horizontal and one vertical. The natural period of the sensor is 2 sec. A global positioning system (GPS) is used for recording the coordinates of the observation sites. The available frequency response range for the sensor is 0.5-20Hz. The length of record for each observation was 20~30 min. In this project this data acquisition system will be applied.

2.34.2.6.6 Detailed building inventory database preparation

Topographic survey and the building inventory database has been carried-out by delineating the building footprints using high resolution (0.5 meter) satellite images and collecting secondary data under TOR-01. Then, Level-1 survey will be carried out in each ward of the city to get detailed physical characteristics using statistical approach to come to know the vulnerability of an area. In the level-1 building survey, side walk and questionnaire surveys were carried out to collect major general and necessary information of the buildings. Level-2 and Level-3 survey were done mostly for seismic vulnerability assessment but in this case it will not be done as because circumstance of project area characteristics.

A more detail building inventory survey will not be used for earthquake vulnerability assessment, but also to make the building inventory for other purposes: like for tax collection by City Corporation, instant physical vulnerability assessment, emergency support providence etc. Moreover, city police administration can use the data for having the information of housing pattern and road-network of a locality for security concern. Beside this, once each and every household information is generated, police can collect each family information of a building in order to track urban security issues.

In this context, there need to make one-to-one building survey to develop a details database of the buildings for the purpose of multi-uses and other infrastructures of the project areas.

Lifeline data base

The lifeline database mainly consists of transportation system and utility system.

The transportation system consists of (1) highway transportation system, (2) railway transportation system, (3) bus transportation system, and (4) ferry transportation system.

While **utility system** consists of (1) portable water system, (2) natural gas system, (3) electricity power system, and (4) communication system and (5) waste (liquid and solid) management system.

Essential facility system

The essential facility system consists of 3 categories: a) Medical care facilities, i.e. hospital and medical clinic, b) Emergency response facilities, i.e. police station, fire station and emergency operation center.

Inventory survey

Respective data will be collected through field observation by traverse method. Every data point location will be controlled by hand GPS; and as per inventory survey checklist, all of information's will be collected and documented in a spreadsheet and location point on base map. Necessary information on land use classification, building occupancy class and building structural type will be documented by code according to ToR specification.

Based on the building and lifeline inventory survey, vulnerability maps will be produced which show the characteristics of the buildings, essential facilities and lifelines that make them susceptible to the damaging effects of earthquake. Table 2-21 below illustrates the outlines of database

Table2-21: Outline of database

List of Features	Updated Information Required
Building Information	Number of stories, Occupancy class, Structural type Number of occupants during the day and the night, Age of the building, Presence of soft story, Presence of heavy overhangs, Shape of the building in plan view, Shape of the building in elevation view, Pounding possibility etc.
Road	Type. Width, with or without footpath
Lifeline facilities	Location of electric pole, cable orientation, location of water pump & sluice valve, water supply and gas network detail with joint points. Underground facilities should be updated based on the information from respective service provider agency.

2.34.3 Resources Allocation

Resources allocation are listed below

a. Geophysical and Geotechnical Testing

- 2 sets boring rig
- PS Logger
- MASW Survey instruments

- Microtremor survey instruments
- Hand GPS

b. Laboratory Testing

- Grain size analysis instrument
- Specific Gravity determination instrument
- Tri-axial test instrument

2.35.4 Location of the Geological Work

Data point locations of all work stations for each survey have been selected by making grid where Arc GIS software has been used. In SPT boring survey, each boring distances around 2 km from each other. In MASW survey, the distance of each workstation is about 4.5 km. And in Microtremor (single array) survey, approximately, 4 km grid has been prepared to select the each work location.

From the above different length of grid, the following numbers of test and/or survey have been found (see Table 2-22). For all three three upazila, tentative survey distributions are shown in Figure 2-33 to Figure 2-35.

Table 2-22: Summary Geological Survey Plan

Name of Upazila		Area	Name of investigations			
			Borelog with SPT (borehole depth-30m)	PS logging (30m depth)	MASW and SSMM (30m depth)	Single Microtremor ($V_s > 100m$ depth)
<u>Bagmara</u>	Municipality/ Town hq.	363.3 sq km	44	5	8	10
	Growth Centres		30	5	7	10
<u>Faridpur Sadar</u>	Municipality/ Town hq.	407.02 sq km	30	6	9	10
	Growth Centres		36	6	9	10
<u>Gangi</u>	Municipality/ Town hq.	341.98 sq km	31	4	6	10
	Growth Centres		30	4	6	10
Total		1112.3 sq km	110	30	45	60

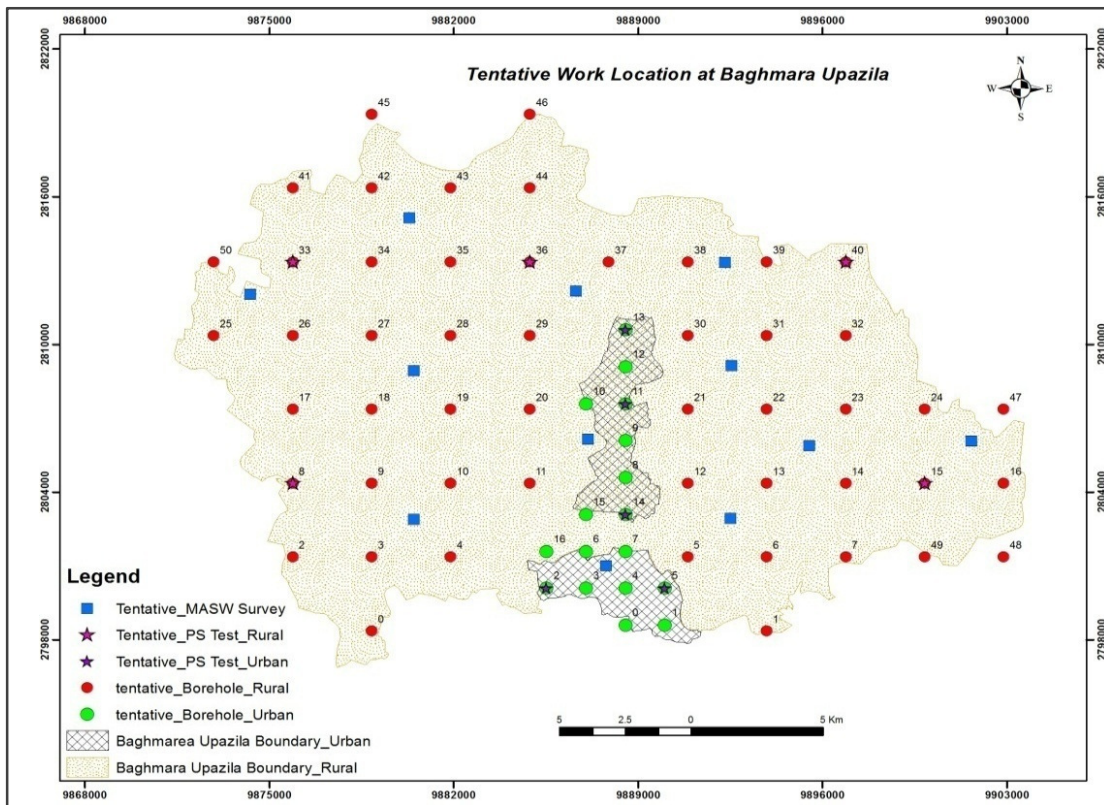


Figure 2-33: Tentative geophysical and geotechnical test locations at Bagmara Upazila

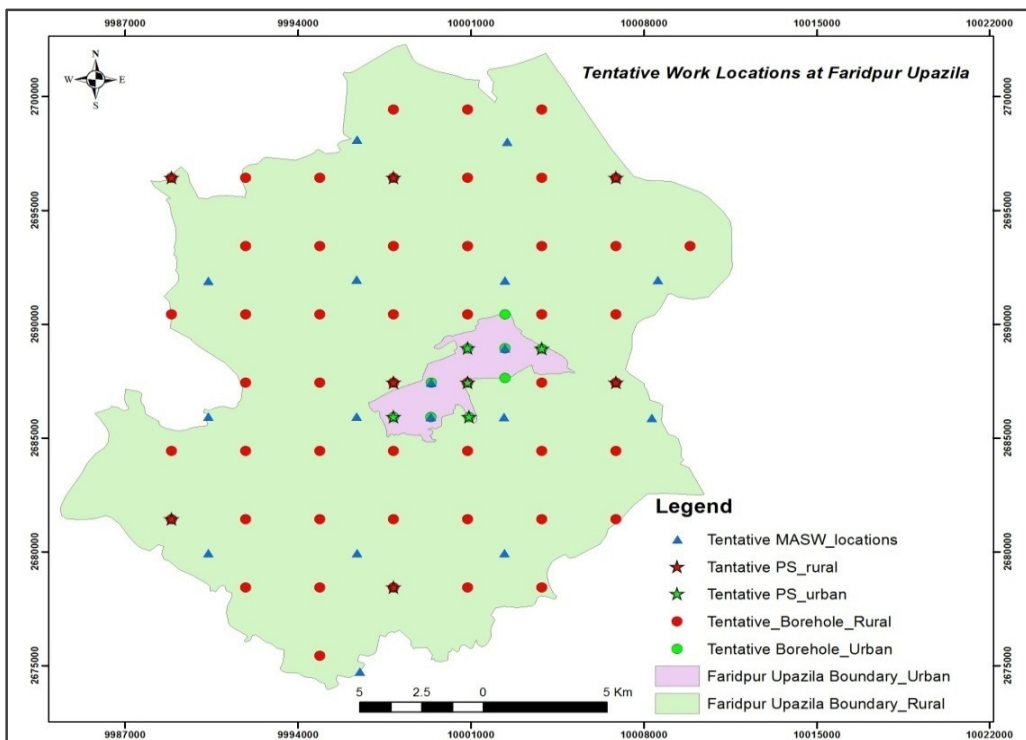


Figure 2-34: Tentative geophysical and geotechnical test locations at Faridpur Sadar Upazila

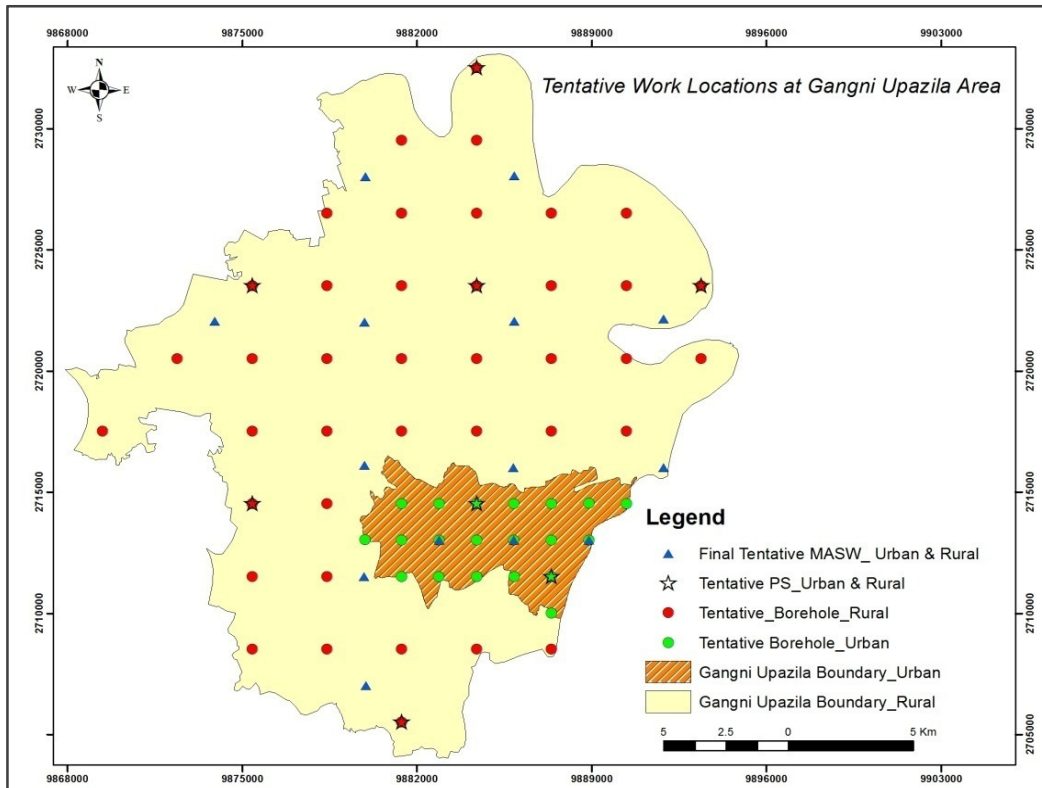


Figure 2-35: Tentative geophysical and geotechnical test locations at Gangni Upazila

2.34.5 Schedule of Fieldwork

According to different geological and geotechnical field survey with their test operation, the following schedule has been given in the table 2-23 below:

Table 2-23: Schedule of Geological Field Survey Work

Description		1st-November- 2015 To 15th-February-2016													
		Faridpur Sadar Upazila				Gangi Upazila				Bagmara Upazila					
		Weeks				Weeks				Weeks				Weeks	
		1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th	13th	14th
Field	Preparing Map & Site Visit														
	Site Selection for Geotechnical and Geophysical Works														
	Standard Penetration Tests (SPTs) Boring														
	Drilling of boreholes and casing by PVC pipe for conducting PS logging test														
	Conduct PS logging test (Down-hole seismic test)														
	Conduct Multi-channel analysis of surface wave (MASW)														
	Conduct single microtremor measurement														
Laboratory	Grain Size Analysis														
	Natural Moisture Content Determination														
	Atterberg Limits Determination														
	Specific Gravity Determination														
	Unit Weight Test														
	Triaxial test (Undrained Unconsolidated)														

2.34.6 Deliverables/Outcome from the study

From the above geological, geotechnical and geophysical investigations result, the following outcomes will be produced which can play the role to develop the risk-informed and environment friendly physical plan. These deliverable items can also be used as a guided tool to develop the design of the infrastructures addressing their risk reduction aspects.

The list of Outcome / Deliverable maps are given in following table 2-24.

Table 2-24: Deliverables for Geological and Geomorphological Study

Method	SL.	Description	Necessary data
Engineering Geology	1.	Geological and geomorphologic map preparation of the study area	Satellite image and land sat image
	2.	Regional morph-tectonic and neo-tectonic mapping for potential earthquake source area identification	Existing Primary and secondary data and maps
	3.	Subsurface lithological 3D model	Calculating from Standard penetration Test (Boring) data
	4.	Foundation layer map which showing the depth of the foundation from existing ground level for footing.	
	5.	Engineering geological mapping based on average shear wave velocity up to depth 30m (AVS 30)	Calculating from PS logging and MASW test data
Seismic Hazards Assessment	6.	Peak Ground Acceleration (PGA) map both in Base rock and local soil (depth 30m)	SPTs, All lab test data, PS logging, MASW and micro-tremor test data
	7.	Spectrum Acceleration for T= 0.2s period (SA 0.2s) map both in Base rock and local soil (depth 30m)	
	8.	Spectrum Acceleration for T= 1s period (SA 1s) map both in Base rock and local soil (depth 30m)	
	9.	Liquefaction and Ground failure maps	
Vulnerability and Risk Mapping	10.	Earthquake Intensity maps	PGA and SA (above no. 6, 7 and 8) map
	11.	Sensibility maps for both high rise building and low rise building	From single micro-tremor test data
	12.	Recommended building height maps for both high rise building and low rise building	From single micro-tremor test data
	13.	Land-use maps by considering all hazards	Integrating all the above maps

The above mention methods would give a clear idea about the geo-hazard status of particular landscape where newly urban developing activities or any other mega infrastructure project is going on and this mentioned investigation also gives idea about the vulnerability of existing build up infrastructure of a particular area. Based on these results, proper management techniques as well as other necessary adaptation process could be addressed before or after the development activities in the studied area. It is to be mentioned that the

long-term maintenance cost will be reduced and the developed structure will withstand against the potential natural hazards if the infrastructures are built following the risk informed physical land-use plan.

2.35 Vulnerability and Risk Assessment

2.35.1 Vulnerability Analysis

The main objective of vulnerability and risk assessment is to focus the seismic vulnerability characteristics of the existing building stock, essential facilities and lifeline facilities and regarding this objective, there need to develop the base map, building stock database, lifeline and essential database considering the vulnerability factors associated with them. According to CDMP-I Project Level -1, Level-2, and Level-3 inventory surveys will be needed to conduct for this purpose but in reality, the settlement nature of the project areas are in semi urban type and most of the houses are comprises with semi-paka or tinshed except Faridpur Sadar Upazila, where some buildings are multistoried within the Paurashava area. That's why, level-2 and level-3 inventory survey will not much necessary and on the other hand, this task also contain some sort of expensive laboratory test which is unbearable for consulting firm within the budget.

Level-1 Survey: In this steps, following necessary information's of building will be collected which are number of stories, occupancy class, structural type, number of occupants during the day and the night, age of the building, presence of soft story (yes/no), presence of heavy overhangs (yes/no), shape of the building in plain view (rectangular, narrow rectangular, irregular, shape of the building in elevation view (regular, setback, and narrow tall), pounding possibility (yes/no), building in slope land (yes/no), visible ground settlement (yes/no), presence of short columns (yes/no), visible physical condition (poor/average/good).

Level-2 Survey: According to CDMP-I project, this task basically carried out on concrete buildings and masonry buildings, but it is avoided in this study because of settlement type

Level-3 Survey: In order to CDMP-1 project, survey include to measure the dynamic behavior of the buildings with respect to strong ground motion but it also be avoided due to same reason as Level-2.

Lifeline data base: The lifeline database mainly consists of transportation system and utility system. The transportation system consists of (1) highway transportation system, (2) railway transportation system, (3) bus transportation system, and (4) ferry transportation system.

While utility system consists of (1) portable water system, (2) natural gas system, (3) electricity power system, and (4) communication system and (5) waste (liquid and solid) management system.

Essential facility system: The essential facility system consists of 3 categories: a) Medical care facilities, i.e. hospital and medical clinic, b) Emergency response facilities, i.e. police station, fire station and emergency operation center, c) educational institute and d) child care or day care center (if present).

Method of inventory survey: Respective data will be collected through field observation by traverse method. Every data point location will be controlled by hand GPS; and as per inventory survey checklist, all of information's will be collected and documented in a spreadsheet and location point on base map. Necessary information on land use classification, building occupancy class and building structural type will be documented by code according to ToR specification.

Based on the building and lifeline inventory survey, vulnerability maps will be produced which show the characteristics of the buildings, essential facilities and lifelines that make them susceptible to the damaging effects of earthquake. Table 2-25 below illustrates the outlines of database

Table 2-25: Outline of database

List of Features	Updated Information Required
Building Information	Number of stories, Occupancy class, Structural type Number of occupants during the day and the night, Age of the building, Presence of soft story, Presence of heavy overhangs, Shape of the building in plan view, Shape of the building in elevation view, Pounding possibility etc.
Road	Type. Width, with or without footpath
Lifeline facilities	Location of electric pole, cable orientation, location of water pump & sluice valve, water supply and gas network detail with joint points. Underground facilities should be updated based on the information from respective service provider agency.

Deliverable: (1) Report of different level of building survey, lifelines and essential facilities system (11) Seismic vulnerability assessment of the buildings, lifelines and essential facilities system.

2.35.2 Damage and Risk assessment

In CDMP-1, damage and risk assessment has been estimated using Hazard United States (HAZUS) software, HAZUS was developed by the United States federal Emergency Management Agency (FEMA) and National Institute of Building Sciences (NIBS), HAZUS risk assessment methodology include interdependent modules of (1) potential earth science hazard assessment, (2) inventory of buildings, essential facilities and lifelines, (3) direct physical damage calculation, (4) induced physical damage calculation (5) direct economic/social losses and (6) indirect economic losses.

Based on CDMP-1and CDMP-II project, vulnerability factors of the building and numerical analyses, damage and risk assessment in all sectors will be developed. Then all the modules and respective sub-sections as described in HAZUS must be analyzed and reported through risk analysis.

Deliverable: Damage and Risk assessment of the potential scenario earthquakes

2.35.3 Detailed building inventory database preparation of Faridpur Sadar, Gangni and Bagmara Upazila

Topographic survey and the building inventory database has been carried-out by delineating the building footprints using high resolution (0.5 meter) satellite images and collecting secondary data under TOR-01. Then, Level-1 survey will be carried out in each ward of the city to get detailed physical characteristics using statistical approach to come to know the vulnerability of an area. In the level-1 building survey, side walk and questionnaire surveys were carried out to collect major general and necessary information of the buildings.

Level-2 and Level-3 survey were done mostly for seismic vulnerability assessment but in this case it will not be done as because circumstance of project area characteristics.

A more detail building inventory survey will not be used for earthquake vulnerability assessment, but also to make the building inventory for other purposes: like for tax collection by pourashava, instant physical vulnerability assessment, emergency support providence etc. Moreover, city police administration can use the data for having the information of housing pattern and road-network of a locality for security concern. Beside this, once each and every household information is generated, police can collect each family information of a building in order to track urban security issues.

In this context, there need to make one-to-one building survey to develop a details database of the buildings for the purpose of multi-uses and other infrastructures of the project areas. The attributes of the database will be as per ToR specification.

Another objective of this activity is to prepare a GIS- based landuse map of the project area using the attribute data base. From this landuse map, the trend of spatial development/growth of a city/town in order to know the future possible extension that will help the decision makers to guide the city development that ultimately helps to reduce possible disaster risk. Finally, to evaluate the present practices of disaster risk reduction and is to integrated into spatial planning (land use/master plan). A guideline (city specific) has to be developed to integrate disaster risk reduction approaches into landuse/master plan.

Deliverables: (1) Preparation of detailed building inventory database, (II) preparation of landuse map (III) Guidline to integrate Disaster Risk Reduction into landuse/master plan.

2.36 Review/Assessment of the Situation at National and Local Level

2.36.1 Identification and Assessment of Planning Parameters

From the national level documents and observations at local levels are assessment would be made to formulate goals and objectives of the tasks. However ToR has already been identified goals and objectives. The consultants will evaluate those and finally make and objective assessment for sharpening the goals.

For plan preparation, basic data will be needed on population and migration, employment, social, economic and physical conditions in the study area, land-use, infrastructure, community and social facilities, environmental conditions etc. Most of this information will be collected from existing studies, plans and programmes, government publications, public authorities, statistical digests, documentation of external agencies as well as the records of UDD, Bagmara, Faridpur Sadar and Gangni upazila and other development agencies working in the area. Reference will be made to relevant national reports, plans etc. Major data gaps will be identified and will be collected through sector studies/surveys.

2.36.2 Goals and Objectives of the Plan

The consultants will review current urban and sectoral policies and programmes, design standards, the institutional arrangements to carryout development in the study area, regulatory and other control tools available and their effectiveness and new initiatives concerning land development and management. Current shortfalls in planning and building legislations; the absence of planning standards; the absence of sub-division

regulation; the absence of guidance on detailed area layouts and the absence of methods of funding urban developments, will all be focused by the consultants.

The consultants will also review the inadequate administrative and organizational structures for effective planning and management at *Upazilas* and concerned agencies. The existing mechanism for co-ordination and liaison among the agencies operating in the area will also be reviewed in search of finding a better sustainable coordination mechanism among them. The need for changes in institutional structures over the long run will also be examined.

2.36.3 Problem Identification

The consultants will carry out a rapid survey of problems affecting different groups and having different impacts such as existing land use including production process is in the urban and rural areas, health and environment condition, lack of social, utility and services, amenities etc. at different scales through PRA session in each ward and union of every upazila. This will be done through discussions with different interest groups and stakeholders at a preliminary stage. After initial identification of the problem, a further attempt will be made to know the exact nature and quantification of the problems by collecting required data from secondary sources as well as from the inputs of the supporting studies to be carried out under this project or already carried out by other agencies.

A critical task for the team will be to sort out and analyze the identified problems. Problems will also be classified to identify complementarities and existing or potential responsibility at local or national government level.

Important parameters for immediate action will be environmentally poor areas with the potential for upgrading. Examples of criteria for selection of such area will be:

- ✓ Environmental and physical conditions,
- ✓ Population distribution and densities
- ✓ Service deficiencies,
- ✓ Health conditions,
- ✓ Location and landuses,
- ✓ Existing production practices,
- ✓ Income level and poverty situation,
- ✓ Shelter condition and land tenure, and
- ✓ Community attitudes and organizations.

2.37 Review of Current Development Projects

Sectoral projects planned or under taken in the study area by different organizations, which will have impact on the form and character of urban growth, will be identified. As required in the ToR, projects will be mapped using thematic overlays to help identify complementary and incompatible outputs of different projects, urban expansion implications and other spatial economic or social impacts. Information will be obtained as necessary from public agencies as well as from private formal and informal sources.

The consultants will review current urban and sectoral policies and programmes, design standards, the institutional arrangements to carryout development in the study area, regulatory and other control tools

available and their effectiveness and new initiatives concerning land development and management Current shortfalls in planning and building legislations; the absence of planning standards; the absence of sub-division regulation; the absence of guidance on detailed area layouts and the absence of methods of funding urban developments, will all be focused by the consultants.

2.38 Review of Relevant Previous Studies and Plans

Sectoral projects planned or under implementation in the Project area by different organizations which will have impact in the form and character of growth will be identified. Projects will be mapped to help identify complementary and incompatible outputs of different projects and other spatial economic or social impacts. Information will be obtained as “necessary from public agencies as well as from private formal and informal sources.”

2.38.1 Implementation through Multi-Sectorial Investment Program

Major infrastructure development works such as primary roads, water supply, drainage etc., would continue to be largely controlled by Government. However, within the framework set by the Planning Component development, implementation of these and other public works is to be efficiently coordinated through the Multi-Sectorial Investment Programme. (MSIP)

2.38.2 Principle of MSIP

The underlying principle of a Multi-Sectorial Investment Programme (MSIP) is to match a list of urban development projects with the funding stream necessary to implement them. There are two basic activities that determine the contents of an MSIP for a planning area.

- ✓ The first activity is to prioritize and schedule the investment projects of all public agencies so that they will collectively help achieve the development goals and objectives of the Plans.
- ✓ The second activity (which can be done in parallel) is to analyze the source and availability of funding for the prioritized list of development projects.

2.38.3 Project Prioritization and Scheduling

The project prioritization and scheduling procedure occurs in two stages:

- The evaluation and ranking of development projects within each sector e.g. transport, water supply, power supply, drainage works etc. by the respective sector agencies;
- The evaluation and ranking of Sectorial priority projects against each other and across all development sectors.

All projects are ranked using three broad sets of criteria:

- Preferred investment projects prioritized through an evaluation of how well they achieve the plan's development goals and objectives;
- Those investment projects that are pre-requisites. This means those projects which for technical or other reasons must be completed before others;
- Those investment projects which complement and reinforce each other or which logically fit well together.

2.38.4 Funding Analyses

This involves a financial analysis of the current and future funding capabilities of the various development agencies to determine what funding may be available to pay for the prioritized list of projects. If development funds are expected to be insufficient (as is usually the case), then the analysis should also recommend ways in which funding might be enhanced. These might include more efficient tax collection methods, direct cost recovery mechanisms, improved accounting and financial management systems, etc. Since development usually requires substantial capital outlays which are beyond the short-term financial resources of local authorities, long-term debt financing and the capability to service such debt is a vital aspect of the analysis. The final result of matching expected development revenues with the schedule of prioritized development projects becomes governments Mufti-Sectoral Investment Program (MSIP) for Project area. The investment program would then be integrated into the next Poverty Reduction Strategy Plan with implementation through the Annual Development Plan.

2.38.5 Community Level Participation

Public participation is an essential element in plan preparation. People's participation will be ensured in the current plan making process through holding a number of formal and informal consultation meetings in the project area. It helps in gathering information regarding public demand of various facilities, identify local problems and peoples view, opinion and attitudes towards future development activities. Besides, such meetings also help in obtaining local knowledge in solving different problems on the project. Physical condition improvement project should have stipulation for public consultation in different stages of the project. Mainly the project for preparation of a planning package like- Structure Plan, Master Plan and Detail Area Plan has provision for public consultation at various stages.

2.38.6 Private Sector Developments

During the reconnaissance visit, it has been noticed that a number of structures and establishments have been recently constructed haphazardly along the road sides through the private sector initiatives in various places of Bagmara, Faridpur Sadar and Gangni Upazila. And these are used as weaving factories, dyeing industries, markets and hats, schools, colleges, fish firms, poultry firms, electric sub-stations, and so on. The overall implications of such developments will be studied.

2.39 Constraints and Opportunities

Assessment of the extent of urban expansion/constraints and opportunities will be carried out using SWOT analysis and people's interview in this respect and incorporate the key spatial impacts of projects identified from the review process of current projects. This task will be assisted, where possible, by the use of information regularly collected by government agencies, field inspection, and verification with the local residents. Key outputs of this task will include identification of critical areas opportunities and constrains in respective areas where, for example, infrastructure costs per capita, distance from main services, dependence on major new transport linkage etc.

2.40 Preliminary Consultation Process

2.40.1 Local Level Participation

The process of planning approach will be carried out through the various stages of consultations involving the concerned agencies and community representatives including potential beneficiaries, project affected people as per requirement of the respective consultation processes. The community level participation in the planning process is the latest demand of the Planners of the Government and Donors to make the development plan rational with respect to accommodation of programs of the line agencies and as well as well distribution of local resources and long term sustainability. The People's Participatory Planning approach will be applied in the formulating Action Area Plan, Bankable Projects and Schemes.

The potential participants of the stakeholders for the consultation process would include the following:

The Local Government/Public Agencies

The consultants will first identify the location specific public agencies likely to be involved in the development process and select the level of the representatives for the consultation process. The potential agencies relevant to the planning of the study area would include, among others, the following: UDD, DPHE, BWDB, LGED, RHD, BTCL, IWTA, PWD, BRTA, REB, Board of Investment, DLRS, and Local Administrations etc. The agencies will be interviewed by the consultants' team members to have the information and status of the existing development activities and future development plans of the respective agencies with objectives and nature of development with targets with respect to benefits and investment, views on impact of the program/plans on social, economic and environmental aspects. After preparation of basic inventory and basic analysis of the database of development plan and programs of reach line/concerned agencies a consolidated summary sheets will be prepared including area of discussion in the consultation process. Based on which the authorized representative of the respective agencies will be invited to participate in the consultation process following approved schedule at agreed venue.

Local Communities

The consultants will identify and assess the potential participation of the local communities in the planning process. The potential local communities with respect to involvement in the consultation process would include, among others, Elected Public Representatives of the respective areas including Members of the Parliament of the respective areas, Zila and concerned Upazila Parishads, Paurashavas, Union Parishad Chairmen, and Ward Commissioners, Community representative, KSS (agricultural cooperative), fishery cooperative, Transport Owners association, Chamber of Commerce and Industries, etc. The community representatives will be discussed in very careful manner so that they become aware of the background and objective of development plan and take part in the planning process through fruitful contribution in the consultation process. Before the consultation, the consultants will interview the identified community representatives separately with the developed format and manuals based on which the consultation outline will be prepared with the aim at making the consultation process appropriate and effective with respect to consensus building.

Private Sectors at Local Level

The Private sectors include the licensed entrepreneurs engaged in the development activities and services providing in the study area. These are transport owners, real estate business, contractors, trader, commerce/industry owners, etc. The agreement already made and license already provided to the various private sectors need to be reviewed and assessed the probable conflict/impact on the Plan Process. The opinions of the private sector need to be carefully examined to avoid the conflict that might hinder the formulation and implementation of the plan. In addition, the present practice of entrepreneurs with respect to land-use, and economic activities following the condition of the agreement and license will be reviewed through physical verification and interview with the entrepreneurs.

NGOs at Local Level

The consultants will identified the active NGOs in the social infrastructure and community development in the Study Area along with status of their development activities and future plan of actions in different social and urban development activities. The potential NGOs will be discussed and their opinion in the planning process will be explored in the planning process, especially for the social development, social infrastructure development, environmental planning, motivation of the communities, etc.

2.40.2 National Level Participation

Professional Groups

The relevant professional groups at the national level from where valuable professional advice and guidance can be sought to enrich the plan and policies. The consultants will discuss the identified issues of this programme with Line agencies, private entrepreneurs, and prevailing resources utilization, infrastructure, economic and environmental issues with potential professional groups.

National Level Government Agencies/Stakeholders

In the local context, the national level government agencies/stakeholders' opinion can play a very important role to take different development plan and policies in the project area. Because they have a clear idea about local constrains and opportunities. With the help of local views of the professional groups can easily take further decision for planning and policy level.

2.41 Methodology for Carrying out the Surveys

The consultants will take various steps of activities in the process of preparation of Development Plan for UDD which are described and provided hereunder in a sequential manner under different stage of Reporting and Deliverables. The Consultants present the methodology almost in accordance with the ToR guideline with some adjustment by blending their views based on the experiences gained from recent past completed similar and related projects.

2.42 Preparation of Planning Options

Preparation of planning options is necessary to choose the best options from among the formulated alternatives. Various alternatives can be discussed at the series of stakeholders meetings at grass root levels and can be identified the better alternatives. However, the alternatives should again be cross examined through our legal and policy regimes. By doing this, ultimately we can get a better option which is legally adaptable, compatible with policies and acceptable to the people.

The following points are the basic steps which will be followed throughout this exercise and finally come to the conclusions to prepare options. Discussion on the basic steps that would be required in preparing the plan package has been made. Steps of Detailed Plan preparation process have been presented in the following Table 2-26:

Table 2-26: Detailed Plan Preparation Process

Step 1	Collection of Maps. Basic Statistics and Information
Step 2	Preparation and Compilation of Base Map and Demarcation of Project Area.
Step 3	Higher Level Frameworks: Concern to Government and Other Agency Level Policies and Decision.
Step 4	Communication Plan and First Consultation: Concern to Local Communities/Beneficiaries and Other Agencies/Interested Quarters (Stakeholders) including all basic surveys
Step 5	Formulate Planning Principles/Standards for the study area
Step 6	Second Consultation: Financial Viability, Social, Economic and Environmental Impact Assessment.
Step 7	Integrated Plans: Concern to Local Communities/Local Leaders/Other Beneficiaries and Investors.
Step 8	Third Consultations
Step 9	Priorities and Phasing: Public Sector Action Program.
Step 10	Development Control, Zoning and Land Management.
Step 11	Legal Supporting Documents.
Step 12	Final Plan preparation and Reporting

2.42.1 Sub-Regional Plan

It would be necessary to prepare a plan at sub-regional level. For this study, we translate sub-region as the District. Thus a District level plan would be prepared. Since, the studies will not be carried out at District level, we propose prepare a strategic plan at sub-region level. Strategic plan means the direction and various policies to be carried out at sub-regional level, where the concern Upazila can be functional for the sub-region. This functionality to be enhanced to increase more interactions both economically and socially. Sub-Regional Strategic Plan would be prepared for 20 years using secondary data. National policies, formulated and integrated different sectoral strategies at sub regional level, spatially interpreted sectoral strategies at sub regional level, formulated Conservation Plan at sub regional level and formulated Development Plan, for example.

The physical setting and social settings of an Upazila must be linked with a greater context, at a sub-regional level, in order to prepare the contexts of planning. For example, roads, drainage shedings, economic interactions and social needs usually do not found confined within an Upazila or a city level. These can be better manage in a larger framework, such as Districts or even Divisions. The ultimate aim of sub regional plan is to make Upazila level plans more appropriate, contextual and interrelated.

The process of preparing sub regional plan is simple and straight forward. We can make visit to the District headquarters and can meet the key people to know and understand the strategic links.

Sub-regional plans usually encounters the following issues and problems.

- ✓ Economic growth perspectives of the sub-region (such as agriculture growth, industries. services etc.)
- ✓ Emerging new growth points within the sub-regions.
- ✓ Sites of all kinds of major investment within the sub-region.
- ✓ Population growth, migration, and settlements patterns.
- ✓ Physical constraints and features.

The above issues and problems will be examined from secondary data and primary observations in sub-region to highlight economic profile, population distribution, characteristics and movement, man-made improvement (or damage) of nature, transportation and communication and overall socio-economic organization of this region. The discussion on the above issues and problems will lead to identify whether the region is homogenous in nature, its geographic entity and economic aspects. Thus a region comes into being that differs from other neighboring areas/region.

After identification of the sub-regional problems (through analysis of Location Quotient and Shift Share Method) planning measures will be undertaken. This should be mentioned here that this sub-regional plans under the current exercise will address issues and problems to resolve the major planning problems of the Upazila under the sub-region (district) to functionally and ecologically improve the overall planning parameters.

From the PRA session in both Urban and Rural area, major findings from the regional development will be incorporated. Urban economic situation will be analysed for this sub-regional plan. Physical feature survey, including transportation linkage with other region will be considered for finalizing the sub-regional plan. Drainage, Hydrological, environmental, geological, vulnerability and risk assessment study and the final output will be consider for sub-regional plan preparation.

The plan will also study on the following component at sub-regional level;

Land Study

In the lands study, reviewing the existing land use and development plans, change in land category and land use after FCD, Assessment of change in land use after construction of major infrastructure, Settlement Pattern, Hinterland, Location and level of major facilities at sub regional level, Hierarchy of settlements within the sub region, Identification of major criteria of the settlements.

Hydrology

In hydrological study, there study about local river's Hydrodynamic, Morphological, Geomorphologic development, Impact of FCD and FCDI at sub regional level (Flood Control, Drainage and Irrigation)

Environmental studies

Related Environmental Policies, Acts and Laws, Environmental Procedures and Guidelines (in sub regional planning study), Economic, Social, Biological and Physical Environment at sub regional level will be considered in sub regional planning procedure.

Hazard management

To prepare the sub regional plan there should study of the hazard management. To conduct this study there should consider guidelines on Hazard management at sub regional level, Hazard mapping considering natural

hazards: Flood, water logging, drainage congestion, salinity intrusion according to guidelines on Hazard and Risk management at sub regional level

Water Resource Management

Agriculture water management and Domestic water management at sub regional level will be considered in sub regional plan period.

Transport Studies (Rail, road, and water)

Preparing the sub-regional plan of the area, there should consider inter and intra-regional transport facilities. To considering this facilities there need to study the Existing Transport Situation, General Situation of Road Infrastructure, Situation of Road Transport (Passengers), Road Transport (Goods), Water Transport, Major Traffic Generating Centers and Areas of Congestion, Traffic Flow Characteristics, Road Transport Services, River Traffic Situation, Travel Pattern, Road Network Development, Situation of Rural Transport, Location of key point installation at sub regional level, Strategic Issues to be addressed in planning the Future Transport System.

Population Study

Population is the vital factor to prepare a plan for a region. We need to assess there need, because all kind of plan should develop for the human development. So, to prepare the sub regional plan there need to analyze the growth trend of the population of these regions and spatial distribution of population and its changes since 1991.

Study on Basic services (major urban area)

Basic urban services are necessary for the plan development of an area. To prepare the sub regional planning there need to study of Housing, Sanitation, Communication, Energy, Education, Health problem, prospect and existing situation of each particular area.

Economic Activities

Economic activities are important for the well-being of the people and also for the regional development. Economic sustainability and prosperity is one of the important aims of this development plan of this area. So following economic activities should study to prepare a better sub-regional plan, those are Agriculture, Industry, Fisheries, Forestry, Disparity analysis.

Anthropological and Ethnographical Study

Livelihood Study of local people, Ethnographical Study will be conduct to prepare sub-regional plan of these Upazilas.

Heritage, Archaeology and Tourism management

Potentials of Tourism in the in the sub region, Planning Tourism in the for the sub region, Linkage of Tourism to Recreation and Sports, Potential Sites of Heritage, Archaeological sites will survey and give the proposal of this conservation, development and tourism management for these Upazilas.

Regional Structure Zoning Category: In order to promote and protect public safety welfare by (i) minimising adverse effect resulting from the inappropriate location or use of sites and structures, (ii) conserving limited land resources and encouraging their efficient use. To carry out the purposes and provisions of the project as

they apply within the context of the Regional Structure Plan, the following land zoning category would be followed:

- Main flood flow zone
- Sub flood flow zone
- Wetland
- Forest
- Agricultural land
- Urban area
- Rural settlements
- Forest settlements
- Industrial moderate hazards
- Industrial low hazards
- Water supply protection zone
- Restricted flood protection reserve
- Restricted military / public safety
- Restricted road / rail/ utility reserve
- Restricted special

Conservation Plan: Major Land use pressure is heavily depending on the ecosystems and resources of the existing nature. Land-use conflicts and clearly unsustainable uses may be found in planning areas. There is a clear need for broad-based, multi-sectorial and long term development management, including community-based initiatives in sanitation, biomass preservation and collective management of natural resources, including more detailed priorities such as ecosystem preservation of fisheries habitat, maintenance of biological diversity and productivity, forestry management, containment of saltwater intrusion and population risk management. Also needed are institutional and regulatory actions.

Contrary to some current impressions, conservation and economic development are not conflicting ideas. In fact, well-planned conservation-oriented development will add to the general economic and social prosperity of a coastal community, while bad development will sooner or later have a negative effect. With innovative management based upon sustainable use, communities may be able to achieve a desirable balance without serious sacrifice to either short-term development progress or longer-term conservation needs. In broad sense Conservation Plan would cover ecology and environment, land forms: forest, wetland, rivers and agricultural land, Major infrastructures, area of archaeological/ anthropological interest.

2.42.2 Structure Plan

It develops broad strategies for managing and promoting efficient urban development over the medium to long term and takes into account the integration of economic, physical and environmental planning objectives. A structure plan provides a broad framework for development activities in an area. However, as the division in the jurisdiction and functionality of the Strategic and the Structure Plan are rather blurry and sometimes overlapping, the client and the consultant have agreed to work this through as the project gradually matures and resolve the conflict regarding this issue and merge the two in a single tier of Structure Plan.

However, considering the pressure of population on land and environment in Bangladesh, specially in the study areas, an ideal approach to Structure planning would be an appropriate zoning of all land in the study area into broad categories. Such categories may include agriculture, water bodies, forest resources and human settlements. At the second level, human settlements can be further studied and planned for detailed

land use under urban and rural settlements. The aim of such broad zoning is to save agricultural land, along with forest and water bodies for sustainability of economy and environment. National land use policy is now being framed in this direction.

Implementation of policy, plans and programs are totally dependent on the ability of the organization on which the responsibility will be entrusted. Ability includes vision, legal coverage, and resources: human and logistics, and leadership. Therefore, the Structure Plan will include a comprehensive institutional and legislative restructuring section for restructuring of the Organization/Authority who will be the guardian of the plan. Structure Plan will be in a scale of RF 1:10000.

2.42.3 Urban Area Plan

Urban Area Plan is prepared for managing and promoting development over medium terms following the broad guidelines set by the longer term Structure Plan. It shows the metropolitan structure of different sub-systems in space over the medium term and identifies broad programmes of direct action especially related to infrastructural development, institutional issues as well as broad financing strategies. The plan may also outline more specific area-wise development policies to guide development over the medium terms. One major objective of preparing Urban Area Plan is the consolidation of development activities by various agencies in areas that have strongest potential for growth in the medium term and can accommodate the anticipated volume of growth. Another purpose of preparing Urban Area Plan is to facilitate the development control function. It shows the broad land use zones on a more detailed scale of maps as derived from Structure Plan. The plan provides details of land use zoning and building controls, the development control function becomes easier to implement with an Urban Area Plan. It also shows land reservations required for essential uses and major infrastructure development. Urban Area Plan will be in a scale of RF 1:3960

2.42.4 Rural Area Plan (RAP)

Rural Area Plan (RAP) provides a long-term strategy for 20 years and covers for the development of rural areas within the project area. Generally, RAP contains an explanatory report, resource maps, conservation and management report, planning rules, rural area plan and a multi-sectoral investment program and so on. The intention has been to concentrate on the physical planning aspects of rural areas in one hand and socio-economic growth and spatial development on the other. The rural area plan aims at primarily zoning rural land use. After synthesizing all maps and data gathered under the present study, rural areas will be categorized under four broad land use categories (or zones). These are land under water bodies and forests. These two categories will be considered as conservation zone. The third category will be agriculture areas. Agriculture areas will be identified and mapped and put forward as a zone of no change of land occupation. Agriculture land will remain as agriculture. The fourth category of land will be human settlements. All development dynamics will rotate within this zone. The zone will be planned in detailed for human habitation, industry development and service sector activity. Urban Area Plan will be in a scale of RF 1:3960

2.42.5 Action Area Plan

The Action Plan is a separate document covering the first five-year period of the structure plan. It examines, in the context of the structure plan, those items that might be implemented in this period and thus contains more detail on a more limited range of subjects than the structure plan. It tries to provide the Upazila with guidance in deciding between priorities.

The Action Area Plan (AAP) guides land use and infrastructure within the area potential for immediate intervention based on public demand and necessity. It is prepared on 5 years interval. The preparation of Action Area Plan (AAP) will be formulated through participatory approach involving the local people. It will contain problem analysis using participatory approach, stakeholder analysis, Potential analysis (Basic and derived potentials), identification of possible projects, Priority ranking of projects, Strategy formulation for prioritized projects. Action Area Plan will provide prioritized projects consisting location of project, goal & objectives, activities, tasks, actors, resources, cost and assumptions/constraints.

The action plan consists of three parts, a summary of resources available, project selection and project evaluation. The analysis of available resources looks at the past availability of funds, in so far as this is possible for such a recent institution as an Upazila and attempts to assess funds likely to be available for the Upazila itself for development in the action plan period. Project selection summarizes existing guidelines as they affect five-year plans and lists the criteria used in selection before identifying priorities in each sector and proposing projects to address these priorities. Urban Area Plan will be in a scale of RF 1:3960.

2.42.6 Formulation of Bankable Project & Schemes

Mere plan preparation is not the objective of the project rather it envisages exploring and suggesting implementation strategy for the plan. One of the steps in this regard is selection and identification of Bankable Projects and Schemes. The Bankable Projects and Schemes will be identified and priorities through PRA session. A good number of projects are implemented with external assistance in the form of aid, loan, technical assistance and supplier's credit. The private sector is also being encouraged to invest in the energy and infrastructure development projects. In this situation it is necessary that the projects that will form the major part of the plan implementation process should be developed to an extent, which will help the client to approach the prospective financiers. The local government agencies later on will prepare their different year long own development plan based on the proposals of the Development Plan prepared under this initiative of UDD. It will facilitate them to justify their efforts to others as well as it will pave the way to manage finance to implement the initiative. To develop the inventory of Bankable Projects a list of the projects that are essential to implement the plan will be prepared in the following format.

- Name of the Project,
- Background of the Project,
- Objective of the Project,
- Justification of the Project
- Description of the Project
- Implementing Authority,
- Feasibility Report,
- Project Cost with detail breakup,
- Source of Finance,
- Land Requirement,
- Impact Assessment,
- Implementation Phase,
- Area of Influence of the Project, and
- Projects relation with higher level frame work

2.43 Formulation of Planning Standards

The main basis of future requirement will be the population size of the Upazila and area will be covered by each utility service. The existing services have to be considered in the forecasts.

The supply and Demand management of utility services fully depends on the consumption level of the residence, existing population and the projected population. Demands of various utility services in the Upazila will be estimated considering population projection for the Upazila. Land requirements for different types of utility services will be analyzed by this following the standard (see Table 2-27).

Table 2-25: Standard for Different Planning Features

Types of Land Uses	Recommended Standard Provision (unit)
General residential	100–150persons/1acre
RealEstate–Public/Private	200population/1 acre
Roads	
Upazila primary roads	150–100feet
Upazila secondary roads	100– 60feet
Upazila local roads	40- 20feet
Education	
Nursery	0.5acre/10,000population
Primary School/kindergarten	2.00acres/5000population
Secondary/High School	5.00acres/20,000population
College	10.00acres/20,000population
Vocational Training Centre	5- 10acres/ Upazilla
Other	5.00acres/ 20,000population
OpenSpace	
Playfield/ground	3.00acres/20,000population
Park	1.00acre/1000population
Neighborhood park	1.00acre/1000population
Stadium/sports complex	5–10acres/UpazilaHQ
Cinema/Theatre	1.0acre/20,000population
Health	
Upazila health complex/hospital	10-20acres/UpazilaHQ
Health centre/Maternity clinic	1.00acre/5,000population
Community Facilities	
Mosque/Church/Temple	0.5acre/20,000population
Eidgah/	1.0acre/20,000population
Graveyard	1.00acre/20,000population
Community centre	1.00acre/20,000population
Police Station	3–5acres/Upazila HQ
Police Box/outpost	0.5acre/per box
Fire Station	1.00acre/20,000population
Post office	0.5acre/20,000population
Commerce and Shopping	
Wholesale market	1.0 acres/10000population
Retail sale market	1.0 acres/1000population
Corner shops	0.25acre/per corner shop
Neighborhood market	1.00acre/per neighborhood market
Super Market	1.50–2.50acres/per super market

Utilities	
Drainage	1.00acre/20,000population
Water supply	1.00acre/20,000population
Gas	1.00acre/20,000population
Solid waste disposalsite	4–10acres/Upazila HQ
Waste transfer station	0.25acres/per waste transfer station
Electric sub-station	1.00acre/20,000population
Telephone exchange	0.5acre/20,000population
Fuel Station	0.5acre/20,000population
Industry	
Small scale	1.50acres/1000population
cottage/agro-based	1.00acres/1000population
Transportation	
Bus terminal	1.0 acre/20,000population
Truck terminal	0.50acre/20,000population
Launch/steamer terminal	1.00acre/20,000population
Railway station	4.00acre/ per Station
Baby taxi/tempo stand	0.25acre/one baby taxi/tempo stand
Rickshaw/van stand	0.25acre/one baby taxi/tempo stand
Passenger Shed	0.25acre/one baby taxi/tempo stand
Administration	
Upazila complex	15.00acres
Upazila office	3–5acres
Jail/Sub-Jail	10acres/Upazila HQ
Agri-extension Farm	10acres/Upazila HQ
Urban Deferred	10 percent of the total buildup area
Reserve	-

Source: (Urban Development Directorate, November 2013)

2.44 Output and Format

The consultants will create a digital database of physical features using the data collected through 3D survey and other secondary sources. These data will be used by the project staffs and counterpart staff of UDD personnel for use in planning, development and as well as for research purpose,

For GIS application purpose, the collected data were stored externally in digital form in GIS software database package. Attribute data were frequently stored externally with the geographic data and were stored within the GIS software. A master geodatabase or spatial data bank by combining all types of collected and interpolated data will be developed. Through Data Base Management System (DBMS). The DBMS provides the essential link between the GIS software and External data sources. DBMS work with different data types, such as character, numerals or Dates. They have languages for describing or manipulating the data or for querying the database for particular pieces of information; they also provide programming tools and have particular structures.

2.44.1 Data Management Structure

To prepare the spatial data, GIS software will be used. The following are the principal features that will be used for implementing the GIS.

The Whole Database was prepared in the following three features:

- ✓ Point
- ✓ Lines and
- ✓ Polygon or Area.

The Database Management System will comply the following:

- To create databases, which are in a carefully structured and consistently logical format
- To create new data bases.
- To extract data from the database in a variety of ways.
- To persistently and constantly execute any commands.
- To display data as required.
- To edit data in requisite way.
- To allow for the transfer of data between various software packages.
- To be independent of particular hardware needs.

The spatial dimension of data will be regarded as the values, character strings or symbols that conveys to the user information about the location of the feature being observed. As GIS have no 'local knowledge' about spatial data used in GIS, therefore GIS needs a mathematical spatial reference. It means spatial data depends on:

- purpose of use
- scale
- spatial entities
- generalization
- projection system
- spatial referencing system
- topology

2.44.2 Inventory

For planning and management of urban infrastructure, maintenance of infrastructure data Inventory is very important. Format of each infrastructure has been previously explained e.g. road inventory, drain inventory etc. Each inventory will have numbers of attribute field. Attribute is the non-spatial data associated with spatial data i.e. point, line and polygon/area entities. Each spatial entity has more than one attribute. For example, a pointer presenting the hotel may have a number of other attributes: the number of rooms; the standard accommodation; the name and address of the owner, etc. Attributes provide additional information about the character of the entities. Some GIS software is good at handling attribute data; and others have very limited database capabilities but all the GIS software offers the linkage facilities from different platform of database management. The most commonly used software for attribute data management are:

- dBase
- Microsoft Access
- MS Excel
- Structured Query Language (SQL)
- SPSS

2.44.3 Project Parameter

Bangladesh Universal Transverse Mercator (BUTM 2010) projection system will be used in all the survey and mapping tasks for the project. BUTM 2010 projection System is developed by Survey of Bangladesh (SoB).

2.44.4 Conversion Factors

The Conversion Factors are used to convert coordinates referenced to one datum to coordinates referenced to another datum. The GIS data with BTM coordinate system will be based on the datum Everest Bangladesh. But Stereo Satellite imagery will be based on WGS 1984 datum. So we need conversion of the coordinates from WGS84 to Everest Bangladesh and vice versa. The following factors for geocentric translation will be used which is established by SOB/JICA study:

From Everest_Bangladesh to WGS84
 X Axis Translation (meter) = 283.729
 Y Axis Translation (meter) = 735.942
 Z Axis Translation (meter) = 261.143

From WGS84 to Everest_Bangladesh
 X Axis Translation (meter) = -283.729
 Y Axis Translation (meter) = -735.942
 Z Axis Translation (meter) = -261.143

2.44.5 Data Precision of Digitization of Mouza Maps

Extra care will be taken during the scanning process for maintaining the proper rotation and alignment, therefore to minimize the distortion and deviation. To confirm the accuracy of the scanning, sample images will print with plotter and verify with the original one using light table. The scanned images will store in CD under consultant's own custody. We will check the scanned Mouza sheets with original Mouza sheets with light table. The accuracy of the scanned Mouza sheets we find very high.

2.45 Check List for Survey and Studies

In the study different survey techniques have been used such as: Topography and Physical feature survey, Landuse survey, Socio-economic survey, etc. Details about different survey and studies have been attached here with the help of following table 2-28 and 2-29:

Table 2-28: Demarcation of the Study Area

No	Name of Activities	Description
1	Collection RS/CS Mauza Maps	RS / CS mauza sheets/maps will be collected for the entire Planning/study area. The mauza sheets having distortion due to rapping or pasting cloths/tape on the mauza maps will be avoided during the collection. These maps will be collected from the local Upazilas/ Paurashava office and DLRS office.
2	Scanning of Mauza Maps	To minimize the distortion and deviations scanning of mauza maps will be carried out using drum scanner. Extra care will be taken for maintaining the proper rotation and alignment of mauza sheets during

		scanning
3	Identification of GCP (T.C) on Digitized Maps	At least 4 Ground Control Points (GCP)/Geo-spatial Reference Points (TICs) will be selected on each mauza identical with the real field condition. For accuracy and quality work, maximum efforts will be given to identify as many as GCP for each mauza sheets.
4	Edge Matching and Preparation of study area map	Edge matching will be with the map of GPS reading. The four TIC points on each sheet will enable the work of edge matching with perfection. Layout of study area map will be done as per ToR using based Arc/info 3.5/ NT/ Arc GIS software. All the features of mauza maps including plot, mauza and boundary of the project area will be identified and shown in the base map in separate layer.
5	Digitization of RS/CS Mauza Maps	Screen digitization method will be used for digitization of mauza maps. GIS based Arc/Info software will be used for this purpose. Feature wise manuscripts will be developed for digitizing the mauza maps and all features will be stored as layer coverage with a separate ID or code number of respective features in the GIS database.
6	Edit Plot Check of Digitized Coverage	After digitization of mauza maps, edit plots will be produced containing all the features and boundaries in different colors. The digitized mauza maps will be checked and verified by superimposing on the original mauza maps using the light table. All possible errors will be solved with this edit plot check and final digital mauza maps will be prepared.
7	Geo-referencing of Mauza Maps	Geo-referencing of mauza sheets will be done using GCP points (Northing, Easting) and GIS based software Arc/Info 3.5/ Arc/view and ArcGIS. After geo-referencing of all the mauza sheets of the project area, the mosaic mauza maps will be found having all the mauza features (point, line, and polygon) with GCP points in different layers.

Table 2-29: Establishment of Bench Mark (BM)

No	Name of Activities	Description
1	Selection of Reference BM	Selection of reference BM is essential for establishment of BM network for the project area. Reference BM provides geo-reference (x, y) and elevation (z) with respect to a datum. For geo-referencing available SoB BMs in the project area and its periphery will be used as reference.
2	Planning proposed BM	Planning the proposed BM/Control points network and selection of tentative locations for those BM/Control Points
3	Constructions and Installation of BM Pillars	The BM pillars will be constructed and installed before the survey work start. As mentioned in the ToR, covering the project area including approximately 1BM pillar per 5 sq.km. grid in urban area and 1BM pillar per 20 sq.km grid rural area (pillar 10"X10", Base 3' X 3', height 5feet). RCC pillars are to be constructed marking unique identification number Coordinate X, Y of these pillars along with Z value is to be marked on base map for future reference. The BM pillars will be constructed and installed before the survey work start. The construction design and specification BM pillars will be obtained from the UDD. The BMs will be established with uniformly distributed grid covering the total project area. <ul style="list-style-type: none"> • Construction and Installation of BM pillars. • Establishment of Co-ordinate of BM Pillars (x, y, z i.e. Northing,

No	Name of Activities	Description
		Easting & RL in mMSL). <ul style="list-style-type: none"> BM ID and location description of the BM
4	Establishment of Co-ordinates (x, y, z) of BM Pillars/Ground Control Points	Establishment of co-ordinate (northing, easting, and elevation in m PWD) of BM Pillars needs extensive GPS survey, data processing, and development of Local Geoids Model. The total work will be followed by selection of reference BM (x, y, z) and RTK-GPS Static Method.

Table 2-30: Sectoral Studies and Survey

No	Name of Activities	Description
1	Household Survey	<ul style="list-style-type: none"> Family Size Age and Sex Structure Religious Groups Educational Status of Household Members Households' Income and Expenditure Levels Migration Status of Residence Occupational Pattern
2	Slum Survey	<ul style="list-style-type: none"> Age and Sex Structure Educational status of slum population. Occupational Status of Slum Population. Monthly Income of Slum Household Reasons behind Migration NGOs working in the Slum Area Facilities Provided by NGOs
3	Urban and Rural Economic Activity Survey	<ul style="list-style-type: none"> Findings of Study of Informal Sector Economy Informal Activities Initial Capital Sources of Loan Rate of Interest Monthly Income Monthly Expenditure
4	Transportation and traffic volume survey	<ul style="list-style-type: none"> Water way Travel demand forecasting Number of ghats and their conditions Road Traffic Survey and Traffic Volume Survey O-D Survey Pedestrian facilities Travel demand forecasting Identification of traffic accident points and their causes Right of way
5	Drainage and Environmental Survey	<ul style="list-style-type: none"> Existing conditions Drainage Network Existing policies Environmental Survey Hazard identification and mapping Vulnerability analysis and assessment Risk Analysis
6	Formal and Informal Industrial Survey	<ul style="list-style-type: none"> Location of Industry Type and Size of Industry details of labor statistics with the housing conditions quality of life of labor

2.46 Monitoring and Supervision of Project Activities

The experts assigned for this project by ECA Ltd. are being worked maintaining close collaboration with the counterpart staff Urban Development Directorate (UDD) and the stakeholders at field level. The team also incorporating the innovative ideas and suggestions of the UDD officials to achieve maximum output. The consultants think that active and functional coordination among the parties will be technically proficient and comfortable in performing the duties to produce effective output under this project. The consultants will give high importance to work with executing agency and the Upazila authority as well as with other concerned development authority to ensure that the activities to be carried out are properly informed to facilitate their contribution in respect to survey, data collection, and analysis and plan preparation.

2.47 Public Hearing

Public hearing is an important part of the planning process. A public hearing may be a formal meeting for receiving testimony from the public at large on a local issue, or proposed government action. Testimony from both sides of an issue is usually recorded for public record, and a report summarizing the key points is generated. As per ToR in each and every Upazila the consultant will conduct two public hearing- one at PRA session and another one after completing draft final report. After completion the draft plan an initiative will be taken to display for about a month the plan and reports at upazila level for receiving comments and criticisms (if any) or any complain may be forward to the planning authority to review and corrections.

2.48 Gazette Notification

Implementation of the master plan is an extremely difficult task. There are many elements of the plan implementation process that cannot be quantified which restrict determination of an overall status of either individual sector or overall level of implementation of the plan proposals. After finalize the Master Plan it will go for gazette notification to the related ministries and thus the plan will be a legal binding for local level institution to implement the plan.

2.49 Institutional Capacity Building for Implementation

To carry out the project activities and after plan preparation to implement the proposed plans by different authorities there is an ample need for reviewing institutional arrangement and their capacity of the concerned agencies. The ToR require to review the existing division of responsibilities for guiding and controlling development and make recommendations on any procedural changes and steps needed to bring about such changes to ensure greater coordination of the activities of the various agencies involved.

A variety of activities will be undertaken to accomplish the stated objectives. Key activities to be undertaken in the present task will include

- Review of existing legal instruments;
- Identify the existing short-comings towards ensuring inter-agency coordination;
- Interview of key persons of all the major development agencies

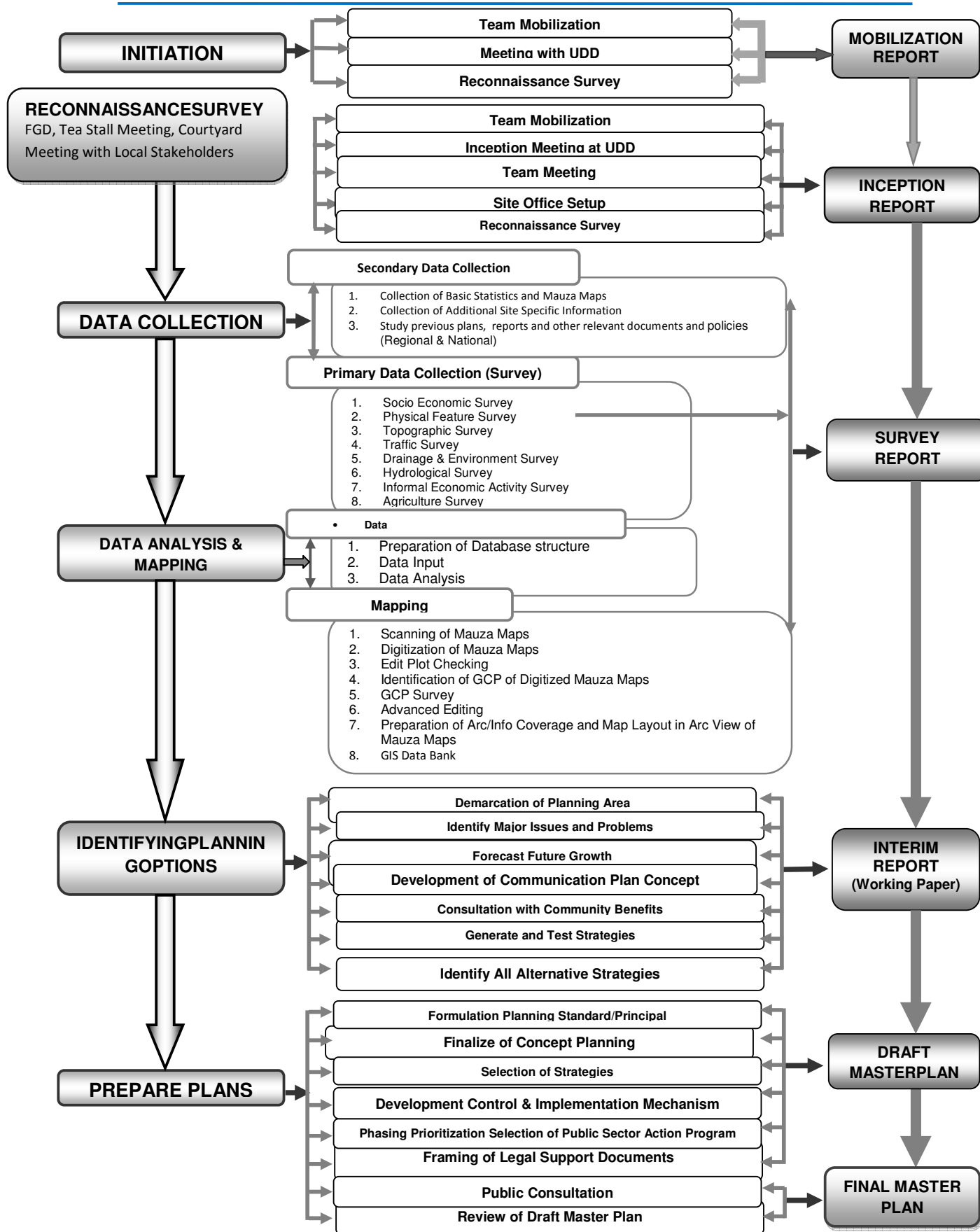
- Seek the opinion of the key persons of the development agencies regarding an acceptable arrangement for sustainable coordination;
- Examine of the needs for legislative and administrative changes that are required to be carried out to implement the agreed mechanism; and
- Recommendation for all necessary changes in organizational set-up, administrative mechanism, and legal provisions

2.50 Training Needs Assessment

With regards to the training requirement of the project, we have to come up with a number of critical parameters for designing a comprehensive training guide line. We have to logically assume some of the complementary and substantive key parameters for the guide line.

2.51 Final Deliverables and Overall Methodology

Final deliverable of the project as per ToR will be the final master/development plan reviewed and approved all concerned and designated parties and it involves a number sequential step to achieve that goal. The following diagram shows the overall methodology for formulating and completing the master plan.



CHAPTER-3

WORK PLAN

3.1 Introduction

Since the contract has been signed on the 10th June 2015, the consultants have commenced the services immediately. The consultant started preliminary activities from that day which include arrangement of office space, mobilization of consultant' steam, conduction of reconnaissance survey and submission of Mobilization Report. The consultants also prepared work plan for survey activities, preparation of survey work and plan preparation as per the requirement of Terms of Reference.

3.2. Revised Work Plan

This section provides details of the Work Plan and Activity Schedule, which is proposed by the Consultants, to be performed during execution of this specialized consultancy services within the stipulated time frame of the present assignment. This Work Plan and Activity Schedule have been prepared by the experienced professionals of ECAL based on the understanding of the well-defined ToR furnished by the Client. Systematic planning of the Activity Schedule always ensures the quality of Standards during the implementation of the project. It is the tradition of ECAL to collect relevant detail information as far as practicable before submission of the mobilization proposal.

From the ToR it is evident that the project will have four phases be namely inception phase, survey reporting, draft final reporting and final reporting. The Work Plan is tentative one considering the fact that it may require some modifications in the course of project period, especially after completing reconnaissance survey and preliminary review of available information. The detailed work program can be prepared in the Inception Phase and will be provided accordingly. The following **Table 3-1** shows the summary of revised work schedule for the concerned project (package-3). A self- explanatory Activity Schedule associated with time frame in the form of MS Project has been developed for this project. Based on the ToR the consultants proposed the work plan (given in **Appendix-06**).

Table 3-1: Revised Work Schedule

No	Activity	Total Days	Start Date	End Date	Months (10th June 2015 to 10th June, 2017)																								
					J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1	Task-1: Contract Sign after Notification of Order	1 day	Wed 06/10/15	Thu 06/11/15																									
2	Task-2: Team formation and Submission of Mobilization Report	15 days	Thu 06/11/15	Tue 06/25/15																									
3	Task-3: Collection Map, Reports, literature review and submission of inception report	30 days	Tue 06/25/15	Sun 07/26/15																									
4	Task-4: PRA Session with Local People	100 days	Mon 07/27/15	Tue 11/03/15																									
5	Task-5: Preparation and Completion of Base Map and Demarcation of Project Boundary/ Area/ Locality	30 days	Tue 06/25/15	Tue 07/25/15																									
6	Task-6: Satellite Image Processing by using Photogrammetric Method	150 days	Tue 12/01/15	Thu 04/28/16																									
7	Task-7: Physical Survey Activities	130 days	Sat 01/02/16	Tue 05/10/16																									
8	Task-8: Socio-economic Survey	120 days	Tue 10/20/15	Thu 03/03/16																									
9	Task-9: Housing, Slum and Squatter Survey	45 days	Sat 01/02/16	Mon 02/15/16																									
10	Task-10: Population and Migration Survey/Study	90 days	Tue 12/01/15	Thu 02/28/16																									
11	Task-11: Urban and Rural Economic Survey	60 days	Tue 12/01/15	Thu 03/31/16																									
12	Task-12: Study of Social Infrastructure	90 days	Tue 12/15/15	Tue 03/15/16																									
13	Task-13: Transportation survey	40 days	Sat 01/16/15	Tue 03/15/16																									
14	Task-14: Hydrological study	45 days	Sat 01/02/15	Sat 04/30/16																									
15	Task-15: Formal and Informal industry survey	30 days	Sat 01/02/15	Sat 04/30/16																									
16	Task-16: Other Survey	120 days	Tue 12/15/15	Sat 04/16/16																									
17	16.1 Recreational Open space	30 days	Sat 01/16/16	Sat 04/16/16																									
18	16.2 Health facilities including community health facilities	30 days	Sat 01/16/16	Sat 04/16/16																									
19	16.3 Educational facilities	30 days	Sat 01/16/16	Sat 04/16/16																									
20	16.4 Agricultural land Demarcation Survey	45 days	Tue 12/15/15	Sat 04/16/16																									
21	16.5 Archeological study	30 days	Tue 12/15/15	Sat 04/16/16																									
22	16.6 Pollution Study	45 days	Tue 12/15/15	Sat 04/16/16																									
23	16.7 Data input in GIS+ SPSS (spatial and attribute)	120 days	Sun 02/14/16	Sun 06/12/16																									
24	16.8 Compilation / analysis of data	45 days	Mon 06/13/16	Wed 07/27/16																									
25	16.9 Preparation of Draft survey report and printing of maps	75 days	Sat 07/16/16	Thu 09/29/16																									
26	Task-17: Earthquake loss assessment	45 days	Sat 01/16/16	Mon 02/29/16																									
27	Task-18: AI Survey Report Completion	30 days	Sat 10/01/16	Mon 10/31/16																									
28	18.1 Draft Report	7 days	Tue 11/01/16	Mon 11/07/16																									
29	18.2 Final Report	21 days	Sun 11/20/16	Sun 12/11/16																									
30	Task-19: Data Processing, Analysis, Interpretation, Presentation and Formulation of Working Papers	65 days	Sat 07/02/16	Sun 11/20/16																									
31	Task-20: Preparation of Planning Package for the Project	104 days	Mon 12/12/16	Sun 03/26/17																									
32	Task-21: Submission of Draft Final Report	88 days	Thu 12/01/16	Thu 03/30/17																									
33	Task-22: Submission of Final Report & Maps	30 days	Mon 05/02/17	Wed 05/30/17																									

3.3. In-house Training Program

There are few in-house training program will be conducted throughout the project. In inception period the training of 3-D image processing photogrammetric technology, topographic survey, RTK GPS survey and physical feature survey, hydro geological survey (urban area), socioeconomic survey, transport survey, disaster related survey, environmental studies, archeological studies, pollution study, bathymetric studies, survey of urban and rural economy, seismic hazard vulnerability and risk assessment has been conducted by specific expert. In draft survey period in house training of knowledge sharing of draft survey report will conduct. In final survey period training program of sub-regional plan will conduct, in sub-regional plan period the training of sub-regional plan and structure plan will conduct. In structure plan period training and knowledge sharing of draft structure plan and draft urban area plan will be conducted. In urban area plan period in house training and knowledge sharing of urban area plan and draft rural area plan will conduct. In rural area plan period training and knowledge sharing of rural area plan and draft action area plan will conduct. In action area plan period training and knowledge sharing of action area plan will be conducted.

3.4. Reporting Schedule

Total six report need to be submitted to finish this work, including draft final plan and final plan of the project. Here below (Table 3-2) show the period of submission to deliver the report,

Table3-2: Timeschedule to deliver the output

Report	Period of Submission
Mobilization Report	Within 15 days of Signing contract
Inception Report	End of 1 st month
Draft Survey Report	End of 8 th month
Final Survey Report	End of 9 th Month
Draft Final Plan with Report	End of 20 th Month
Final Plan with Report	End of 21 th Month

CHAPTER-4

PROGRESS OF WORK

4.1 Introduction

The Development Plan project is commenced on 10th June, 2015. From commencement of the work to the end of the Inception period, the core team members of the project have completed several tasks as identified and designed by the consultants to carry out the preparation of Development Plan project. The progress of the project activities of Bagmara, Gangni and Faridpur Sadar Upazila during inception period has been presented in the following sections.

4.2 Office Establishment

In the field visit of inception period the consulting firm established two site offices in Bagmara at Bhavaniganj Pourashava and Gangni Upazila during completion of field activities Office at Faridpur is under process. These office will be functional from 1st Oct, 2015. (Legal Documents of Rent given at Appendix-07). The following Photos (from Photo 4-1 to Photo 4-3) shows the in real snapshot of hired local office space.



Photo 4-1: Hired Local project Office at Bagmara Upazila.



Photo 4-2: Hired Local project Office at Faridpur Sadar Upazila.



Photo 4-3: Hired Local project Office at Gangni Upazila.

4.3 Collection of Satellite Images

The Pleiades Satellite image in 0.5-meter panchromatic and 2.0 -meter multi spectral four-band images in stereo pairs for both urban and rural area in stereo pairs will be procured. The 0.5-meter pan and 1.0 meter multi spectral imagery will also be fused to yield 0.5-meter color imagery (pan-sharpened).

4.4 Collection of Mouza Maps

The CS/RS Mouza maps are the basis of the base map for the project area. The project area will be delineated on Mouza sheets. Mouza maps have been collected from the DLRS covering the entire project area. The collection status of Mouza maps shown in Table 4-1

Table 4-1: Collection status of Mouza maps

Sl No	Upazila Name	Total Mouza		Collection Status		Remaining	
		Mouza	Sheet	Mouza	Sheet	Mouza	Sheet
1	Bagmara	292	357	-	-	292	357
2	Faridpur Sadar	164	222	-	-	164	222
3	Gangni	103	232	25	35	78	197
Total		569	811	25	35	544	776

4.5. Workshops

Three workshops in Bagmara, Gangni and Faridpur Sadar Upazila will have been conducted. One workshop will have been conducted in each Upazila during 1st and 2nd week of August, 2015. And another workshop will have been conducted after the submission of draft plan. Several types of meeting will be held at union and Upazila level. Already twelve numbers of consultation meeting conducted at union and Upazila level. The Consultants and implementing organization will organize consultation meetings and workshop with the Upazila and Union level to ensure the participation of stakeholders from all walks of life

4.6 Reconnaissance Survey

Urban Development Directorate (UDD) under Ministry of Housing and Public Works has taken an initiative to prepare a development plan for 20 years of 14 Upazilas through participatory method. Participatory methods have gained momentum in recent years as field practices and development experts have sought more effective ways to involve local people in decision-making. Participation is the process through which stakeholder's influence and share control over priority setting, policy-making, resource allocation and access to public. Considering the above, the concerned planning team has conducted many Community meetings (Focus Group Discussion-FGD, Tea Stall and Courtyard meeting) and met with key persons as reconnaissance survey at the project areas (Bagmara, Gangni and Faridpur Sadar Upazila) for creating future working environment with local people as well as institutions.

Objective of Meetings:

- To aware the local people about the project activities.
- To understand the local people's views through collecting their opinions.
- To seek assistance to the local people for upcoming PRA session.

4.7 FGD, Courtyard Meeting and Tea Stall Meeting

A team of development plan preparation including representatives from client successfully implemented initial information dissemination in three Upazila (Faridpur Sadar, Gangni and Bagmara) under package 3. Briefly described below is the activities and outcome of information dissemination trip. Focused Group Discussion (FGD) was organized in all the Upazila at the head quarter and union levels.

Faridpur Sadar Upazila

Serial	Site	Event	Participants	Date	Place
1	Faridpur Sadar Upazila	FGD	UNO, Upazila Chairman, Chairmen of Ups, Development and Technical Committee members No. of participant : 60 plus	6.8. 15	Upazila Auditorium
2	Gangni Upazila	FGD	local MP, UNO, Upazila chairman, 8 union Parishad chairmen, press representative and two NGO representatives	9.8.15	Gangni Upazila Parishad
			Teachers and others No. of participant: 60 plus	9.8.15	Gangni Mohila Degree College
		Courtyard Meeting	No. of participant: 50 plus	10.8.15	Shaharbati, Dhankhola, Sholotaka and Motmura Unions
3	Bagmara Upazila	FGD 1	UNO, Upazila Vice-Chairman, Chairman of 10 union Parishad, Press representative, Bhavaniganj Pourashava Mayor, Dvelopment committee members, Engineers , NGO representatives, others No. of participant No. of participant	13.8.15	Bagmara Upazila parishad
		FGD 2	Teachers and others No. of participant: 35 plus	12.8.15	Bhavaniganj Degree College
		Courtyard meeting 1	PARTICIPANTS No. of participant: 6	12.8.15	Bhavaniganj Pourashava
		Courtyard meeting 2	PARTICIPANTS No. of participant: 13	14.8.15	Ganipur Union Parishad

Attendance List of these meetings is given at Appendix-10.

Objectives of the Team

The main objectives of the Reconnaissance and Information Dissemination Team were to-

- Initial information dissemination on the project to the local people and to the persons who have close relations with local people in three Upazilas.
- Prepare the local people representatives to disseminate project objectives and scope to the local people.
- Inform the media personnel about the project so that they can explore on the project view and spread the message to the mass people.
- Informing the concerns about the coming PRA sessions on Participatory Planning and asking their cooperation.
- Ensure people's participation from the initials of the project.

Methodology:

An advance team made liaison with the local MP, UNO, Upazila chairman, Union Parishad chairmen, Press representative, Private College teachers, NGO representatives and other concerns for arranging FGDs and Courtyard meetings in three Upazilas FGDs and Courtyard meetings were scheduled at their suitable time and places. The FGDs and Courtyard meeting Team included The Social Expert, The Geologist and The GIS Expert. FGDs and Courtyard meetings were undertaken by a team of consultants conversant in the language of the area in presence of PMU Representative. The team was made up of three types of members: FGD facilitators, a note-taker/recorder and an observer. The Team conducted FGDs and Courtyard meetings with participants of both genders. Each FGD and Courtyard meeting lasted two to three hours and the participants were entertained with lunch (at lunch period) and snacks. At the time of conducting FGDs at Upazila Parishad with Union Council Chairmen, a small stipend equivalent to the cost of their travelling expense was given to participants to compensate them for their time. Following introductions and explanations, FGD and Courtyard meeting team facilitated discussions and recorded the discussion in writing and using electronic recorders.

The Tea Stall Meetings were conducted at tea stalls of public gathering. Two extra team with trained persons in addition to FGD and Courtyard meeting Team members were engaged for Tea Stall Meetings. Objectives, scope and other initial information on the project were disseminated in the meetings. The meetings were participatory. The local people attended in the Tea Stall Meeting were entertained with tea and snacks.

Discussion about the project

All the above listed events were organized maintaining required formalities. The session began with self-introduction of the participants. In all the events (listed in the above) members of the visiting team shared the goal, vision, objectives of the project and described in detail the methodologies and the process of planning including the expectation that participation of all stakeholders is considered important for the success of this project. The team also shared the short- and long term benefits of preparing development plan and their implementation.

The presence appreciated mentioning importance of undertaking this project. However, they participants to the events mentioned the problems of respective area, shared views and expectations in these gathers. Following is the excerpts of Upazila wise outcome from the events:

Faridpur Sadar

- Water scarcity of drinking water is the biggest challenge for Faridpur to meet. Annual recurrent flooding makes the situation worst.
- Main City is protected by embankment from flood but the north-eastern still exposed to flood waters,
- The Upazila Parishad and Pourashava both own very small quantity of mentioned by the concerned administrative and elected representatives and added, this is a considerable obstacle to implement any kind of development activities,
- Within the City drainage and solid waste management both are struggling due to acute water logging, low surface elevation and having no waste management and disposal system in place,
- Annual Budget allocation of Upazila Parishad and Pourashava is too small than the minimum requirements to meeting demands,

- The elected Union representatives consider them as the most deprived group in having budget allocation for development works,
- Urban sprawl is very much identifiable at western and southern part of the Upazila especially at Kajjuri, Kanai pur, Krishna Nagar Union.
- The visiting team found that the under construction Pourashava building at Kanaipur Union will be handed over soon,
- According to the local teachers and press people education rate is quite high in Faridpur,
- Political situation in Faridpur has been quite stable,
- The main agricultural crops for are: Jute and rice. However, farmers not adopting scientific and environment friendly method for raw jute retting,
- Kajla River - the life line for Faridpur, travels almost all through the Upazila. In dry season most parts contain very little water.
- In Decreeer char and Gerda Union, the visiting team seen erosion of Kajla river.
- Sluice Gate constructed at the upstream of Kajla River towards Paturia Ghat (at Decreeer char Union) is considered the main cause for lean flow of water of Kajla River according to the local people. The team observed the site during their field investigation.
- In Ambikapur and Ishan Gopalpur Unions, Fisheries along with Jute Cultivation is the main profession for the local residents,
- Decreeer char and Char Madhabdia are the most deprived unions under Faridpur Sadar Upazila. These two unions separated from the mainland by the Padma river and characteristically char area and communication is very poor,
- Most land of the Decreee char Union has already been eroded by the mighty Padma, so the Decreeer char union Parishad was shifted to Faridpur Sadar about five years ago,
- Char Madhabdia Union is a kind of isolated union for the region. It is connected with Faridpur by the bukhoaghat Bridge (very narrow, only a van rickshaw takes all the space of the bridge). Rate of education is the lowest, employment opportunities, utilities, absent,
- Transport condition of Faridpur Sadar Upazila in Southern and Western part is quite satisfactory and other parts have faulty roads, narrow in width, no foot path etc.
- The visiting team has identified number of big growth centers in this region (both Bazar and Hat) such as Kanaipur, krishno Nagar, Kajjuri, Ambikapur, Gerda Hat etc.
- At Sonatoli there is big fish market and cold store, from where Hilsha fish exported to India and Dhaka.
- Along the main roads many stationery shops, groceries and other types of shops has grown up over the last ten years but don't maintain safe distance from the main road. It has increased the risk of road accident.



Photo 4-4: FGD at Faridpur Sadar Upazila Complex



Photo 4-5: FGD at Govt. Rajendra College, Faridpur Sadar



Photo 4-6: FGD at Gerda Union Complex, Faridpur Sadar



Photo 4-7: FGD at Ambikapur Union Complex Faridpur Sadar Upazila



Photo 4-8: FGD with Local Press People at Faridpur Sadar



Photo 4-9: Tea Stall Meeting at Kanaipur Hat, Faridpur Sadar

Gangni Upazila

- Gangni Pourashava area yet to be urbanized as much as it should be. Urban characteristics visible only the Gangni Bus Stand and adjacent areas,
- The visiting team found no drainage provision in Gangni Pourashava area,
- Most Parishad Chairmen live in Gangni Pourashava area,
- Jute, Rice and Fruits are the main crops in this region. The Upazila Parishad along with other relevant agencies has arranged Boro-pits along the main road outside the Pourashava area for jute retting,
- Drought and scarcity of water is the biggest problem in Gangni Upazila,

- Bhairav and Ichamoti Rivers are flowing at the northern part of the Upazila and inner part is criss-crossed by number of canals. The rivers during dry season carries very little useable water to meet the water demand for agriculture and other daily necessities,
- Agriculture is highly dependent on ground water irrigation,
- Near Shaharabati Union zone was built during 2001-03 as Jute processing Industry which is now inactive. According to local people, for the economic development of the Upazila it is very urgent to reopen the industry or transform it as a technical college of agriculture.
- There are 20 Hats and bazaars, fair 1 most important ones are: Garabari Hat, Tentulbaria Hat, Karamdi Hat, Kazipur Hat, Betbaria Hat, Naodapara Hat and Baishakhi Mela.
- Most educational institutions concentrated at Gangni, so students from distant places have no alternative than coming here. Often time, female students carry a feeling of insecurity,
- Smuggling and Gambling are wide spread as come out during discussion,
- Goat is common to every rural household (Desi Chagol and Bruta Chagol) and according to them these have a significant importance in their development.
- Bhatra, an NGO has been active in this region for about 10 years,
- Political situation is not quite stable in Gangni,
- Literacy rate and income not at high side,
- Agriculture is the main occupation,
- The team found one or two jute mills,
- Tobacco production (Pann Pata) is another important agricultural practice here,
- People filling in the low lying lands indiscriminately,
- Sanitation condition in rural parts still not satisfactory and very often households have safe latrine,
- No waste management system in place in the in the Municipality area,
- Road condition in eastern and western regions quite worst whereas that of southern and northern parts are quite good,
- Kazipur and Bamondi are considered the most progressive unions out of all unions,
- Lots of small scale water bodies (pond) have been observed. These are used for fisheries and store of water by local,
- The region is highly influenced by Kushtia and Meherpur in terms politics, economic activities and others,
- "Khejurpatar Pati" is a renowned cottage work in this region. Satisfactory market demand exists in the local markets.



Photo 4-10: FGD at Gangni Mohila Degree College, Gangni



Photo 4-11: Discussion with Upazila Chairman at Gangni Upazila



Photo 4-12: FGD at Gangni Upazila Complex in presence of Local MP, UNO, Upazila Chairman, Union Parishad Chairmen and Others

Bagmara Upazila

- It is the biggest Upazila under package-3 having 16 unions (according to Upazila Parishad data 17 union), two Pourashava. It is still predominantly a rural area,
- Taherpur Pourashava and Bhavaniganj Pourashava area can be considered as growth centers rather than urban area. No drainage provision has been observed either in Bhavaniganj or Taherpur Pourashava,
- Except Upazila Parishad, two Pourashava has no well-furnished buildings for operating their activities,
- There are 35 colleges and 210 secondary schools in the Upazila. It also reflects the high literacy rate in this region. But unfortunately the ownership of all the colleges are still run under private management,
- Political situation is quite stable here,
- Inadequacy of land and budget are the two main constraints for development works according to local elected representatives and UNO,
- UNO suggested the visiting team more on resource management during plan formulation,
- Fokirni River is the life line for this region but carries water in rainy season, resulting high scarcity of water during the lean periods,
- Agricultural works highly dependent of ground water extraction,
- Agriculture is the main profession for the region. Major crops are: rice, fruits, tobacco, wheat, potato, maize, mustard, sesame, betel leaf, vegetables and jute,

- The visiting team observed huge amount of submerged lands all over the Upazila during their visit. According to local representative almost one third of agricultural land remain under water for 4-5 months every during the monsoon,
- Medical facilities very poor. Most of the unions don't have any clinic or other facilities,
- Sanitation facilities are quite good here.
- Road condition in maximum place is good, only the connecting road between Taherpur-Bhavaniganj and Noagoan highway-Bhavaniganj are in worst condition,
- Internal water bodies such as Beel Joshoi, TaktaBeel, Mosher Beel, NakkatiBeel, Katila Beel and Bagir Dara are silted up and dried up during dry season,
- Every year during monsoon flood is a common affair here,
- In Taherpur and other southern part of the Upazila fishery and poultry business flourished during the last ten years,
- Dwippur, Nardas, Gobindapara and other Northern unions are considered under developed areas out of all,
- Shubhadanga, Basupara and Hamirkustha, unions are termed the most progressive unions. Except Pourashava area these three unions have large market and Hats.
- Upazila Vice-Chairman mentioned that about one third of total household in Bagmara Upazila is landless and rate of unemployment is very high here,
- There is no cold storage facility for agri-product. Storage/processing centers available within Upazila jurisdiction boundary. Nearest cold store is located at Noagoan-Rajshahi highway, according to the local representatives it is another reason for obstructing the agricultural works in this region.



Photo 4-13: FGD at Bagmara Upazila Complex in Presence of UNO, Upazila Vice-chairman, Bhavaniganj Pourashava Mayor and other Union Parishad Chairman



Photo 4-14: FGD with Teachers at Bhavaniganj, Bagmara



Photo 4-15: Discussion Meeting with Bhavaniganj Pourashava Mayor

CHAPTER-5

CONCLUSION

5.1 Conclusions

With the background situation prevailing all over the Upazila of the country, planned development has become an essential paramount task of the concerned authority. The Urban Development Directorate (UDD) under the Ministry of Housing and Public Works (MoHPW) has initiated the preparation of a fresh set of development plans of fourteen Upazilas through active participation of the stakeholders with projection for a period of 20 years applying the concept of new generation five tier plans Sub Regional Plan, Structure Plan, Urban Area Plan, Rural Area Plan and Action Area Plan.

The plan preparation process will follow an attempt by using modern technology. This is a bold departure from the traditional time consuming manual procedures. It ensures the degree of accuracy which makes monitoring, control and mid-course correction or evaluation immensely easier. Survey findings make up the back bone of the plans. Accuracy of survey findings will depend on planning and designing of the survey activities and scheduling of the tasks. The TOR prescriptions are being followed in every step which helped to avoid pitfalls to a great extent in the process of project area map preparation.

Plan preparation is a team work. The guidelines provided by UDD justifiably expand the roles of individual team members. The consultants also believe that overall cooperation and linkage with implementing agency can ensure timely completion of the tasks involved.

It is believed that this initial effort taken by the consultants will be appreciated by the client and be treated as an immense incentive for conducting forthcoming works of the project. Let us proceed with next steps of activities.

5.2 Way Forward

With the approval of inception report the consultant's team is oriented to prepare the draft survey report for the project. The consultants will conduct all forms of survey activities (Topographic Survey, Physical Feature Survey, Socio-Economic Survey, Traffic Survey, Bathymetric Report Studies, Hydro-geological Survey, Survey of Urban and Rural Economy, Environment Studies, Disaster Studies, Social Space Studies etc.) and collect relevant data from published sources. The consultants will also conduct three (03) workshops (one in each Upazila) in the project area. The Draft Survey report will include the following (with necessary maps/figures/diagrams/graphs etc.):

- Purpose of the study, objectives and scope of services and activities to be performed.
- A review of the work plans and time schedule for the remaining period of the contract
- Topography, physical feature and undulation of the area
- Land Use including spatial quality, and trends and patterns of growth
- Housing and socio-economic condition
- Social and Urban Infrastructure

- Agriculture
- Utilities and Services including water supply, sanitation, sewerage disposal,
- Transportation and traffic
- Hydrology and bathymetric studies (if any)
- Geology including both engineering and hydro-geology
- Urban and Rural Economy including informal economic and industrial sector
- Environment, Disaster Risk Assessment, Waste Management and Pollution
- People's participation and Social space
- Historical Importance, archaeology and Tourism

Appendices

Appendix-01

Invoice of Satellite Image Purchase order

Appendix-02
Physical Infrastructures Survey Format

Appendix-03
Topographic Survey Format

Appendix-04
Broad Categories of Land Use

Appendix-05
Technical Specifications of GIS Data

Appendix-06
Detail Work Plan

Appendix-07
Contact Agreement of Site office

INVOICE OF SATELLITE IMAGE PURCHASE ORDER

 **ইঞ্জিনিয়ারিং কনসালটেন্টস এন্ড এসোসিয়েটস লিমিটেড**
ENGINEERING CONSULTANTS AND ASSOCIATES LIMITED
● architects ● engineers ● planners ● management consultants
154, MONIPURIPARA, FARMGATE, TEJGAON, DHAKA-1215, BANGLADESH, PHONE: 8116214, 9110176, 9111277, FAX: 88-02-8119761, E-mail: ecalimited@yahoo.com, ecal@dhaka.net

Ref: ECAL/P-UDD/191/2015
October 07, 2015

All Source Analysis
1325 Dry Creek Drive, Suite 304
Longmont, CO 80503

Attn: **Mr. Charles P. Harring**
Chief Marketing Officer

Sub: Quotation for Pleiades Stereo Imagery for Bangladeshi Project, Your Quotation No. ASA-14-156.

Dear Mr. Chuck,

Thanks for sending the quotation. We are accepting the quotation formally and requesting you to send the purchase order which will include all the relevant specifications and terms and conditions to safeguard the interest of both the parties.

Our interest is to get the imagery within December positively with all the specification provided earlier.

Thanking you in anticipation.

Faithfully yours,


(Rashid Ahmed Khan)
Managing Director



1325 Dry Creek Drive, Suite 304
 Longmont, CO 80503
 (303) 720-526-6000

Purchase Order

PO Number:	ASAPO-14-156
PO Date:	10/8/2015

Bill To:	
Company:	Engineering Consultants @ Associates LTD
Name:	Shahreen Chowdhury
Address:	128 santos court, Fremont, CA 94536
Address:	
Country:	USA
Email:	shahreen.rashid@gmail.com
Contact Number:	ecalimited@yahoo.com

Ship To:	
Company:	SAME
Name:	Rashid Ahmed Khan
Address:	154 Monipuripara
Address:	Farmgate, Tejgaon, Dhaka 1215
Country:	Bangladesh
Email:	ecalimited@yahoo.com
Contact Number:	88-01713129594

Project Name:	Stereo Tasking in Bangladesh
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Description and Area of Interest:	High resolution stereo tasking, processing level:1B, cloud cover: less than 10 percent, 0.5 meter panchromatic, 2-meter multi spectral 4-band, 16 bit depth, delivered via incremental FTP
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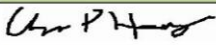
Product Description	Unit Price	Quantity	Total
AOI #1 - Pleiades Stereo – New Collect \$40.00 per sq km	\$40.00	370.00	\$14,800.00
AOI #2 - Pleiades Stereo – New Collect \$40.00 per sq km	\$40.00	343.00	\$13,720.00
AOI #3 - Pleiades Stereo – New Collect \$40.00 per sq km	\$40.00	379.00	\$15,160.00

Grand Total (USD \$)	\$43,680.00
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Terms of Sale:	AllSource requires 25% (\$10,920) payment at the time of order placement (via wire transfer or credit card), the remaining payable to AllSource NET 30 upon final delivery. FTP deliveries as imagery is collected and produced. This purchase order is confidential and a proprietary property of AllSource Analysis, Inc.; it may not be disclosed to any third party without the express written permission of AllSource Analysis, Inc. Failure to pay invoice when due will result in a monthly 1.5% delinquency charge being posited to your account. In case of a default on your part in the payment of this invoice, you agree to pay all reasonable costs of collection, including court costs, attorney's fees, and finance charges. Goods may not be returned without prior written authorization, are subject to inspection before a credit is issued to your account and may be subject to a re-stocking fee or order cancellation fee. Any claims for goods damaged in transit or defects should be made within 10 days from their receipt. All data products are licensed — a copy of the EULA (End User License Agreement) will be delivered with the data. All warranties are included in the EULA. Corrupt or loss of data will be replaced by reprocessing or recollection of data.
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Payment Terms:	Ship via:
Credit Card / Wire Transfer - (select one)	FTP

Credit card information (if not using wire transfer)		
Visa / MasterCard / Amex (circle one) number and CVV:	Exp.	Name as it appears on credit card:

Accepted By (sign and date):	AllSource Representative:
 Rashid Ahmed Khan	 Charles Herring



PHYSICAL INFRASTRUCTURE SURVEY FORMAT

Sl. No	Physical Feature Name	Data Type			Z Value (Z measurement level)			Description
		Point	Line	Polygon	On Top	On Ground/Level	Not Required	
1A. Water Bodies								
1	1. River Edge			X		X		
2	2. Khal Edge			X		X		
3	3. Drainage Channels			X		X		Name, width
4	4. River/khal centreline		X			X		Name, width
5	5. Flow direction	X					X	
6	6.onds/Tanks/Dishes			X		X		
7	7. Coastline		X			X		
B. Building/Structure		Pucca/Semi pucca/stories, Building area>1.5 sqm (Depending on map Scale)						
8	1. House			X	X			Residential Building
9	2. Industry			X	X			Industrial Building
10	3. Commercial			X	X			Commercial Building
n	4. Mixed			X	X			Mixed Use
12	5. Boundary Wall		X		X			Wall use as boundary
C. Roads								
13	1. Road Pucca		X	X		X		Asphalt Road
14	2. Road HBB		X	X		X		HBB Road
15	3.,Road Katcha		X	X		X		Katcha Road
16	4. Path Pucca		X	X		X		Pucca Path
17	5. Path Katcha		X	X		X		Katcha Path
18	6. Traffic Island/Divider		X	X		X		
19	8. Road/Path Centreline		X			X		Name, width
D. Railways								
20	1. Railway Row Line		X			X		
21	2. Railway centreline		X			X		

22	3. Railway Junction Points	X				X		
E. Other Structure and Flood works			Length, width, condition of abutments and wing-walls					
23	1. Bridge / Culverts			X	X			Type, area, Name
24	2. Embankments			X	X			Name, length
25	3. Pump Station for Flood			X		X		Name
26	4. Sluice Gates		X		X			Name
27	5. Bus/Trucks Terminals			X		X		Indicate right way and areas
28	Harbor/ Bathing/boat Jetty		X		X			Harbor, Boat jetty
F. Natural Features								
29	1. Forest			X	X			Area > 2500 Sqm
30	2. Group of trees			X	X			Area < 2500 Sqm
31	3. Group of Trees Point	X			X			
32	4. Wetlands / Bog/ Marshland/ Flood prone area			X		X		Area > 2500 Sqm
33	5. Sand/Sand Dunes			X		X		Area > 2500 Sqm
34	Significant Single Tree	X				X		Easily identified single tree
E. Utility Services								
35	1. High voltage Electric Line		X		X			National/regional grid
36	2. Telephone Line		X		X			
37	3. Gas Line		X			X		
38	4. Utility Substation	X				X		Electric, Telephone exchange, Gas
39	5. Overhead Water Tank			X	X			Name, Capacity
40	4. Waste disposal and treatment points	X				X		A dustbin of municipality and other informal points
41	3. Water work			X		X		
42	5. Deep Tube well Stations	X				X		R.C.C EPHE and other deep tube well stations and output
F. Area Polygon								
43	Residential Area			X		X		Planned, Unplanned, Density (High, Middle, Low)
44	Commercial Area			X		X		Established markets with ancillary shop, groups of shops

								including small workshops
45	Institutional, Educational, Health Govt. office			X		X		School/college/ madrasa, clinics, hospital, govt. office
46	Industrial (as classified by acts and rules)			X		X		Main activity, type of waste effluent
47	Agricultural Area			X		X		All types of agricultural uses
48	Recreation / sports			X		X		Parks/play/sports ground, indoor facilities, zoological garden. Stadium area
49	Religious / cemetery			X		X		Mosques, Temples, Church, Mazar and others
49	Graveyard. Cemetery			X		X		Sites
51	Historic Place			X		X		Sites
52	Borrow Pits			X		X		Areas cut for filling material
53	Vacant Land			X		X		Vacant land with no apparent use
54	Public gathering			X		X		Place of public meeting, open-air cultural performance and religious gathering
55	Garden			X		X		Indication Rea, pineapple etc.
56	Disaster prone areas			X		X		Flood, (indicating the flood affected area in 1998) Earthquake and fault line

Topographic Survey Format

SI. No	Survey Item	Illustrated			
	Special DEM Object	Map object 'which may be used if registered with a view to DEM use			
		As break line	As terrain points	For delimitation of unsurveyed	For Mask Areas
	Spot height	Road Pucca		Coastline	Building
	Special elevation point	Road Katcha		Pond	Pond
	Contour line	Path Pucca			Wetland/bog/ marsh land
	Break line	Path Katcha			
	Mask Area	River Edge			
	Unsurveyed Area	Khal Edge			
	DEM Boundary	Pond			
		Drain channel			

Appendix I-Broad Categories of Land use

Land uses	Illustrated
Residential	Planned Residential Area, Govt. Quarters, Private Housing, Rest/Guest/Circuit House, Banglow, Mess, Orphanage/Old Home, Rural Homestead, Slum, Squatters
Commercial	Residential Hotel/ Hotel & Restaurant, Wholesale Rice Market, Wholesale Vegetables Market, Wholesale Fish Market, Wholesale Paper Market, Wholesale Grocery Goods Market, Wholesale Fruit Market, Book Stall, Cloths Shop, Paper & Magazine, Stationery Shop, Shoe Shop, Bag & Leather Goods, Cosmetics, Spectacles, Electronic Goods, Audio Video Cassette, Utensils/Crockery, Sports Goods, Computer Goods, Motor Car Parts, Jewelry shops, Show Room, Furniture Shop, Department Store, Mobile Sales Center, Hardware Goods, Sweet Shop, Bakery Shop, Gift Shop, Press & Printing, Grocery Shop, Gun Shop, Iron & Steel Shops, Shopping Center/Mall, Shopping Mall, Super Market, Rubber Stamps, Phone-Fax-Photocopy, Cycle Store, Studio/Colour Lab, Drug/Pharmacy, Pottery shop, Electronics, Sports and Athletics, Kitchen Market, Katcha Bazaar, Beauty Parlor/Hair dresser, Govt. Food Godown, Cold Storage, Others Godown
Mixed Use	Commercial-Residential, Office-Residential, Commercial-Industrial, Two or more use
Transport	R & H Road/LGED Road, Primary Road/Major Through fare, Secondary Road (Pucca), Secondary Road (Kutchra), Local Road (Pucca), Local Road (Kutchra), Access Road (Pucca), Access Road (Kutchra), Footpath (Paved), Footpath (Unpaved), Walkway, Embankment cum Road, Airport/Bus terminal/Truck terminal/BRTC bus Depot/Tempo stand/Rickshaw stand/Railway station/BIWTA Terminal/Launch Terminal etc, Broad gauge, Meter gauge, River.
Administrative	Deputy Commissioner's Office, Zila Parishad Office, SP Office/Police Headquarter, Civil Surgeon Office, LGED Office, Upazila Headquarter, Paurashava Office, Union Parishad Office, Settlement Office, Post office, Bank, Public Works Department Office, R&H Office, DPHE Office, Statistical Bureau Office, PDB Office, BWDB Office, DoE Office, All types of Government Office, Private Bank/ Insurance Company, Mercantile & Cooperatives, Money Exchange Center, Private company/Different types of NGO/CBO/Club, Construction Office, Commercial Group Office, Trading Corporation Office, Security Service Office, Law Chamber, Doctors Chamber, Political Party Office, Professional's Association, Labor Union
Industrial	Dairy Products, Fish & Sea Food, Salt Crushing Mill, Soft Drink, Bakery Product, Cotton Textile, Jute Textile, Silk & Artificial Textile, Dyeing Industry, Coconut Fiber Industry, Knitting Industry, Hosiery Products, Readymade Garments, Tannery & Finishing, Leather Buying House, Leather Footwear, Compressed Natural Gas, Fertilizers, Insecticides Industry, Soap & Detergent, Paints & Varnishes, Medicine and Drugs Company, Paper Product (all kind), Newspaper, Rubber Footwear, Cycle & Tyre Tube, PVC Product, Glass Product, Bricks Kiln/Fields, Cement, Iron & Steel, Re rolling mills, Hand & Edge tools, Bland &, Knives, Heating & Lighting, Plumbing, Equipment, Machinery Equipment, Wire & Cables, Electric Lamps, Electrical, Apparatus, Fruits & Vegetables, Oil Products,

Land uses	Illustrated
	Edible Salt, Molasses, Atta, Maida & Suji (Flour Mill), Spice Industry, Rice Mill, Boiler (Rice), Handicrafts, Pottery, Carpets, Fabrics, Sewing/Hand loom Products, Wooden Furniture, Cane Furniture, Steel Furniture, Ship Building, Lime Stone, Sports & Athletics
Agriculture	Single crop land, Double crop land, Triple crop land, Barren land, Mango garden/Lichi/Jackfruit/Banana/Lemon/others, fruits garden etc, Different types of flower garden, Tree cultivation, Hatchery/Gher, Livestock/Poultry Farm/Diary Farm, Agricultural Research Area
Education	Kindergarten and Nursery, Primary School, High School, College, Public University, Private University, Public Medical College, Private Medical College, Homeopathic Medical College, Engineering College/University, Law College, Social Research, Health Research, Economic Research, Vocational Training Institute, Physical Training Institute, Nursing Training Institute, Teachers Training College, Computer Training Institute, Dakhil Madrasa, Alim Madrasa, Fazil Madrasa, Kamil Madrasa, Hafezia Madrasa, Tutorial/ Coaching Center, Government Training Institute, Library, Museum, Social Welfare Institution
Health	Govt. Hospital/Pvt Hospital/Mental Hospital/ Maternity/Children Hospital/Clinic/ Diagnostic Center, Veterinary Hospital
Recreational	Cinema Hall, Theater Hall, Museum & Art gallery, Auditorium/Community Center/Town Hall, Park/Playground/Amusement Park/Theme Park, Stadium/ Gymnasium/Swimming Pool, Tennis Complex
Places of Worship	Mosque, Eidgah/Mazar/Dargha, Temple, Church, Pagoda
Restricted Area	Cantonment/BDR/Navy, Police Station, Ansar Camp, Jailkhana, TV Station, Radio Station, T&T Board, Power Supply Station
Open space	Historic Sites, National Park/Botanical Garden, Zoological Park, Forest Land/Urban Green, Ecological park/sites, River Bank
Water bodies	Pond, Tank, Beels, Lakes, River, Khals, Streams, Drain
Graveyard	Graveyard, Cemetery, Cremation place
Miscellaneous	Solid Waste Dumping Ground, Slaughter House, Water Pump House, Hazardous Area, Overhead Tank, Monument, Shahid Minar

APPENDIX XII: TECHNICAL SPECIFICATIONS OF GIS DATA

This document contains the technical specifications for the development of GIS database. It has two sections: Section-A and Section-B. In Section-A, specifications for mauza map scanning and digitization has been provided. Section-B contains the specifications of GIS layers of Survey and Plan Maps

Section-A: Specifications for Mauza Map Scanning & Digitization

This section contains the scanning specifications and digitization of mauza maps.

Scanning Specifications of Mouza Maps

The scanning specification of mauza maps specifies Image Type, Image Format, Image Resolution and Image scale as follows:

Image Type	Color or Grayscale
Image Format	JPEG
Image Resolution	300 dpi
Image Scale for Digitization period will be required Map unit & Display unit select inches from drop down Icon. Otherwise, when you will give the Mouza map sheet print as per same scale that time will not get the print copy of your mouza map scale.	(1:10-15)

Classification of Scanned Mouza Maps\GIS Data Management

A systematic classification will be followed for naming the scanned image files of the mauza maps and GIS Data Management.

Location Path	Example: D:\Division\ (Rajshahi.div)\District(Rajshahi.dis)\Upazila(Bagmara)\Union_Ward(Nardash) D:\Division\Rajshahi.div\Rajshahi.dis\Bagmara\Nardash					
	Drive: D:\	Division			First Double click on My Computer and go to Drive D:\ and create the Division folder under Division, District, Upazila and Union_Ward Name folder. If we prepare the union_Ward Map then we will make the Union_Ward folder otherwise the folder do not need of Union_Ward. Mouza Image will appropriately store up the mouza Image sheet under Union_Ward folder.	
		dhaka.div			2nd time will create the dhaka.div and so on.	
File Name	KAP_078_00					
				XX X		JL No. of the Mouza (3 digits)
					_	An underscore to separate JL No. and Sheet No.
					XX or xxx	Number of Sheet No of the mauza map. (2 or 3 digits)

Example: KAP_078_00 or 01.....99 or KAP_078_001....999.jpeg represents the image file in JPEG format of Sheet no. 00 of Koali Para Mouza having JL no. 78 of Shibpur Upazila of narsingdi District.

Digitization of Scanned Mouza Maps

Digitization of Mauza map will be done in four layers/Coverage (two point shapefiles/Coverage, one line shapefile/Coverage and one polygon shapefile/Coverage) to capture all the features in the existing map. Name and attribute structure of these layers will be as follows:

1) Shape file\Coverage name: PN_XXX_XX or XXX.shp (PN = Plot Number)
Type: Point

This shape file\Coverage will contain dag number (plot number) of the Mouza maps as point features. It must contain the field as described in the following table:

Field Name	Field Type	Width of the field	No. of Decimal Places	Purpose of the field
Division	String	25	-	To put or Type name of the current Division.
District	String	25	-	To put or Type name of the current District.
Upazila	String	25	-	To put or Type name of the current Upazila.
Union	String	25	-	To put or Type name of the current Union.
Plot_No	Long Integer	-	-	To contain dag number (plot number)
MZ_Name	String	100	-	To contain name of the Mouza name
JL_No	String	3	-	To contain JL Number of the Mouza
Sheet_No	String	2	-	To contain sheet no the Mouza
Mouza_JL_S	String	100	-	To contain Mouza name+single space+JLno(3-digits)+single space+sheet no(2-digits)
MZ_Verion	String	6	-	To contain Mouza version of the mouza sheet E.g. CS, RS, BS and so on.
Scale	String	20	-	To contain scale of the mouza sheet.
Revenue_No	String	100	-	To contain survey number of the mouza map
SV_Period	String	20	-	To contain survey period of the mouza map. E.g 1973-85
Plot_desc	String	20	-	To contain following plot types <ul style="list-style-type: none"> - "Plot" - "Katcha Road" - "Semi-Pucca Road" - "Pucca Road" - "Halot" - "Pond" - "Canal" - "River"
Remarks	String	100	-	To contain remarks, if any.

2) Shape file\Coverage name: ML_XXX_XX or XXX.shp (ML = Mouza Line)
Type: Polyline

This shape file\Coverage will contain all line features of the mauza map. It must contain the field as described in the following table:

Field Name	Field Type	Width of the field	No. of Decimal Places	Purpose of the field
Division	String	25	-	To put or Type name of the current Division.
District	String	25	-	To put or Type name of the current District.
Upazila	String	25	-	To put or Type name of the current Upazila.
Union	String	25	-	To put or Type name of the current Union.
Plot_No	Long Integer	-	-	To contain dag number (plot number)
MZ_Name	String	100	-	To contain name of the Mouza Name
JL_No	String	6	-	To contain JL Number of the Mouza
Sheet_No	String	6	-	To contain sheet no the Mouza
Mouza_JL_S	String	100	-	To contain Mouza name+single space+JLno(3-digits)+single space+sheet no(2-digits)
MZ_Ver	String	6	-	To contain Mouza version of the mouza sheet E.g. CS, RS, BS and so on.
Scale	String	25	-	To contain scale of the mouza sheet.
Revenue_No	String	100	-	To contain survey number of the mouza map
SV_Period	String	25	-	To contain survey period of the mouza map. E.g 1973-85
Line_Code	Long Integer	10	-	To contain feature code or unique ID of different line feature. For example 11, 12 and 14 are the codes for Mouza boundary, Sheet boundary and Plot boundary features respectively.
Line_Desc	String	30	-	To contain the type of plot boundaries and other line features such as - "Mouza boundary" - "Sheet boundary" - "Plot boundary" - "Katcha Road" - "Semi-Pucca Road" - "Pucca Road" - "Halot" - "Khal" - "Thoka/Adjacent line or Boundary" - "North line" - "Unknown line"
Remarks	String	100	-	To contain remarks, if any.

3) Shape file\Coverage name: MP_XXX_XX or XXX.shp (MP = Mouza Polygon)
Type: Polygon

This shape file\Coverage will contain dag number (plot number) of the Mouza maps as point features. It must contain the field as described in the following table:

Field Name	Field Type	Width of the field	No. of Decimal Places	Purpose of the field
Division	String	25	-	To put or Type name of the current Division.
District	String	25	-	To put or Type name of the current District.
Upazila	String	25	-	To put or Type name of the current Upazila.
Union	String	25	-	To put or Type name of the current Union.

Plot_No	Long Integer	-	-	To contain dag number (plot number)
MZ_Name	String	100	-	To contain name of the Mouza name
JL_No	String	3	-	To contain JL Number of the Mouza
Sheet_No	String	2	-	To contain sheet no the Mouza
Mouza_JL_S	String	100	-	To contain Mouza name+single space+JLno(3-digits)+single space+sheet no(2-digits)
MZ_Verion	String	6	-	To contain Mouza version of the mouza sheet E.g. CS, RS, BS and so on.
Scale	String	20	-	To contain scale of the mouza sheet.
Revenue_No	String	100	-	To contain survey number of the mouza map
SV_Period	String	20	-	To contain survey period of the mouza map. E.g 1973-85
Layer_Code	Long Integer	10	-	To contain feature code or unique ID of different line features. For example 11, 12 and 14 are the codes for Mouza boundary, Plot boundary and Pond features respectively.
Layer_desc	String	20	-	To contain following plot types - "Plot Boundary" - "Katcha Road" - "Semi-Pucca Road" - "Pucca Road" - "Halot" - "Pond" - "Canal" - "River"
Remarks	String	100	-	To contain remarks, if any.

4) Shape file/Coverage name: PF_XXX_XX or XXX.shp (PF = Point Feature)

Feature Type: Point

This shape file/Coverage will contain all line point features except the plot numbers of the mauza map. It must contain the field as described in the following table:

Field Name	Field Type	Width of the field	Purpose of the field
Division	String	25	To put or Type name of the current Division.
District	String	25	To put or Type name of the current District.
Upazila	String	25	To put or Type name of the current Upazila.
Union	String	25	To put or Type name of the current Union.
Plot_No	Long Integer	-	To contain dag number (plot number)
MZ_Name	String	100	To contain name of the Mouza Name
JL_No	String	6	To contain JL Number of the Mouza
Sheet_No	String	6	To contain sheet no the Mouza
Mouza_JL_S	String	100	To contain Mouza name+single space+JLno(3-digits)+single space+sheet no(2-digits)
MZ_Ver	String	6	To contain Mouza version of the mouza sheet E.g. CS, RS, BS and so on.
Scale	String	25	To contain scale of the mouza sheet.

Revenue_No	String	100	To contain survey number of the mouza map
SV_Period	String	25	To contain survey period of the mouza map. E.g 1973-85
Line_Code	Long Integer	10	To contain feature line code or unique ID of different line feature. For example 15, 16 and 17 are the codes for Mouza boundary, Sheet boundary and Plot boundary features respectively.
Point_Code	String	3	To contain the user ID of different point features. For example: 45 is the ID of Traverse Station (New)
Point_Desc	String	50	To contain Point description of point features such as - "Traverse Station [Old]" - "Traverse Station [New]" - GT Station, etc. And also to contain texts of label features such as "Sheet No. 2", "Shaktola No. 101", etc.
PF_Name	String	100	To put or type the Adjacent name of Mouza, JL No, Sheet No, River and so on.
Remarks	String	100	To contain remarks, if any.

4) Shape file/Coverage name: ST_XXX_XX or xxx.shp (ST = Structure)

Feature Type: Polygon

This shape file will contain all line area features such as Structures (Building), Waterbody (Pond), etc. of the mauza map. It must contain the field as described in the following table:

Field Name	Field Type	Field Width	Purpose of the field
Division	String	25	To put or Type name of the current Division.
District	String	25	To put or Type name of the current District.
Upazila	String	25	To put or Type name of the current Upazila.
Union	String	25	To put or Type name of the current Union.
Plot_No	Long Integer	-	To contain dag number (plot number)
MZ_Name	String	100	To contain name of the Mouza Name
JL_No	String	6	To contain JL Number of the Mouza
Sheet_No	String	6	To contain sheet no the Mouza
Mouza_JL_S	String	100	To contain Mouza name+single space+JLno(3-digits)+single space+sheet no(2 or 3 -digits)
MZ_Ver	String	6	To contain Mouza version of the mouza sheet E.g. CS, RS, BS and so on.
Scale	String	25	To contain scale of the mouza sheet.
Revenue_No	String	100	To contain survey number of the mouza map
SV_Period	String	25	To contain survey period of the mouza map. E.g 1973-85
OthersName	String	100	To put or type the Adjacent name of Mouza, JL No, Sheet No, River and so on.
ST_Code	Long Integer	6	To contain the user ID of different polygon features. For example: 31 is the ID of Permanent Structure (Dalan), 32 is for Tinshed Structure, etc.
ST_Desc	String	50	To contain type of features such as - "Permanent Structure [Dalan]" - "Tinshed Structure" - "Other Structure" - "Pond/Waterbody" - "Pan Baraz" - "Graveyard"
Remarks	String	100	To contain remarks, if any.

Feature Codes

The following feature codes (Unique ID) will be used in mauza map digitization.

Feature Type/Item	Shape File/Coverage Name	Feature Code (ID)
International Boundary	ML_XXX_XX or XXX	10
Division Boundary		11
District Boundary		12
Upazila Boundary		13
Union Boundary		14
Mouza Boundary		15
Sheet Boundary		16
Plot Boundary		17
Thoka/Adjacent\Match Line		18
Embankment		19
Hill		20
Road		21
Halot		22
Khal (Canal)		23
River		24
Rail Line		25
Slope		26
North Line		27
Pucca Road		28
Semi-Pucca Road		29
Katcha Road	30	
Unknown Line	99	
Permanent Structure [Dalan]	ST_XXX_XX or XXX	31
Tin Shed Structure		32
Other Structure		33
Pan Baraz		34
Pond/Water Body		35
Graveyard		36
Missing or not readable plot number	PN_XXX_XX or XXX	99999
Boundary Pillar	PF_XXX_XX or XXX	41
Bench Mark		42
Iron Pillar		43
Traverse Station(Old)		44
Traverse Station (New)		45
GT Station		46
Other Pillars		47
Pucca Well		51
Tube Well		52
Mosque		53
Temple		54
Adjacent Mouza/Sheet		61
Otier Info		62
Demarcation Pillar		71
Settlement Pillar		72
Stone		73
Station		74
Pucca Pillar		75

Municipality Pillar		76
CS Iron Pillar		77
Other Point Feature		88
Plot Boundary	ML_XXX_XX or XXX	14
Katcha Road		30
Semi-Pucca Road		29
Pucca Road		28
Halot		22
Pond		14
Canal		23
River		24

Section-B: Specifications for Layers of Survey and Plan Maps

It specifies name of the spatial layers and the structure of their attribute tables.

1) Shape file\Coverage name: **Adb11601.shp**(Standard Code such as Thana\Upazila)
Type: **Polyline**

This shape file\Coverage will contain administrative boundaries of project area. It must contain the field as described in the following table:

Field Name	Field Type	Width of the field	No. of Decimal Places	Purpose of the field
Type	Long Integer	10		To Contain Polyline ID
Line_Desc	String	100	-	To contain the following administrative boundaries “International Boundary” “District Boundary” “Upazila Boundary” “Union boundary” “Ward Boundary” “Mauza boundary” “Sheet boundary”

2) Shape file\Coverage name: **AdbP11601.shp** (Standard Code such as Thana\Upazila)
Type: **Polygon**

This shape file\Coverage will contain plots of merged BS Mouza maps of project area as polygon features. It must contain the field as described in the following table:

Field Name	Field Type	Width of the field	No. of Decimal Places	Purpose of the field
Division	String	25		To put or Type name of the current Division.
District	String	25		To put or Type name of the current District.
Upazila	String	25		To put or Type name of the current Upazila.
Pourashava				To put or Type name of Paurashava.
Union_Ward	String	25		To put or Type name of the current Union\Ward.

Plot_no	Long Integer	-	-	To contain <i>dag</i> number (plot number)
Layer_Desc	String	20	-	To contain following plot types - "Plot" - "Katcha Road" - "Semi-Pucca Road" - "Pucca Road" - "Halot" - "Pond" - "Canal" - "River"
Mouza	String	100	-	To contain name of the Mouza
JL_No	String	3		To contain JL Number of the Mouza
Sheet_No	String	2	-	To contain sheet no the Mouza
Mouza_JL_S	String	100	-	To contain Mouza name+single space+JLno(3-digits)+single space+sheet no(2-digits)
Mouza_JL	String	100	-	To contain Mouza name+single space+JLno(3-digits)
Scale	String	20		To contain scale of the mouza sheet.
Revenue_No	String	100		To contain survey number of the mouza map
Survey_Period	String	20		To contain survey period of the mouza map. E.g 1973-85
Landuse	String	50	-	To contain name of the Land use Categories e.g. Waterbody.
Crop_Land1				To contain name of the 1 st crop land phase-1 from the project area.
Crop_Land2				To contain name of the 2 nd crop land phase-2 from the project area.
Crop_Land3				To contain name of the 3 rd crop land phase-3 from the project area.
Sq_meters				To contain area in Square meters.
Hectares	Double	0		To contain area in Hectares.
Acres	Double	0		To contain area in Acres.
Katha	Double	0		To contain area in Katha.
Decimal	Double	0		To contain area in Decimal.
Geo-Code	String	16	-	To contain Nine-digit BBS Geocode of Mouza as District+Thana+Union/Ward+Maauza
Remarks	String	100	-	To contain remarks, if any.

2) Shape file\Coverage name: AdbP11601.shp (Standard Code such as Thana\Upazila)
Type: Polygon

This shape file\Coverage will contain plots of merged BS Mouza maps of project area as polygon features. It must contain the field as described in the following table:

Field Name	Field Type	Width of the field	No. of Decimal Places	Purpose of the field
Division	String	25		To put or Type name of the current Division.
District	String	25		To put or Type name of the current District.
Upazila	String	25		To put or Type name of the current Upazila.
Pourashava				To put or Type name of Paurashava.
Union_Ward	String	25		To put or Type name of the current Union\Ward.

Plot_no	Long Integer	-	-	To contain <i>dag</i> number (plot number)
Layer_Desc	String	20	-	To contain following plot types - “Plot” - “Katcha Road” - “Semi-Pucca Road” - “Pucca Road” - “Halot” - “Pond” - “Canal” - “River”
Mouza	String	100	-	To contain name of the Mouza
JL_No	String	3		To contain JL Number of the Mouza
Sheet_No	String	2	-	To contain sheet no the Mouza
Mouza_JL_S	String	100	-	To contain Mouza name+single space+JLno(3-digits)+single space+sheet no(2-digits)
Mouza_JL	String	100	-	To contain Mouza name+single space+JLno(3-digits)
Scale	String	20		To contain scale of the mouza sheet.
Revenue_No	String	100		To contain survey number of the mouza map
Survey_Period	String	20		To contain survey period of the mouza map. E.g 1973-85
Landuse	String	50	-	To contain name of the Land use Categories e.g. Waterbody.
Crop_Land1				To contain name of the 1 st crop land phase-1 from the project area.
Crop_Land2				To contain name of the 2 nd crop land phase-2 from the project area.
Crop_Land3				To contain name of the 3 rd crop land phase-3 from the project area.
Sq_meters				To contain area in Square meters.
Hectares	Double	0		To contain area in Hectares.
Acres	Double	0		To contain area in Acres.
Katha	Double	0		To contain area in Katha.
Decimal	Double	0		To contain area in Decimal.
Geo-Code	String	16	-	To contain Nine-digit BBS Geocode of Mouza as District+Thana+Union/Ward+Maauza
Remarks	String	100	-	To contain remarks, if any.

3) Shape file\Coverage name: AdbL11601.shp (Standard Code such as Thana\Upazila)
Type: **Polyline**

This shape file\Coverage will contain line features of merged BS Mouzas of project area as polyline features. It must contain the field as described in the following table:

Field Name	Field Type	Width of the field	No. of Decimal Places	Purpose of the field
ID	Long Integer	16	-	To Contain Mouza polyline ID.
Type	String	20	-	“Plot Boundary” “Sheet Boundary” “Mauza Boundary” “Katcha Road”

				"Semi-Pucca Road" "Pucca Road" "Halot" "Pond" "Canal" "River"
Remarks	String	100	-	To contain remarks, if any.

4) Shape file\Coverage name: AdbN11601.shp (Standard Code such as Thana\Upazila)

Type: **Point**

This shape file\Coverage will contain Plot numbers of merged BS Mouzas of project area as point features. It must contain the field as described in the following table:

Field Name	Field Type	Width of the field	No. of Decimal Places	Purpose of the field
Division	String	25		To put or Type name of the current Division.
District	String	25		To put or Type name of the current District.
Upazila	String	25		To put or Type name of the current Upazila and Pourashava.
Pourashava				To put or Type name of Paurashava.
Union_Ward	String	25		To put or Type name of the current Union\Ward.
Plot_no	Long Integer	-	-	To contain <i>dag</i> number (plot number)
KhasLand	String	3	-	Whether the Khas land exist in the plot. - "Yes" - "No"
Mouza	String	100	-	To contain name of the Mouza
JL_No	String	3		To contain JL Number of the Mouza
Sheet_No	String	2	-	To contain sheet no the Mouza
Mouza_JL_S	String	100	-	To contain Mouza name+single space+JLno(3-digits)+single space+sheet no(2-digits)
Mouza_JL	String	100	-	To contain Mouza name+single space+JLno(3-digits)
Scale	String	20		To contain scale of the mouza sheet.
Revenue_No	String	100		To contain survey number of the mouza map
Survey_Period	String	20		To contain survey period of the mouza map. E.g 1973-85
Plot_Desc	String	20	-	To contain following plot types - "Plot" - "Katcha Road" - "Pucca Road" - "Halot" - "Pond" - "Canal" - "River"
Geocode	String	9	-	To contain Nine-digit BBS Geocode of Mouza as

				District+Thana+Union/Ward+Mauza
Remarks	String	100	-	To contain remarks, if any.

5) Shape file\Coverage name: Str11601.shp (Standard Code such as Thana\Upazila)

Type: Polygon

This shape file\Coverage will contain the information of each structure in the area under project. It must contain thirteen fields as described in the following table:

Field Name	Field Type	Width of the field	No. of Decimal Places	Purpose of the field
Division	String	25		To put or Type name of the current Division.
District	String	25		To put or Type name of the current District.
Upazila	String	25		To put or Type name of the current Upazila and Pourashava.
Pourashava				To put or Type name of Paurashava.
Union_Ward	String	25		To put or Type name of the current Union\Ward.
ID	Long Integer	16	-	To Contain Structure ID.
Area_Sqft	Double	0		To Contain Structure area in square feet.
Str_Type	String	20	-	To contain the type of the structure as follows - "Pucca" - "Semi-pucca" - "Katcha"
Storied	Short Integer	-	-	To contain the number of floors of the structure.
Str_Use1t	String	100	-	1. To contain the use (1 st) of the structure. 2. The attributes should be according to the given "Existing_Landuse" categories.
Str_Use2t	String	100	-	To contain the use (2 nd) of the structure.
Str_Use3t	String	100	-	To contain the use (3 rd) of the structure.
Str_name	String	100	-	To contain the name of the structure.
Cons_Year	Short Integer	-	-	To contain the year of construction.
Undercons	String	3	-	To contain the information if it was being under construction during the feature survey. - Yes/No ; True/False ; 1/0
Struc_Owner	String	100	-	To contain the owner name of the structure.
Struc_Use	String	100	-	To contain the structure use of the Government or private and so on.
Cell_No	String	50		To contain the mobile number.
Family_Size	Short Integer	10		To contain the family members.
Male	Short Integer	10		To contain the male family members.
Female	Short Integer	10		To contain the female family members.
Hyperlink	String	100		To contain the owner picture with the structure.
Holding_no	String	50	-	To contain Holding number of the structure.
Road_ID	String	50	-	To contain adjacent road number, if any
Road_name	String	100	-	To contain the name of the nearby road

Locality (Mauza/ Ward)	String	50	-	To contain the name of the Mauza_JL_Sheet.
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6) Shape file\Coverage name: **RdP11601.shp (Standard Code such as Thana\Upazila)**
Type: **Polygon**

This shape file\Coverage will contain the existing roads as polygon features in the area under project. It must contain three fields as described in the following table:

Field Name	Field Type	Width of the field	No. of Decimal Places	Purpose of the field
Road_name	string	100		To contain the name of the road, if any
Road_ID	string	20	-	To contain the ID of Road
Road_type	string	20	-	To contain the physical type of the road as follows - "Pucca" - "WBM" - "HBB" - "Katcha"
Road_Class	string	100		To contain the Class of road according to RHD & LGED in the followings: RHD Road Class - "National Highways" - "Regional Highways" - "District\Zila Road" LGED Road Class - "Upazila Road(Pucca)" - "Upazila Road(Katcha)" - "Union Road(Pucca)" - "Union Road(Katcha)" - "Village Road A (Pucca)" - "Village Road A (Katcha)" - "Village Road B (Pucca)" - "Village Road B (Katcha)"

7) Shape file\Coverage name: **RdE11601.shp (Standard Code such as Thana\Upazila)**Type: **Polyline**

This shape file\Coverage will contain the existing roads as polyline features in the area under project. It must contain three fields as described in the following table:

Field Name	Field Type	Width of the field	No. of Decimal Places	Purpose of the field
Road_name	string	100		To contain the name of the road, if any
Road_ID	string	20	-	To contain the ID of Road
Road_Type	string	20	-	To contain the physical type of the road as follows - "Pucca" - "WBM" - "HBB" - "Katcha"

Road_Class	string	100		<p>To contain the Class of road according to RHD & LGED in the followings:</p> <p>RHD Road Class</p> <ul style="list-style-type: none"> - “National Highways ” - “Regional Highways” - “District\Zila Road” <p>LGED Road Class</p> <ul style="list-style-type: none"> - “Upazila Road(Pucca” - “Upazila Road(Katcha)” - “Union Road(Pucca)” - “Union Road(Katcha)” - “Village Road A (Pucca)” - “Village Road A (Katcha)” - “Village Road B (Pucca)” - “Village Road B (Katcha)”
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8) Shape file name: RoadL11601.shp (Standard Code such as Thana\Upazila)

Type: **Polyline**

This shape file will contain the centerlines of existing roads as polyline features in the area under project. It must contain the following fields compatible to network analysis:

Field Name	Field Type	Width of the field	No. of Decimal Places	Purpose of the field
Road_name	string	100		To contain the name of the road, if any
Road_no	string	20	-	To contain road number, if any
Road_ID	string	20	-	To contain the ID of Road
Road_type	string	20	-	<p>To contain the physical type of the road as follows</p> <ul style="list-style-type: none"> - “Pucca” - “WBM” - “HBB” - “Katcha”
Road_Class	string	100		<p>To contain the Class of road according to RHD & LGED in the followings:</p> <p>RHD Road Class</p> <ul style="list-style-type: none"> - “National Highways ” - “Regional Highways” - “District\Zila Road” <p>LGED Road Class</p> <ul style="list-style-type: none"> - “Upazila Road(Pucca” - “Upazila Road(Katcha)” - “Union Road(Pucca)” - “Union Road(Katcha)” - “Village Road A (Pucca)” - “Village Road A (Katcha)” - “Village Road B (Pucca)” - “Village Road B (Katcha)”
Road_width	numeric		-	To contain average width of the road segment in meter

Road_length	numeric		-	To contain calculated length of the road segment in meter
Num_Lanes	numeric		-	To contain number of lanes on the road segment such as 1, 2, etc.
Road_own	string	100		To contain the name of the department or organization to which the road segment belongs.
METERS	Double	-	-	To contain length of the road in meters
FT_MINUTES	Float	-	-	To contain the time duration needed to travel the arc from the start node unto the end node, measured in minutes.
TF_MINUTES	Float	-	-	To conation the time duration needed to ravel the arc from the end node unto the start node of the arc, measured in minutes,
Oneway	string	2		To contain the value to represent the possible directions to travel an arc
Hierarchy	Long			To contain order or rank assigned to road network elements.

8) Shape file name: **RoadL11601.shp (Standard Code such as Thana\Upazila)**

Type: **Polyline**

This shape file will contain the centerlines of existing roads as polyline features in the area under project. It must contain the following fields compatible to Road Inventory sets with Road shapefiles:

Field Name	Field Type	Width of the field	No. of Decimal Places	Purpose of the field
Rd_Length	Double	0		To contain the area in meters
Road_ID	string	20	-	To contain the ID of Road
Remarks To prepare completely the road, Electricity, Telephone, drain and pipe line inventory so that the inventory can to use properly with road shapefiles.I have given an example data table right side.....	Chainage	Road_Condition	Type	Additional +Field
	0-500 meters	Pucca	Pucca	To add more field as per your Required.
	500-500m	Culvert	Culvert	To add more field as per your Required.
	500-1000m	Katcha	Katcha	To add more field as per your Required.
	1000-1012m	Bridge	Bridge	To add more field as per your Required.

9) Shape file\Coverage name: **RdFP11601.shp (Standard Code such as Thana\Upazila)**

Type: **Polygon**

Surface

This shape file\Coverage will contain footpath of project area. It must contain the field as described in the following table:

Field Name	Field Type	Width of the field	No. of Decimal Places	Purpose of the field
Road_name	string	50	-	To contain road name
Road_ID	string	20	-	To contain the adjacent Road ID

FP_Width	numeric		-	To contain width of Footpath
FP_Type	string	50	-	To contain footpath conditions.
Footpath				-Yes; true; 1

10) Shape file\Coverage name: RdIL11601.shp (Standard Code such as Thana\Upazila)

Type: **Polygon**

This shape file\Coverage will contain road islands of the project area. It must contain the field as described in the following table:

Field Name	Field Type	Width of the field	No. of Decimal Places	Purpose of the field
Road_name	string	50	-	To contain road name
Road_No	string	20	-	To contain road number if any
Road_ID	string	20	-	To contain the adjacent Road ID
IL_Width	Long integer	20	-	To contain width of Island
IL_Type	string	50	-	To contain footpath conditions.

11) Shape file\Coverage name: Wbd11601.shp (Standard Code such as Thana\Upazila)

Type: **Polygon or polyline**

This shape file will contain water bodies of project area. It must contain the field as described in the following table:

Field Name	Field Type	Width of the field	No. of Decimal Places	Purpose of the field
WBD_ID	Long integer	20	-	To contain Water body ID.
WBD_Type	string	50	-	To contain following type of water bodies - "River" - "Khal" - "Irrigation Canal" - "Swamp" - "Pond" - "Ditch" - "Borrow Pits"
Use_Type	string	50	-	To contain the use of water body such as Private or Public use

12) Shape file\Coverage name: Emb11601.shp (Standard Code such as Thana\Upazila)

Type: **Polyline**

This shape file\Coverage will contain embankment features of project area. It must contain the field as described in the following table:

Field Name	Field Type	Width of the field	No. of Decimal Places	Purpose of the field
Emb_name	string	100		To contain the name of the road, if any
Emb_ID	string	20	-	To contain the ID of Road
Emb_Type	string	20	-	To contain the physical type of the Embankment to follow the road preparing

				method.
Emb_Class	string	100		To contain the Class of the Embankment -“Road cum Embankment” -“Embankment”
Emb_width	numeric		-	To contain average width of the road segment in meter
Emb _width	numeric		-	To contain average width of the embankment segment in meter
Emb_length	numeric		-	To contain calculated length of the road segment in meter
Num_Lanes	numeric		-	To contain number of lanes on the road segment such as 1, 2, etc.
Owner	string	100		To contain the name of the department or organization to which the embankment segment belongs.

13) Shape file name: DTM11601.shp (Standard Code such as Thana\Upazila)

Type: **Point**

This shape file will contain 3D points at regular interval (10m x 10m) in project area. It must contain four fields as described in the following table:

Field Name	Field Type	Width of the field	No. of Decimal Places	Purpose of the field
ID	Sort Integer	10		To contain the ID
RL	Double	0	0	To contain Reduced Level (RL) of a point in meter as referenced with PWD
Easting	Double	0	0	To contain X-coordinate of the point
Northing	Double	0	0	To contain Y-coordinate of the point

14) Shape file name BM11601.shp (Standard Code such as Thana\Upazila)

Type: **Point**

This shape file will contain BM Pillars established in the project area. It must contain four fields as described in the following table:

Field Name	Field Type	Width of the field	No. of Decimal Places	Purpose of the field
RL	Double	0	0	To contain Reduced Level (RL) of a point in meter as referenced with PWD
Easting	Double	0	0	To contain X-coordinate of the point
Northing	Double	0	0	To contain Y-coordinate of the point
organization	String	100	-	To contain name of the organization
Remarks	String	100	-	To contain remarks, if any.

15) Shape file name: CTR11601.shp (Standard Code such as Thana\Upazila) (CTR = Contour)

Type: **Polyline**

This shape file will contain the contour lines of the area under project area. It must contain three fields as described in the following table:

Field Name	Field Type	Width of the field	No. of Decimal Places	Purpose of the field
Contour	Double	0	0	To contain the value (RL) of the contours up to three decimal places.
Label	Double	0	0	To contain the value of contour up to one decimal place. This can be used to label the contours in map.
Type	String	7	-	To contain the value of this field as follows: - "Index" - "Intermediate" The purpose of this field is to symbolize and label the contours only. (The values must be calculated in such way that after successive 4 thin (Regular) contours there should be one thick (Index) contour in map. That is if 0.00 is a thick (Index) contour then 0.3, 0.6, 0.9, and 1.2 will be (Regular) contours and 1.5 will be thick contour.

16) Shape file name: ELU11601.shp (Standard Code such as Thana\Upazila) (ELU = Existing Landuse)
Type: **Polygon**

This shape file will contain existing land use of project area which will be prepared on the basis of physical feature and land use survey. It may contain the field as described in the following table:

Field Name	Field Type	Width of the field	No. of Decimal Places	Purpose of the field
Land_use	string	50	-	To contain existing land use as - "Administrative" - "Agriculture" - "Commercial" - "Circulation Network" - "Institutional" - "Flood Flow Zone" - "Industrial" - "Mixed Use" - "Recreational" - "Restricted / Special Use" - "Socio-Cultural" - "Transport & Communication" - "Urban Residential" - "Urban Services" - "Vacant Land" - "Water Body"
Remarks	string	100	-	To contain remarks, if any.

17) Shape file name: HTD11601.shp (Standard Code such as Thana\Upazila) (HTD = Homestead)
Type: **Polygon**

This shape file will contain rural homestead areas in project area as polyline features. It must contain the field as described in the following table:

Field Name	Field Type	Width of the field	No. of Decimal Places	Purpose of the field
Location	String	20	-	To contain the name of Mauza (Mauza_JL_Sheet) or the locality in which homestead areas lies.
Type				To contain the type of homestead area (Accordingly structures) -Urban -Rural

18) Shape file name: BRD11601.shp (Standard Code such as Thana\Upazila) (BRD = Bridge)

Type: **Polygon**

This shape file will contain Bridge/Culvert/Box culvert/Over bridge/Railway Bridge etc as polygon features in project area. It must contain the field as described in the following table:

Field Name	Field Type	Width of the field	No. of Decimal Places	Purpose of the field
Length	Double	0	0	To contain the length of the bridge/culvert
Width	Double	0	0	To contain the width of the bridge/culvert
Abutment	Long integer	20	0	To contain the number of abutment
Span	Double	0	0	To contain the span of the bridge/culvert
Location	String	30	-	To contain the area name (Mauza_JL_Sheet or locality)
Remarks	String	254	-	To contain comments about the bridge such as conditions of abutment, deck, wing wall, etc. *** To follow the road preparing methods.

19) Shape file name: BREL11601.shp (Standard Code such as Thana\Upazila) (BREL = Bridge Edge Line)

Type: **Polyline**

This shape file will contain Bridge/Culvert/Box culvert/Over bridge/Railway Bridge etc as polyline features in project area. Each feature must be a multipart feature. It must contain the field as described in the following table:

Field Name	Field Type	Width of the field	No. of Decimal Places	Purpose of the field
Length	Double	0	0	To contain the length of the bridge/culvert
Width	Double	0	0	To contain the width of the bridge/culvert
Abutment	Double	0	0	To contain the number of abutment
Span	Double	0	0	To contain the span of the bridge/culvert
Location	String	20	-	To contain the area name (locality)
Remarks	String	254	-	To contain comments about the bridge such as conditions of abutment, deck, wing wall, etc. *** To follow the road preparing methods.

20) Shape file name: BRDP11601.shp (Standard Code such as Thana\Upazila) (BRDP = Bridge Point)
Type: **Point**

This shape file will contain Bridge/Culvert/Box culvert/Over bridge/Railway Bridge etc as point features in project area. It is expected that this shape file will be generated/produced from converting the **Bridge_CL.shp** file into centroids. It must contain the field as described in the following table:

Field Name	Field Type	Width of the field	No. of Decimal Places	Purpose of the field
Length	Double	0	0	To contain the length of the bridge/culvert
Angle				To contain the Geographic angle of the bridge/culvert
Width	Double	0	0	To contain the width of the bridge/culvert
Abutment	numeric	20	0	To contain the number of abutment
Span	Double	0	0	To contain the span of the bridge/culvert
Location	String	20	-	To contain the area name (Mauza_JL_Sheet or locality)
Remarks	String	254	-	To contain comments about the bridge such as conditions of abutment, deck, wing wall, etc. *** To follow the road preparing methods.

21) Shape file name: EDRN11601.shp (Standard Code such as Thana\Upazila) (EDRN = Existing Drain Line)
Type: **Polyline**

This shape file will contain the information of existing drains in the project area. It must contain three fields as described in the following table:

Field Name	Field Type	Width of the field	No. of Decimal Places	Purpose of the field
Type	string	20	-	To contain the (construction) type of the drain. The value of the field may be any of the following two - Surface (Katcha) - Surface (Uncovered) - Surface (Covered) - Pipe
Drain_width	Double	0	0	To contain the width of the drain
Drain_depth	Double	0	0	To contain the depth of the drain
Drain_radios	Double	0	0	To contain the radios of the drain
Road_ID	string	20	-	To contain the adjacent Road ID
Remarks	String	254	-	*** To follow the road preparing methods.

22) Shape file name: BWL11601.shp (Standard Code such as Thana\Upazila) (BWL=Boundary Wall Line)
Type: **Polyline**

This shape file will contain boundary walls as line features of project area. It must contain the field as described in the following table:

Field Name	Field Type	Width of the field	No. of Decimal Places	Purpose of the field
Type	string	50	-	To contain line features such as Boundary wall.

23) Shape file name: WSL11601.shp (Standard Code such as Thana\Upazila) (WSL= Water Supply Line)

Type: **Polyline**

This shape file will contain water distribution pipe network as line features in project area. It must contain the field as described in the following table:

Field Name	Field Type	Width of the field	No. of Decimal Places	Purpose of the field
Type	string	20	-	To contain type of pipe (Steel, PVC, etc)
Dia	Double	0	0	Diameter of pipe in mm
Remarks	String	254	-	*** To follow the road preparing methods.

24) Shape file name: OHT11601.shp (Standard Code such as Thana\Upazila) (OHT = Overhead Tank)

Type: **Point**

This shape file will contain overhead water tanks as point features in project area. It must contain the field as described in the following table:

Field Name	Field Type	Width of the field	No. of Decimal Places	Purpose of the field
Capacity	Double	0	0	To contain the capacity of the overhead tank.
Catchment	Double	0	0	To contain the catchment area in sq. meter
Owner				Contains the owner name

25) Shape file name: ESL11601.shp (Standard Code such as Thana\Upazila) (ESL = Electricity Supply Line)

Type: **Polyline**

This shape file will contain High Voltage Electric Lines as line features in project area. It must contain the field as described in the following table:

Field Name	Field Type	Width of the field	No. of Decimal Places	Purpose of the field
capacity	string	20	-	Contains the capacity of each line as 11KV, 33 KV etc.
Owner	string	20		Contains the name of Organization
Remarks	String	254	-	*** To follow the road preparing methods.

26) Shape file name: ULT11601.shp (Standard Code such as Thana\Upazila) (ULT = Utilities)

Type: **Point**

This shape file will contain locations of various utility features as described in the following table:

Field Name	Field Type	Width of the field	No. of Decimal Places	Purpose of the field
Type	string	20	-	To contain - “Electric Pole” - “Electric Tower” - “High Volt Electric Tower” - “Electric Box” - “Power Station” - “Power Sub-station” - “Transformer” - “Gas Transmission Center” - “Light Post” - “Telephone Pole” - “Telephone Box” - “Fire Service Station” - "Traffic Signal Pole”
Owner				Contains the name of the owner
Remarks	String	100	-	*** To follow the road preparing methods.

27) Shape file name: SRL11601.shp (Standard Code such as Thana\Upazila) (SRL = Sewerage Line)
Type: **Polyline**

This shape file will contain sewerage network as line features in [project area]. It must contain the field as described in the following table:

Field Name	Field Type	Width of the field	No. of Decimal Places	Purpose of the field
Size	string	20	-	To contain pipe diameter of sewerage line
Type	string	25	-	Contains type of waste water carried by the sewerage line such as storm sewerage or household sewerage line etc.
Location	string	20	-	Contains location of sewerage line
Owner				Contains the name of the owner
Remarks	String	100	-	*** To follow the road preparing methods.

28) Shape file name: OHP11601.shp (Standard Code such as Thana\Upazila) (OHP = Other polygon)
Type: **Polygon**

This shape file will contain polygon features of project area. It must contain the field as described in the following table:

Field Name	Field Type	Width of the field	No. of Decimal Places	Purpose of the field
Type	string	50	-	To contain boundary of following features - “Graveyard” - “Crematorium” - “Cemetery” - “Eidgah” - “Restricted Area” - “Airport”

				<ul style="list-style-type: none"> - “Brick Field” - “Rikshaw Garage” - “Automobile Garage” - “Slum” - “Monument” - “Open Space” - “Parks” - “Playground” - “Stadium” - “Golf Course” - “Botanical Garden” - “Zoological Park” - “Power Plant/Station” - “Bus Terminal” - “Truck Terminal” - “Water Treatment Plant” - “Sewerage Treatment Plant” - “Waste Disposal Plant” - “Railway Station” - “Bazaar Boundary” - “Forest Land” - “Sand Fill” - “Swimming Pool” - - <i>Other if necessary</i>
Owner				Contains the name of the owner

29) Shape file name: AP11601.shp (Standard Code such as Thana\Upazila) (AP = All point)

Type: **Point**

This shape file will contain point features of project area. It must contain the field as described in the following table:

Field Name	Field Type	Width of the field	No. of Decimal Places	Purpose of the field
Type	string	50	-	<ul style="list-style-type: none"> - “Airport” - “Bazar” - “Government Bank” - “Private Bank” - “Brickfield” - “Bridge” - “Bus Terminal” - “Cemetery” - “Church” - “Cinema Hall” - “College” - “Crematorium” - “Deep tube well” - “Dustbin” - “Filling Station” - “Graveyard” “Growth Center”

				<ul style="list-style-type: none"> - “Hand tube well” - “Historic site” - “ Government High School” “Registered High School” “Non-Registered High School” - “Hospital/Clinic” - “Madrasa” - “Registered Madrasa” - “Non-Registered Madrasa” - “Mazar/Dargah” - “Monument” - “Mosque” - “Museum” - “Oil Reservoir/Depot” - “Over Bridge” - “Pagoda” - “Police Box” - “Police Station” - “Post Office” - “River Port” - “Government Primary School” - “Registered Primary School” - “Non-Registered Primary School” - “Sluice gate” - “Temple” - “Theater Hall” - “Truck Terminal” - “Under Pass” - “University” - “Private University” - “Well” - “Culvert” - <i>Other if necessary</i>
Name	string	50	-	To contain name of the feature, if any
PointType	string	50	-	To contain short name “GPS” of the feature, e.g. Government Primary School (GPS)
Owner				Contains the name of the owner
Remark	string			Contains Further Explanation

30) Shape file name: ITN11601.shp (Standard Code such as Thana\Upazila) (ITN = Important Names)

Type: **Point**

This shape file will contain the names of important places and structures as point features in project area.

Field Name	Field Type	Width of the field	No. of Decimal Places	Purpose of the field
Name	String	100	-	To contain - Name of locality, market, bazaar, important structure, historic site, university, play ground, poultry farm, river, khal, lake, pond, etc.

31) Shape file name: RN11601.shp (Standard Code such as Thana\Upazila) (RN = Road Name)

Type: **Annotation/Line**

This shape file will contain the names of important places and structures as point features in project area.

Field Name	Field Type	Width of the field	No. of Decimal Places	Purpose of the field
Name	String	100	-	To contain the name of road segment.

32) Shape file name: PRL11601.shp (Standard Code such as Thana\Upazila) (PRL = Proposed Road Line)

Type: **Polyline**

This shape file will contain center lines of proposed roads as line features in the project area.

Field Name	Field Type	Width of the field	No. of Decimal Places	Purpose of the field
Width_m	Double	0	0	To contain width of the proposed road in meter
Width_ft	Double	0	0	To contain width of the proposed road in foot
From_To	String	100	-	To contain the names (of road/place) from where the road starts and to where the road ends.
Prop_type	String	20	-	To contain any of the two - “New” - “Widening”
Type	String	20	-	To contain any of the following - “Underground” - “Ground” - “Flyover” - “Viaduct”
Remarks	String	254	-	*** To follow the road preparing methods.

41) Shape file name: PPL11601.shp (Standard Code such as Thana\Upazila) (PPL = Population)

Type: **Polygon**

This shape file will contain polygon features of unions and wards derived from dissolved Mouzas of the project area area. It must contain the field as described in the following table:

Field Name	Field Type	Width of the field	No. of Decimal Places	Purpose of the field
Union_Ward	String	50	-	To contain name of the Mouza
Area_BBS	Double	0	0	
Area_GIS	Double	0	0	
Pop_2001	Double	0	0	
Pop_2011	Double	0	0	
Pop_2021	Double	0	0	
Pop_2035	Double	0	0	
Pop_den_2011				
Thana				
Union				
Geocode	String	11	-	To contain BBS geocode of the Union
Remarks	String	254	-	*** To add more field.

42) Shape file name: **STP11601.shp** (Standard Code such as Thana\Upazila) (STP = Structure Plan)

Type: **Polygon**

This shape file will contain proposed policy on the **merged mouza map** of the project area. It must contain the fields as described in the following table:

Field Name	Field Type	Width of the field	No. of Decimal Places	Purpose of the field
Policy_Zone	String	50	-	To contain proposed policy on the plots.
Remarks	String	100	-	To contain remark, if any.

Point Feature Codes

The following Point feature codes (Unique ID) will be used as follows.

Point Feature Categories	Unique ID
- "Airport"	255
- "Bazar"	260
- "Government Bank"	265
- "Private Bank"	270
- "Brickfield"	275
- "Bridge"	280
- "Bus Terminal"	285
- "Bus Stand"	290
- "Cemetery"	295
- "Church"	300
- "Cinema Hall"	305
- "Government Medical College"	245
- "Private Medical College"	250
- "Government College"	145
- "Government Woman College"	150
- "Registered College"	155
- "Non-Registered College"	160
Government Poly Technical Institute	165

Private Poly Technical Institute	170
Vocational Institute	175
Jubo Unnayan Kendra	310
Government Teacher's Training College	235
Private Teacher's Training College	240
- "Crematorium"	315
- "Deep tube well"	320
- "Dustbin"	325
- "Filling Station"	330
- "Graveyard"	335
"Growth Center"	340
- "Hand tube well"	345
- "Arsenic Hand tube well"	350
- "Tara Pump"	355
- "Historic site"	360
- "Government High School"	125
- "Government Girl's High School"	130
"Registered High School"	135
"Non-Registered High School"	140
- "Hospital/Clinic"	365
- "Government Kamel Madrasa"	180
- "Registered Kamel Madrasa"	185
- "Government Fazel Madrasa"	190
- "Registered Fazel Madrasa"	195
- "Government Alem Madrasa"	200
- "Registered Alem Madrasa"	205
- "Government Eftedayee Madrasa"	210
- "Registered Eftedayee Madrasa"	215
- "Non-Registered Madrasa"	220
- "Mazar/Dargah"	370
- "Monument"	375
- "Mosque"	380
- "Museum"	385
- "ASA NGO"	390
- "BRAC NGO"	395
- "Proshikha NGO"	400
- "TMSS NGO"	405
- "Other's NGO"	410
- "Insurance Company"	415
- "Life Insurance Company"	420
- "Oil Reservoir/Depot"	425

- "Over Bridge"	430
- "Pagoda"	435
- "Police Box"	440
- "Police Station"	445
- "Post Office"	450
- "River Port"	455
- "Government Primary School"	100
- "Registered Primary School"	105
- "Non-Registered Primary School"	110
- "K.G. School"	115
- "Kindergarten School"	120
- "Sluice gate"	460
- "Temple"	465
- "Theater Hall"	470
- "Truck Terminal"	475
- "Under Pass"	480
- "Government University"	225
- "Private University"	230
- "Well"	485
- "Culvert"	490
- <i>Other if necessary</i>	To put or add the Unique ID accordingly 5 interval

FIGURE 5.1: Gantt Chart of Project Activity for Package-3

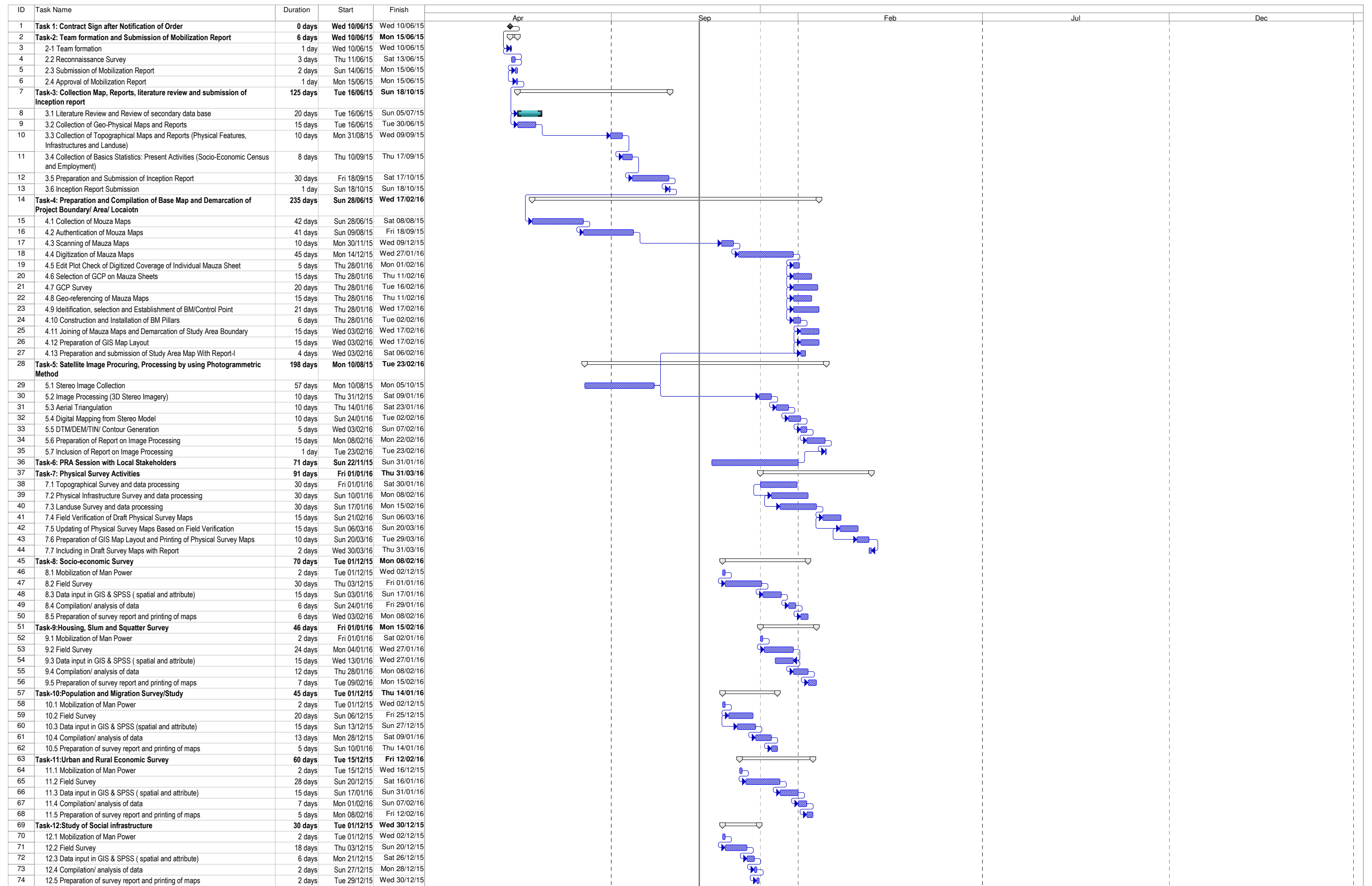
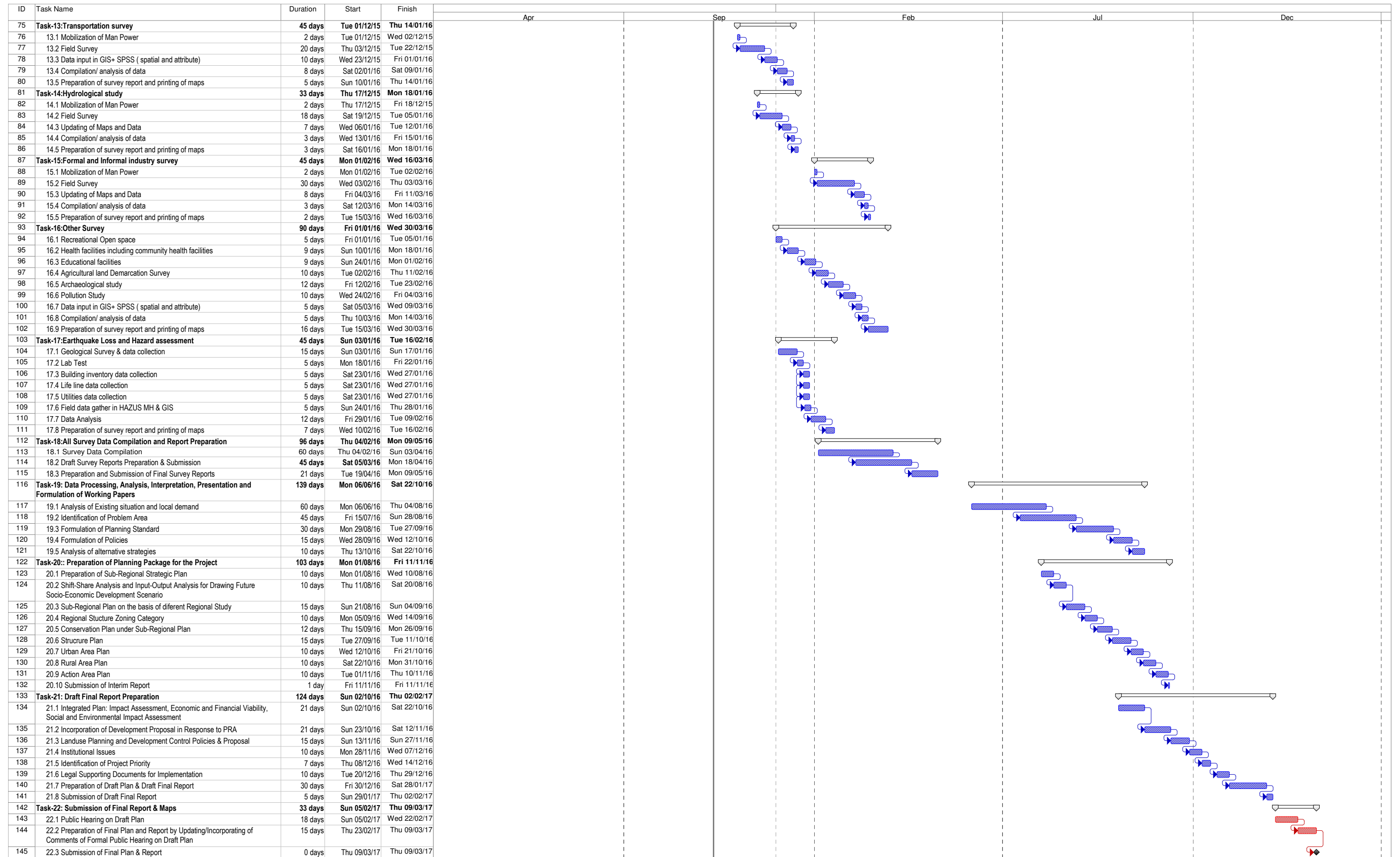


FIGURE 5.1: Gantt Chart of Project Activity for Package-3



Non-critical Task
 Milestone
 Inactive Task
 Inactive Summary
 Duration-only
 Manual Summary
 Finish-only
 Progress

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার

₹ ১০০



₹ ১০০

একশত টাকা

কজ

০১৯২০৭৮

শেখ মোঃ আবু বক্কর সিদ্দিক

১৫/০৮/১৫

“ভাড়াটিয়া চুক্তি পত্র”

প্রথম পক্ষঃ শেখ মোঃ আবু বক্কর সিদ্দিক, পিতা-মৃত শেখ আবুল কাশেম, মহল্লাঃ টানপাড়া সোনালী ব্যাংক এর পূর্ব পার্শ্ব, ভবানীগঞ্জ পৌরসভা, বাগমারা, রাজশাহী।

দ্বিতীয় পক্ষঃ ইঞ্জিনিয়ারিং কনসালটেন্টস এন্ড এসোসিয়েটস লিঃ ১৫৪, মনিপুরি পাড়া ফার্মগেট তেজগাঁও, ঢাকা-১২১৫।

১ম পক্ষ তাঁর টানপাড়া সোনালী ব্যাংক এর পূর্ব পার্শ্ব বসতবাড়ি (বাসা) দুইটি রুম অফিস হিসাবে ভাড়া দেওয়ার ঘোষণা করিলে ২য় পক্ষ অফিস পরিচালনার জন্য তাহার নিম্নলিখিত শর্ত সাপেক্ষে ভাড়া নিতে সম্মত হয়।

শর্তসমূহঃ

- ১। এই চুক্তিপত্র স্বাক্ষরের তারিখ হতে ছয় (০৬) মাস বলবৎ থাকিবে।
- ২। দ্বিতীয় পক্ষ মাসিক ভাড়া ও বিদ্যুৎ বিল সহ সর্বমোট ২,০০০/- (দুই হাজার) টাকা মাত্র প্রতিমাসের ১০ (দশ) তারিখের মধ্যে প্রথম পক্ষকে পরিশোধ করিবে।
- ৩। দ্বিতীয় পক্ষ নিরাপত্তা জামানত (ফেরতযোগ্য) হিসাবে এক মাসের ভাড়ার সমপরিমান অর্থাৎ ২,০০০/- (দুই হাজার) টাকা প্রথম পক্ষকে পরিশোধ করবেন। এই ফেরতযোগ্য জামানত চুক্তির মেয়াদ শেষে প্রথম পক্ষ দ্বিতীয়কে পরিশোধ করিবেন।



গণপ্রজাতন্ত্রী বাংলাদেশ সরকার

₹ ১০০



₹ ১০০

একশত টাকা

কজ

০১৯২০৭৭

স্বাক্ষরিত এবং তারিখের জিএমডি

[Signature]

পাতা - ২

- ৪। উভয় পক্ষ প্রয়োজন বাতিল করিতে পারিবেন। তবে তাহা বাতিলের তারিখ থেকে ১ মাস পূর্বে লিখিতভাবে/ মৌখিকভাবে প্রথম পক্ষকে অবহিত করিবেন। এক্ষেত্রে কোন প্রকার বিলম্ব করা যাবে না।
- ৫। উভয় পক্ষের আলোচনার ভিত্তিতে নতুন ভাড়া নির্ধারণ করিয়া বুক্তিটি নবায়ন করা যাবে। তবে বুক্তি মেয়াদ শেষ হওয়ার ১ মাস আগে দ্বিতীয় পক্ষ প্রথম পক্ষকে কাঙ্ক্ষিত নবায়নের কথা জানাইবেন।
- ৬। বুক্তির মেয়াদকালীন সময়ে প্রথম পক্ষ দ্বিতীয় পক্ষের কাছে কোন বর্ধিত ভাড়ার দাবি করিতে পারিবেনা।
- ৭। বাসায় কোন প্রকার অসামাজিক বা অবৈধ ব্যবসা পরিচালনা করা যাবে না। দ্বিতীয় বাসাটি অন্য কার্ডকে কিংবা উপভাড়া দিতে পারিবেনা।
- ৯। দ্বিতীয় পক্ষ বাসাটি প্রথম পক্ষ থেকে যে ভাবে বুঝিয়ে নিবে বুক্তি মেয়াদ শেষে ঠিক সেই ভাবে ফেরৎ দিবেন।
- ১০। দ্বিতীয় পক্ষ বাসাটি কোন ব্যক্তি বা প্রতিষ্ঠানের কাছে লীজ বা বন্ধক দিতে পারিবেনা।



গণপ্রজাতন্ত্রী বাংলাদেশ সরকার

₹ ১০০



₹ ১০০

একশত টাকা

কজ ০১৯২০৪০

পাতা - ৩

- ১১। বাসার কোন প্রকার ক্ষতি সাধন করিলে তা নিজ খরচে মেরামত করিবেন।
- ১২। দ্বিতীয় পক্ষ মালিকের নিয়মকানুন সম্পন্নরূপে মেনে চলতে বাধ্য থাকবেন।
- আমরা উভয় পক্ষ বৃক্তি নামার সকল শর্ত মেনে স্বাক্ষরণের উপস্থিতিতে ১১/০৯/২০১৫ স্বাক্ষর করিলাম।

প্রথম পক্ষ

স্বাক্ষর: মোঃ গুস্তাফ আলী

দ্বিতীয় পক্ষ

F. ASHID AHMED KHAN
MANAGING DIRECTOR
ENGINEERING CONSULTANTS AND
ASSOCIATES LIMITED

স্বাক্ষরণ: Mr. Shajim msh



গণপ্রজাতন্ত্রী বাংলাদেশ সরকার

₹ ১০০



₹ ১০০

একশত টাকা

কজ ০১৯২০৭৪

“ভাড়াটিয়া চুক্তি পত্র”

প্রথম পক্ষঃ খাইরুলজামান খাঁন, পিতা-আঃ রশিদ খাঁন, গ্রামঃ বদরপুর, ডাকঘরঃ কোমরপুর, উপজেলাঃ ফরিদপুর সদর, জেলাঃ ফরিদপুর।

দ্বিতীয় পক্ষঃ ইঞ্জিনিয়ারিং কনসালটেন্টস এন্ড এসোসিয়েটস লিঃ ১৫৪, মনিপুরি পাড়া ফার্মগেট তেজগাঁও, ঢাকা-১২১৫।

আমি ১ম পক্ষ খাইরুলজামান খাঁন, পিতাঃ আঃ রশিদ খাঁন, গ্রামঃ বদরপুর, ডাকঘরঃ কোমরপুর, উপজেলা-ফরিদপুর সদর, জেলাঃ ফরিদপুর এর বসতবাড়ী (বাসা) দুইটি রুম অফিস হিসাবে ভাড়া দেওয়ার ঘোষণা করিলে ২য় পক্ষ অফিস পরিচালনার জন্য তাহার নিম্নলিখিত শর্ত সাপেক্ষে ভাড়া নিতে সম্মত হয়।

শর্তসমূহঃ

- ১। এই চুক্তিপত্র স্বাক্ষরের তারিখ হতে ছয় (০৬) মাস বলবৎ থাকিবে।
- ২। দ্বিতীয় পক্ষ মাসিক ভাড়া ও বিদ্যুৎ বিল বাদে সর্বমোট ২,২০০/- (দুই হাজার দুই শত) টাকা মাত্র প্রতিমাসের ১০ (দশ) তারিখের মধ্যে প্রথম পক্ষকে পরিশোধ করিবেন।
- ৩। দ্বিতীয় পক্ষ নিরাপত্তা জামানত (ফেরতযোগ্য) হিসাবে এক মাসের ভাড়ার সমপরিমান অগ্রিম ২,২০০/- (দুই হাজার দুই শত) টাকা প্রথম পক্ষকে পরিশোধ করবেন। এই ফেরতযোগ্য জামানত চুক্তির মেয়াদ শেষে প্রথম পক্ষ দ্বিতীয়কে পরিশোধ করিবেন।



গণপ্রজাতন্ত্রী বাংলাদেশ সরকার

৳ ১০০



৳ ১০০

একশত টাকা

কজ ০১৯২০৭৬

[Handwritten signature]

পাতা - ২

- ৪। উভয় পক্ষ প্রয়োজন বাতিল করিতে পারিবেন। তবে তাহা বাতিলের তারিখ থেকে ১ মাস পূর্বে লিখিতভাবে/ মৌখিকভাবে প্রথম পক্ষকে অবহিত করিবেন। এক্ষেত্রে কোন প্রকার বিলম্ব করা যাবে না।
- ৫। উভয় পক্ষের আলোচনার ভিত্তিতে নতুন ভাড়া নির্ধারণ করিয়া বুক্তিটি নবায়ন করা যাবে। তবে বুক্তি মেয়াদ শেষ হওয়ার ১ মাস আগে দ্বিতীয় পক্ষ প্রথম পক্ষকে কাক্ষিত নবায়নের কথা জানাইবেন।
- ৬। বুক্তির মেয়াদকালীন সময়ে প্রথম পক্ষ দ্বিতীয় পক্ষের কাছে কোন বর্ধিত ভাড়ার দাবি করিতে পারিবেনা।
- ৭। বাসায় কোন প্রকার অসামাজিক বা অবৈধ ব্যবসা পরিচালনা করা যাবে না। দ্বিতীয় বাসাটি অন্য কাউকে কিংবা উপভাড়া দিতে পারিবেনা।
- ৯। দ্বিতীয় পক্ষ বাসাটি প্রথম পক্ষ থেকে যে ভাবে বুঝিয়ে নিবে বুক্তি মেয়াদ শেষে ঠিক সেই ভাবে ফেরৎ দিবেন।
- ১০। দ্বিতীয় পক্ষ বাসাটি কোন ব্যক্তি বা প্রতিষ্ঠানের কাছে লীজ বা বন্ধক দিতে পারিবেনা।



চলমান পাতা - ৩

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার

₹ ১০০



₹ ১০০

একশত টাকা

কজ

০১৯২০৪৩

পাতা - ৩

- ১১। বাসার কোন প্রকার ক্ষতি সাধন করিলে তা নিজ খরচে যোরামত করিবেন।
- ১২। দ্বিতীয় পক্ষ মালিকের নিয়মকানুন সম্পূর্ণরূপে যেনে চলতে বাধ্য থাকবেন।

আমরা উভয় পক্ষ বৃ্তি নামার সকল শর্ত যেনে স্বাক্ষীগণের উপস্থিতিতে ১১/০৯/২০১৫ স্বাক্ষর করিলাম।

প্রথম পক্ষ

Rashid Ahmed Khan

দ্বিতীয় পক্ষ

Rashid Ahmed Khan

RASHID AHMED KHAN
MANAGING DIRECTOR
ENGINEERING CONSULTANTS AND
ASSOCIATES LIMITED

RASHID AHMED KHAN
MANAGING DIRECTOR
ENGINEERING CONSULTANTS AND
ASSOCIATES LIMITED

স্বাক্ষীগণঃ

১১/০৯/২০১৫



গণপ্রজাতন্ত্রী বাংলাদেশ সরকার

₹ ১০০



₹ ১০০

একশত টাকা

কজ ০১৯২০৭৬

(Signature)

(Signature)

“ভাড়াটিয়া চুক্তি পত্র”

প্রথম পক্ষঃ মোঃ ছাদের আলী, পিতা- মৃত ছিতাব আলী, গ্রামঃ গাংনী বাজার পাড়া (চনং ওয়ার্ড), থানাঃ গাংনী, জেলাঃ মেহেরপুর।

দ্বিতীয় পক্ষঃ ইঞ্জিনিয়ারিং কনসালটেন্টস এন্ড এনোসিয়েটস লিঃ ১৫৪, মনিপুরি পাড়া ফার্মগেট তেজগাঁও, ঢাকা-১২১৫।

আমি ১ম পক্ষ তার গাংনী বাজারের পশ্চিম পার্শ্ব অবস্থিত ৪তলা ভবনের ৩য় তলায় (২টা কক্ষ) অফিস হিসাবে ভাড়া দেওয়ার ঘোষণা করিলে ২য় পক্ষ অফিস পরিচালনার জন্য তাহার নিম্নলিখিত শর্ত সাপেক্ষে ভাড়া নিতে সম্মত হয়।

শর্তসমূহঃ

- ১। এই চুক্তিপত্র স্বাক্ষরের তারিখ হতে ছয় (০৬) মাস বলবৎ থাকিবে।
- ২। দ্বিতীয় পক্ষ মাসিক ভাড়ার ২৩০০/- টাকা মাত্র প্রতিমাসের ১০ (দশ) তারিখের মধ্যে প্রথম পক্ষকে পরিশোধ করিবেন। ভাড়া ব্যতিত মিটার রিডিং অনুসারে বিদ্যুৎ বিল আলাদাভাবে দ্বিতীয় পক্ষ প্রদান করিবেন।
- ৩। দ্বিতীয় পক্ষ নিরাপত্তা জামানত (ফেরতযোগ্য) হিসাবে এক মাসের ভাড়ার সমপরিমান অর্থাৎ ২,৩০০/- টাকা প্রথম পক্ষকে পরিশোধ করবেন। এই ফেরতযোগ্য জামানত চুক্তির মেয়াদ শেষে প্রথম পক্ষ দ্বিতীয়কে পরিশোধ করিবেন।



গণপ্রজাতন্ত্রী বাংলাদেশ সরকার

₳ ১০০



₳ ১০০

একশত টাকা

কজ

০১৯২০৭৯

০১৯২০৭৯

পাতা - ২

- ৪। উভয় পক্ষ প্রয়োজন বাতিল করিতে পারিবেন। তবে তাহা বাতিলের তারিখ থেকে ১ মাস পূর্বে লিখিতভাবে/ মৌখিকভাবে প্রথম পক্ষকে অবহিত করিবেন। এক্ষেত্রে কোন প্রকার বিলম্ব করা যাবে না।
- ৫। উভয় পক্ষের আলোচনার ভিত্তিতে নতুন ভাড়া নির্ধারণ করিয়া বুক্তিটি নবায়ন করা যাবে। তবে বুক্তি মেয়াদ শেষ হওয়ার ১ মাস আগে দ্বিতীয় পক্ষ প্রথম পক্ষকে কাক্ষিত নবায়নের কথা জানাইবেন।
- ৬। বুক্তির মেয়াদকালীন সময়ে প্রথম পক্ষ দ্বিতীয় পক্ষের কাছে কোন বর্ধিত ভাড়ার দাবি করিতে পারিবেনা।
- ৭। বাসায় কোন প্রকার অসামাজিক বা অবৈধ ব্যবসা পরিচালনা করা যাবে না। দ্বিতীয় বাসাটি অন্য কাউকে কিংবা উপভাড়া দিতে পারিবেনা।
- ৯। দ্বিতীয় পক্ষ বাসাটি প্রথম পক্ষ থেকে যে ভাবে বুঝিয়ে নিবে বুক্তি মেয়াদ শেষে ঠিক সেই ভাবে ফেরত দিবেন।
- ১০। দ্বিতীয় পক্ষ বাসাটি কোন ব্যক্তি বা প্রতিষ্ঠানের কাছে লীজ বা বন্ধক দিতে পারিবেনা।



গণপ্রজাতন্ত্রী বাংলাদেশ সরকার

₳ ১০০



₳ ১০০

একশত টাকা

কজ ০১৯২০৪৬

পাত - ৩

- ১১। বাসার কোন প্রকার ক্ষতি সাধন করিলে তা নিজ খরচে মেরামত করিবেন।
- ১২। দ্বিতীয় পক্ষ মালিকের নিয়মানুসার সঙ্গতরূপে মেনে চলতে বাধ্য থাকিবেন।

আমরা উভয় পক্ষ মূক্তি নামার সকল শর্ত মেনে স্বাক্ষরগণের উপস্থিতিতে ০১/১১/২০১৫ স্বাক্ষর করিলাম।

প্রথম পক্ষ

দ্বিতীয় পক্ষ

ৱাঃ ১১১১১১১১

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স্বাক্ষরগণঃ

ৱাঃ ১১১১১১১১

