CHAPTER TWO: APPROACH AND METHODOLOGY

2.1 Introduction

First of all, the consultants reviewed different national policies and plans. Then, they developed a general survey methodology for conducting formal informal economic survey. Then appropriate personnel of formal and informal economic units were being interviewed with the approved questionnaire (Please see Annexure-I). The following reports are the general elaboration of the followed methodology of the survey. The consultants used convenient survey technique under non-probability sampling technique to collect questionnaire based primary data for formal informal economic analysis.

2.2 Sample Selection

Three criteria usually will need to be specified to determine the appropriate sample size: the level of precision, the level of confidence or risk, and the degree of variability. The determination of sample size for this project is concerned with the following issues under the assumption that the characteristic of the population to different homogenous group.

- The definition of the population;
- The creation of sampling frame;
- The choice of Probability versus Non-probability sampling;
- The calculation of sample size.

The definition of the population: Different types of formal and informal economic units are being considered as the population for this formal-informal economic survey (BBS, 2011).

The creation of sampling frame: The standard rule for sampling frame has been followed based on SRS (Simple Random Sampling).

The choice of Probability versus Non-probability sampling: Probability sampling has been followed.

The calculation of sample size: To determine the minimum sample size the following formula has been followed: $n = \frac{z^2}{d^2} pq$

Where,

$n = Sample\ size$,

$z = Statistical$ certainty $chosen$,

$p = \text{Coverage rate/estimated prevalence}$,

$q = 1 - p$ and

$d = \text{precision desired} : 0.05$

Then, they used stratified sampling technique under probability sampling technique to collect questionnaire based primary data for formal-informal economy analysis. The stratified sampling technique is further used for collecting samples from all the sub zones such as industries, hawkers etc. of this Upazila. For each types then random sampling technique is used to select the industries for survey using Microsoft excel.

2.3 Tools Development

The Survey tool was developed following the below steps. (1) Review of National Policies and Plans (2) Collection of Upazila Map (3) Find out sectors, indicators and variables (4) Preliminary questionnaire develop and share with Team leader as well as Project Management Office (5) Pretesting at field level (6) Questionnaire Finalization.

2.3.1 Preparation of Questionnaire

In order to conduct the survey, a compact and extensive pre-coded structured questionnaire (please see Annexure-01) has been prepared for all the packages and it has been approved by the authority of Urban Development Directorate (UDD). The questionnaire has intended to capture information according to the provided format in the TOR.

2.3.2 Pre-testing

The questionnaires were pretested with formal and informal economic units with participation of survey team (Survey supervisors, Enumerators) and members of Project management team. Then the survey team discussed about the field level problem with the economic expert, Team leader and Project Management team for finalization of Questionnaire format.

2.3.3 Training of Enumerators and Survey Supervisors

JV of SCPL-ABL considered the experience of working in similar types of survey functions and educational qualifications for selection in the formal-informal economic survey team. Considering these issues, a survey team of 21 members were selected for carrying out the survey work at Shibpur Upazila (see Annexure-II). An arrangement has also been made to provide orientation and training to the survey team by the Team Leader (TL). After orientation and training at the headquarters of JV of SCPL-ABL, the survey team has been sent to the field.

2.3.4 Survey Team Mobilization

The survey started in 12.08.2015 and the total survey is taken about 30 days from that date.

2.4 Quality Control Measures

To ensure quality of data, a number of validation checks were conducted during data collection period:

(a) The survey supervisor went back to the respondent as well as talked over mobile phone number for validate or accurate the collected data by enumerator.
(b) After data collection had been completed, some economic units were randomly chosen, and then the supervisors went to the field for further investigation. If any inconsistencies were found, then the supervisors discussed the issue with the enumerators.
(c) Project Manager from Project Management Office as well as formal-informal economic expert had been checked randomly for quality of collected data.

2.5 Database Preparation and Processing

After completing the survey works in the field (Annexure-II), a detail database has been prepared to follow the survey questionnaire. The database has prepared by using SPSS 20 software. To make the data input process easier, coding system has been used in the necessary field. Few data have been stored in MS Excel software. 3 micro computers are exclusively used for data entry. SPSS 20 software is used for all data management that has been collected from the field. In this chapter socioeconomic survey data have been presented into three forms/styles viz. tabular form, geographical and textual/report form.

CHAPTER THREE: REVIEW OF PLAN AND POLICIES

3. 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 plans and policies viz. Plans - the Five Year Plans, later Poverty Reduction Strategy Paper (PRSP), Vision 2021; Vision 2021-2041; 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 Shibpur Upazila. 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 this section, penitent national plans and policies have been critically reviewed to provide guidance to prepare an appropriate and sustainable economic development plan for the Upazila in line with the TOR of the consultancy services.

3.2 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:

1. End poverty in all its forms every where
2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture
3. Ensure healthy lives and promote well-being for all at all ages
4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.
5. Achieve gender equity and empower all women and girls
6. Ensure availability and sustainable management of water and sanitation for all.
7. Ensure access to all affordable, reliable, sustainable and modern energy for all
8. Promote sustainable, inclusive and sustainable economic growth, full and decent work for all;
9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation;
10. Reduce inequality within and among countries;

11. Make cities and human settlements inclusive, safe, resilient and sustainable;
12. Ensure sustainable consumption and production pattern;
13. Take urgent action to combat climate change and its impacts
14. Conserve and sustainably use the oceans, sea and marine resources for sustainable development;
15. Protect, restore and promote, sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and revers land degradation and biodiversity loss;
16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels;
17. Strengthen the means of implementation and revitalize the global partnership for sustainable development;

In illustration of these goals, some targets have proposed to meet the goals of SDG. Some relevant targets to meet up the goals related to the formal informal economic sector are mentioned below:

Goal 1: Poverty Elevation

Target 1.3: Ensure all men and women in poor and vulnerable, have equal rights to economic resource and access to basic services, ownership and control over land and other forms of property, inheritance, natural resource appropriate new technology and financial services including microfinance.

Target 1.5: Build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters.

Goal 5: Gender Equality

Target 5.1: End all forms of discrimination against all women and girls everywhere.

Target 5.3: Eliminate all forms of violations against all women and girls in the public and private spheres, including trafficking and sexual and other types of exploitation.

Goal 9: Sustainable Infrastructure and Industrialization

Target 9.2: Promote inclusive and sustainable industrialization by 2030, significantly raise industry's share of employment and gross domestic product, in line with national circumstances, and double its share in least developed countries.

Target 9.4: Upgrade infrastructure and retrofit industries to make them sustainable, with increase resource-use efficiency and greater adaptation to clean and environmentally sound technologies and industrial processes.

Goal 12: Sustainable Consumption and Production Patterns

Target 12.6: Encourage companies, especially large and transnational companies, to adopt sustainable practices to integrate sustainable information at reporting cycle.

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 Shibpur 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.

3.3 Development Goals of Bangladesh: Vision 2021 and 2041

Vision 2021 was the political manifesto of the Bangladesh Awami League party before winning the National Elections of 2008. It stands as a political vision of Bangladesh for the year 2021, the golden jubilee of the nation. The policy has been criticized as a policy emblematic of technological optimism in the context of Bangladesh and the state repression of media, low internet penetration, inadequate electricity generation. The 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.

The main goal is for Bangladesh to become a middle income country where poverty will be completely eradicated. Economic development & initiatives identified are:

a. Meeting basic needs
b. Population and labor force
c. Alleviation of poverty
d. Food & nutrition
e. Health care center
f. Education
g. Industry
h. Energy security
i. Infrastructural development
j. Housing
k. Environment
l. Water resources

3.4 Perspective Plan (2010 – 2021)

A nation without vision is a nation gone astray. Such is not the case for Bangladesh whose independence in 1971 was the culmination of a people's struggle, as much for political freedom as it was for 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.

Vision 2021 stipulates middle income status for Bangladesh by 2021, reaching annual GDP growth rate of 10% by that year and averaging 9.2% for the period 2011-21. Fulfillment of this vision requires superior double digit performance for manufacturing taking its share in GDP to 27 percent by 2021, and that of industry to 37 percent. Accelerated pace of industrialization will be necessary to address the increasingly diminishing capacity of agriculture to absorb the incremental labour force, strengthen backward and forward linkages with agriculture and services sectors, cater to the growing domestic demand for industrial goods, and take advantage of emerging opportunities in the global market.

3.5 Seventh Five Year Plan (SFYP)

The Government's Vision 2021 defines several economic and social outcomes for Bangladesh to achieve by 2021. To convert this Vision into long-term development targets, a Perspective Plan 2010-2021 was prepared. The targets of Vision 2021 and the associated Perspective Plan 2010-2021 were to be achieved through the implementation of two five-year plans, the Sixth Five Year Plan (2011-15) and the Seventh

Five Year Plan (2016-2020). The 6th FYP made solid progress in increasing per capita income and reducing poverty through a strategy of pro-poor economic growth. The Seventh Five Year Plan has targets for economic growth, employment, poverty reduction, human resources development, gender balance and environmental protection. If the targets are achieved, the socio-economic environment of the country will transform it from a low-income economy to the first stages of middle-income country. Goals and Targets of 7th FYP are:

A. Income and poverty

- Attaining average real GDP growth of 7.4% per year over the Plan period.
- Reduction in the head-count poverty ratio by 6.2 percentage point.
- Reduction in extreme poverty by about 4.0 percentage point.
- Creating good jobs for the large pool of under- employed and new labor force entrants by increasing the share of employment in the manufacturing sector form 15 percent to 20 percent.

B. Sector Development

- Increase the contribution of the manufacturing sector to 21% of GDP by FY20.
- Substantial improvement of export to $54.1 billion by FY20. Achieving a Trade & GDP ratio of 50% by FY20.

C. Urban Development

- Access to improved water source will be ensured for all urban dwellers.
- Coverage of drainage system to be expanded to 80%
- Ensure sustainable urban development that supports increased productivity, investment and employment.

3.6 National Social Security Strategy (NSSS) of Bangladesh

The Government's Social Security Strategy is a part of policies and programs that comprises the Social Development Framework. This forms a wider umbrella incorporating the Government's poverty reduction strategy and strategies on education, health, nutrition, population, sanitation and water supply, financial inclusion, women and gender empowerment, social inclusion of ethnic and religious minorities, environmental protection, climate change management, disaster management and social security. The aim of this framework is to have a comprehensive and consistent set of policies that can help Bangladesh achieve better equity and social justice in the context of its development effort.

3.7 Other National Policies

The following national policies have also been studied:

- National Agriculture Policy, 2004
- 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

- National Plan for Disaster Management 2008-2015
- Disaster Management Act 2012 and Disaster Management Policy 2015

3.8 Private Sector Developments

During the reconnaissance & economic survey period, 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 Shibpur 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 have also been studied.

3.9 Linkage of Policies, Plans and Acts/Rules Related to Economic Development of Shibpur

The above mentioned vision, plan, policies and strategies will be prepared considered for preparation of development plan Shibpur upazila. The sectoral policies will also be reflected in the final plan preparation

CHAPTER FOUR: FORMAL ECONOMIC SURVEY

4.1 Introduction

The major formal types of economic activities in Shibpur are: 1) Brick Field 2) Handicrafts 3) Ice cream factory 4) Rice mill 5) Workshop 6) Yarn and Fabrics industry 7) Building materials 8) Cottage 9) Cottage and Handicrafts and 10) Flour mill. The locations of interviewed economic unit's personnel are given below:

Table 4.1 Type of Industries with Location

	Brick Field	Handicrafts	Ice cream factory	Rice mill	Workshop	Yarn and Fabrics	Building materials	Cottage	Cottage and Handicrafts	Flour mill	Food processing	Total
Ayubpur	1	0	0	0	0	0	0	0	0	0	0	1
Chakradha	1	1	0	0	0	0	2	1	2	0	0	7
Masimpur	0	0	0	2	2	0	1	0	0	0	0	5
Putia	2	0	0	0	0	4	0	0	0	0	0	6
Sadharchor	0	0	1	1	1	0	0	0	0	0	0	3
Shibpur	0	0	0	0	0	0	0	0	0	1	1	2

Source: Field survey 2015

There are 4 brick fields in this Upazila. One is located at Ayubpur and Chakradha. Rest of twos are located at Putia. These two brick fields are contributing to develop the local household and infrastructure development functions. Chakradha union contains the highest number (7) of industries interviewed. Along with brick field, it also has 1 handicraft, 1cottage, 2 building materials and 2 cottage & handicraft industries. Cottage industries play vital role to supply local cotton based products. Putia Union contains the second largest (6) number. Along with brick field, it also possesses 4 yarn and fabrics industries. Masimpur union has 2 rice mill, 2 workshop and 1 building materials industries. In Sadharchor union 1 ice cream factory, 1 rice mill and 1 workshop are interviewed. On the other hand, Shibpur union contains 1 flour mill, and 1 food processing industries. Those are employing few people at food processing unit. It has been seen that there are various types of industries are located varying from brickfields to small workshops in Shibpur upazila.

4.2 Ownership Pattern

Most of the formal economic units (about 87%) ownership pattern is private. Rest of them is owned by limited companies. Thus, most of the employments of this upazila are from private sectors. Moreover, it has also been seen that, there are no government owned company is working here (Please see figure 4.1).

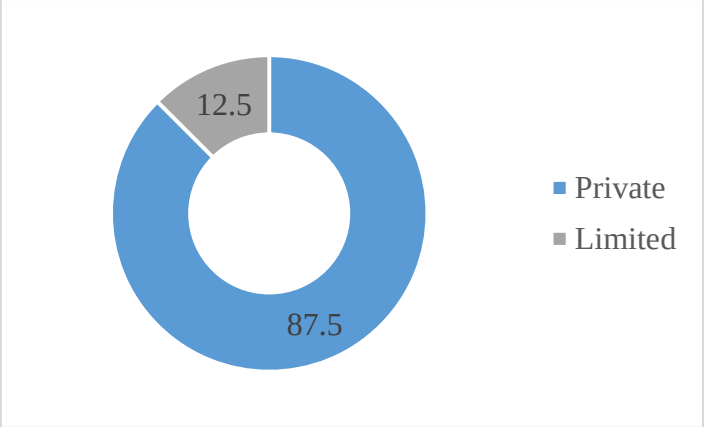


Figure 4.1: Ownership patterns of formal economic units (Source: Field Survey, 2015)

4.3 Area Occupied

It has been found that about half of total formal economic units needs area less than 0.1 acre. About one third of total also need more than 0.1 but less than 1 acres. In addition, the brick fields mainly need more land (more than 10 acre) than others (Please see figure 4.2).

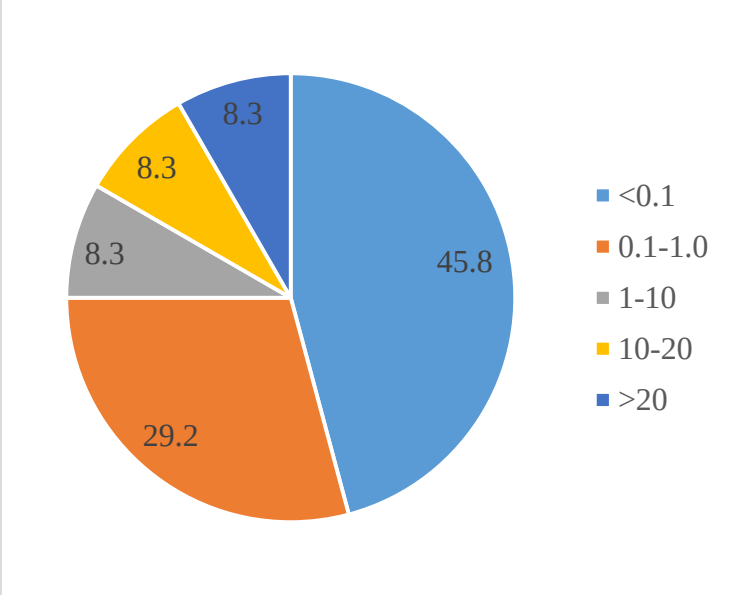


Figure 4.2: Area occupied by formal economic units in acre (Source: Field Survey, 2015)

4.4 Number of Employees

It has been found that two third of total brick fields need more than 100 people. Rest of them need less than 100 but more than 10 people. On the other hand, almost all of the handicrafts, ice cream factories, workshops and cottage industries need less than 10 people. About two third of total rice mills and almost all of the yarn & fabrics industries need more than 10 and less than 150 people. Thus, in this upazila comparatively brick fields employ more people than others.

Table 4.2: Distribution of no. of employees (in percentage) by types of industries

	<10	10-100	100-150	>150
Brick Field		25.0	50.0	25.0
Handicrafts	100.0			
Ice cream factory	100.0			
Rice mill	33.3	66.7		
Workshop	100.0			
Yarn and Fabrics industry		50.0	50.0	
Building materials	66.7	33.3		
Cottage	100.0			
Cottage and Handicrafts	50.0	50.0		
Flour mill	100.0			
Food processing	100.0			

Source: Field Survey, 2015

4.5 Male-Female Ratio in Different Types of Industries

It has been found that, most of the industries have little or no participation of female in their industries. In cottage & handicraft industries highest number of female participation has observed. In that particular types of industries about two third of total employees are female. Rice mills employed the second highest (about one third) female employees. In brick fields also about 17% of total employees are found female.

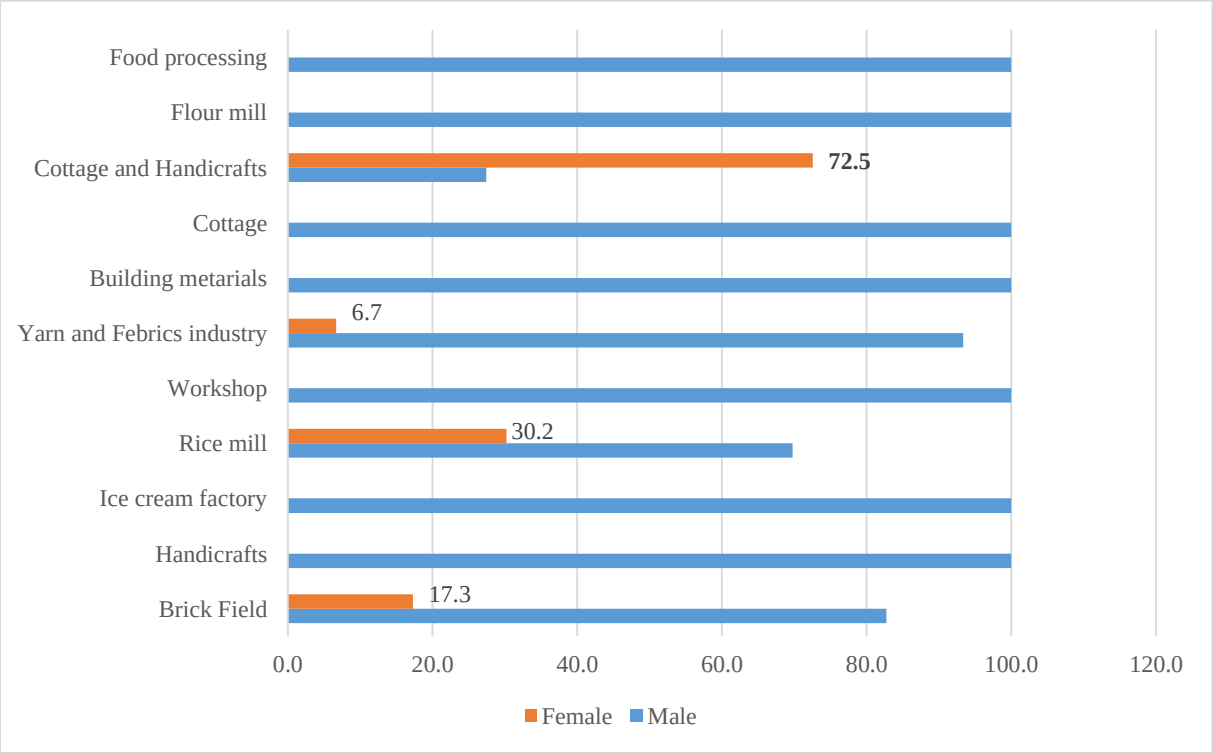


Figure 4.3: Male-Female Ratio in Different Types of Industries (Source: Field Survey, 2015)

4.6 Raw Materials

4.6.1 Major Raw Materials

Major raw materials vary by different types of industries. For instance, major raw material for brick field is soil, whereas bamboo is the major raw material of cottage industries and handicraft industries. Again sugar is mentioned as one of the major raw materials for ice cream factories. Iron and rod are the major raw materials for workshop. Moreover, flour is the major raw materials for food processing industries, whereas paddy is for rice and turmeric is for flour mill. Though major raw materials vary from industries to industries, except yarn and fabrics industries, almost all of the industries' major raw materials' sources are local market. Thus, the upazila is self-sufficient in the perspective of supply of major raw materials for most of the industries.

Table 4.4: Major raw materials (in percentage)

Industries	Major raw materials
Brick Field	Soil
Handicrafts	Bamboo
Ice cream factory	Sugar
Rice mill	Paddy
Workshop	Iron (66.67), Rod (33.33)
Yarn and Fabrics industry	Yarn
Building materials	Brick or broken bricks (66.67), Iron (33.33)
Cottage	Bamboo
Cottage and Handicrafts	Bamboo
Flour mill	Turmeric
Food processing	Flour

Source: Field Survey, 2015

4.6.2 Minor Raw Materials

Apart from the major raw materials, the industries also used some minor raw materials. For example, brick fields also used coal, sand and diesel in their industries. And almost all of the coal's source is other regions. Apart from these, most of the industries' (except yarn and fabrics) minor raw materials' source is local market. Moreover, food processing industries used sugar, and ice cream factories used flour as their minor raw materials. Again flour mills used chilly in their industries. Workshops also used Plain Sheet as their minor raw materials.

Table 4.5: Minor raw materials (in percentage)

Industries	Minor raw materials
Brick Field	Sand, Coal, Diesel (33.33% each)
Handicrafts	Guna
Ice cream factory	Flour
Workshop	Plain sheet
Yarn and Fabrics industry	Parts (66.67), Diesel (33.33)
Building materials	Sand (66.67), Sheet (33.33)
Cottage	Plastic
Cottage and Handicrafts	Cloths

Flour mill	Chilly
Food processing	Sugar

Source: Field Survey, 2015

4.6.3 Other Raw Materials

Building Materials industries also mentioned as cement, rod and GP sheets are the other raw materials they used. Whereas, food grade color is another raw material used in food processing. Ice cream factory also used milk as their raw materials in their industries. As most of the workshop works have been done by electricity, the industries also mentioned it along with steel and color sheet as their raw materials. In addition, almost all of the raw materials have been collected from local markets. Thus, the economy of this upazila is strong enough to support its own production.

Table 4.6: Other raw materials

Industries	Other raw materials
Ice cream factory	Milk
Workshop	Color sheet (50), Steel (50)
Yarn and Fabrics industry	Needle
Building materials	Cement, Rod, GP sheet (33.33% each)
Cottage and Handicrafts	Yarn
Flour mill	Chilly
Food processing	Color

Source: Field Survey, 2015

4.7 Products and Their Market

It has been seen that brick fields, yarn and fabrics industries along with cottage and handicrafts industries exported their products in other markets. Whereas cottage and handicrafts industries export most of their products (about 95%). Apart from these, most of the industries' product only supports the local needs.

Table 4.7: Products and Their Market

Industries	Product	Local (%)
Brick Field	80	20
Handicrafts	100	0
Ice cream factory	100	0
Rice mill	100	0
Workshop	100	0
Yarn and Fabrics industry	55	45
Building materials	100	0
Cottage	100	0
Cottage and Handicrafts	5	95
Flour mill	100	0
Food processing	100	0

Source: Field Survey, 2015

4.8 Production Amount and Their Yearly Price

It can be seen in Table 4.8 that production of different products in this upazila and their yearly price has been given. Here, brick fields produced average 4712500 pcs of brick per year which yearly price is highest (about BDT 3,56,75,000) among other products. Rice mills positioned in second (BDT 1,16,00,000) in the perspective of yearly price of production. On the other hand, food processing industries produce about 87.6 tons' products yearly which yearly production price is the next highest (BDT 87,60,000).

Table 4.8: Production amount and their yearly price

Industries	Amount of Production	Unit	Avg. Price in BDT
Brick Field	4712500	pcs in year	3,56,75,000
Ice cream factory	54000	pcs in year	6,48,000
Workshop	252	pcs in year	8,30,000
Building materials	5630	pcs in year	24,90,000
Cottage	9125	pcs in year	36,500
Cottage and Handicrafts	27500	pcs in year	2,87,500
Rice mill	998	tons per year	1,16,00,000
Workshop	13	tons per year	8,30,000
Yarn and Fabrics industry	3.5	tons per year	8,88,333
Flour mill	10.95	tons per year	2,19,000
Food processing	87.6	tons per year	87,60,000
Handicrafts	750	gauge/meter per year	45,000
Yarn and Fabrics industry	48250	gauge/meter per year	8,88,333

Source: Field Survey, 2015

4.9 Mode of Transportation of Raw Materials

About one-third total industries use Van/Rickshaw as their primary mode of transportation for raw materials. This is because, as discussed earlier the major source of raw materials and products produced are the local markets. Moreover, about more than one-fourth of total industries also used tempo/*nosimon* as their primary mode of transportation. In addition, about more than one third (37%) of total industries also used truck and pickup as their primary mode of communication.

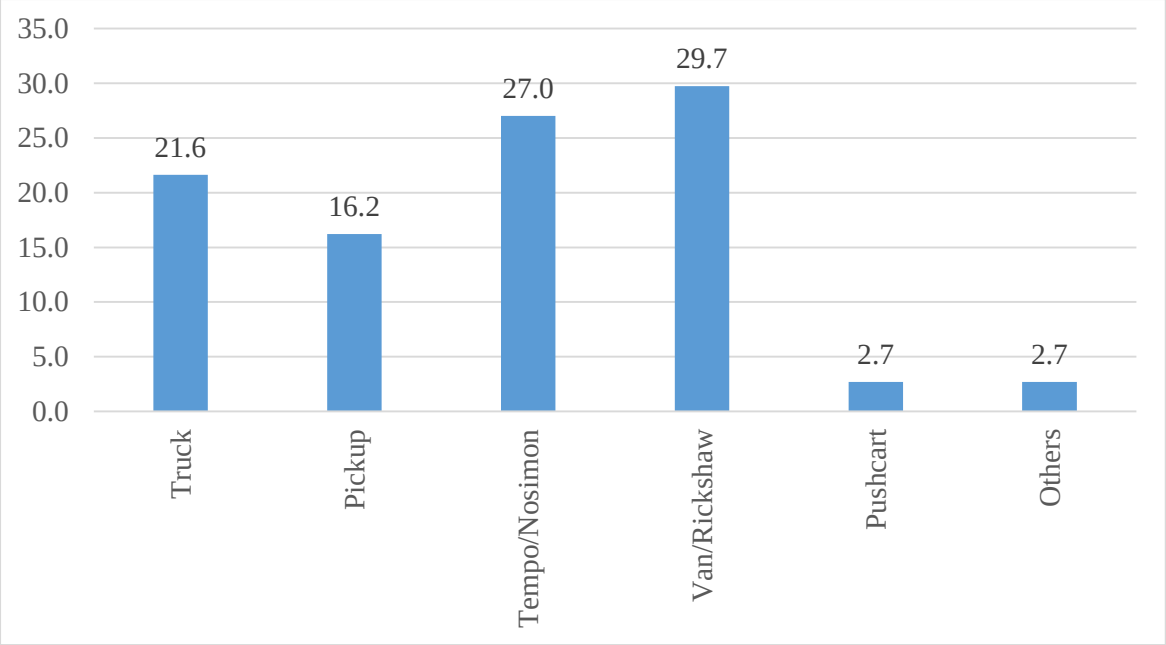


Figure 4.4: Mode of transportation of raw materials (Source: Field Survey, 2015)

4.10 Solid Waste, Management and Environment

a. Waste disposal site

From the survey it has been found that brick fields make highest amount (62.5 tons) of solid waste whereas cottage handicraft industries make about 1.5 tons of solid waste. And rest of the types of industries produce less than one tons of solid waste. About more than half of them dispose the waste into roadside. About 200% of total industries try to use the wast as poultry & dairy food and to sell. But the alarming is that about one fourth of total industries also use agricultural land as waste disposal site (please see figure 4.5). Whereas, about 28% of total waste is non-refined.

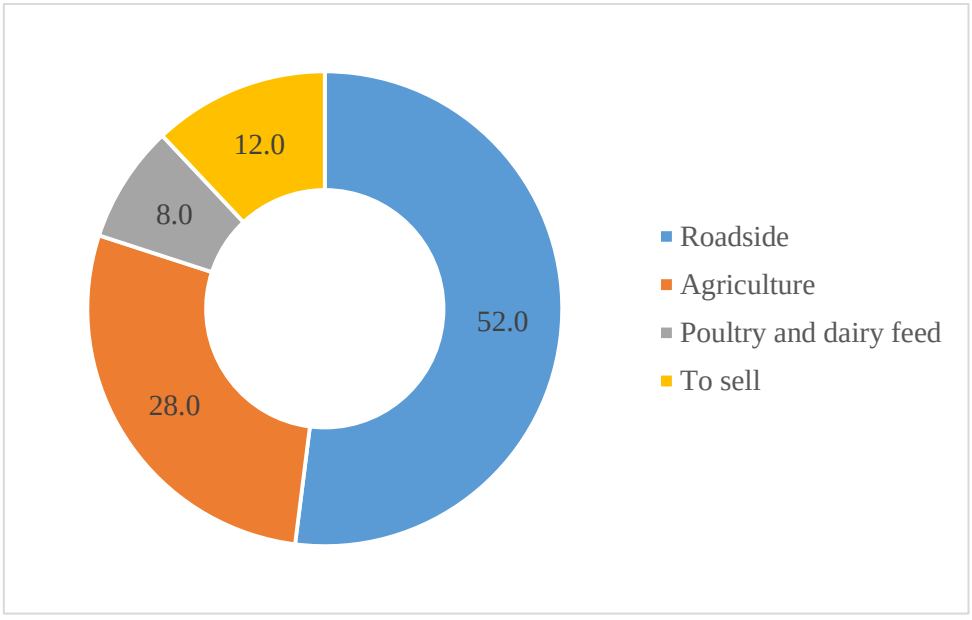


Figure 4.5: Waste disposal site (Source: Field Survey, 2015)

b. Availability of waste treatment system

Moreover, approximately more than two third of total industries said they do not have any waste treatment system (please see figure 4.6). Thus, the waste disposal condition of the industries of this upazila is unhealthy and unplanned. Necessary steps should be taken regarding these.

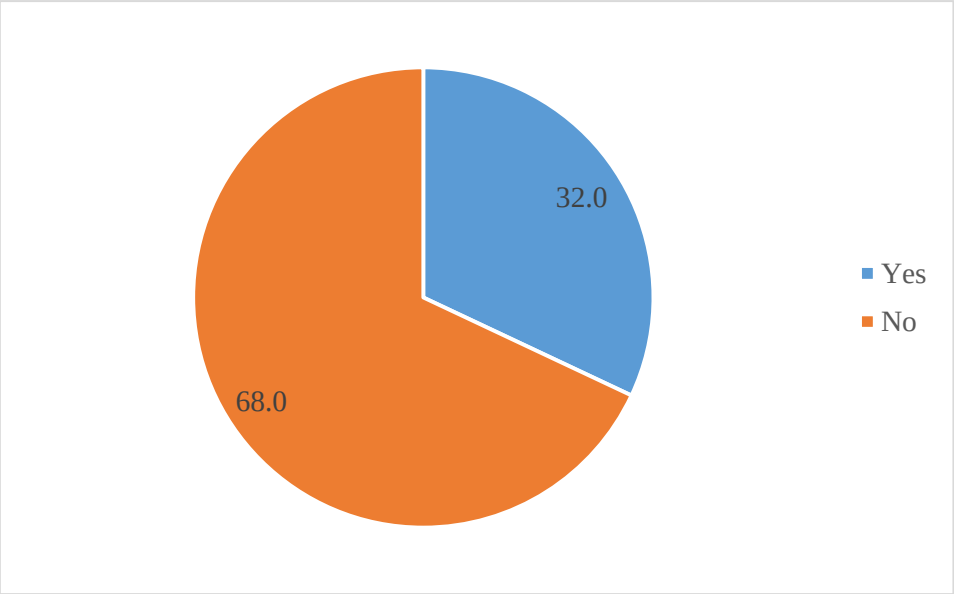


Figure 4.6: Availability of waste treatment system (Source: Field Survey, 2015)

c. Measures taken against pollution

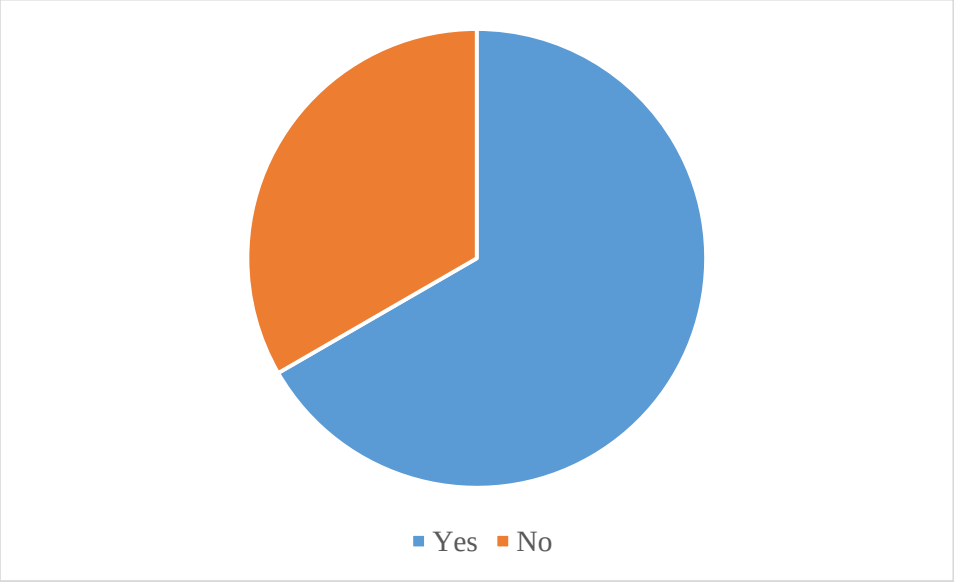


Figure 4.7: Availability of environmental clearance (Source: Field Survey, 2015)

In addition, alarming is that, about more than 90% of total industries mentioned that they do not take any measurements regarding against pollution (please see figure 4.8). In addition, not a single industries completed their Environmental Impact Assessment (EIA) report but about two third of total industries mentioned that they have environmental clearance of the industry (please see figure 4.7).

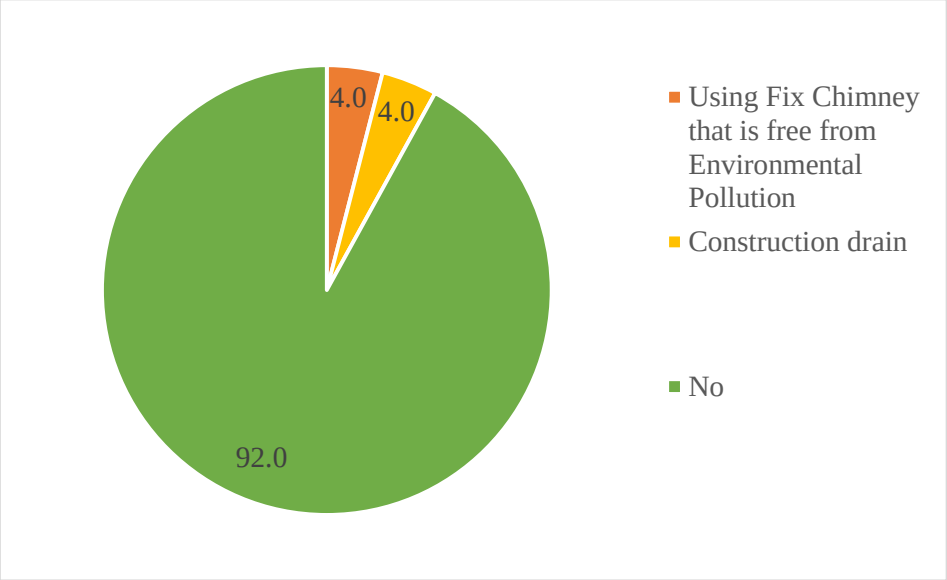


Figure 4.8: Measures taken against pollution (Source: Field Survey, 2015)

4.11 Health Security of the Worker

In approximately 8% of total industries, workers have no health security. But most of the workers of industries (about three fourth of total) opinioned that owner pays on health security of the workers. Thus, in this case, workers get their rights of treatment in most of the time.

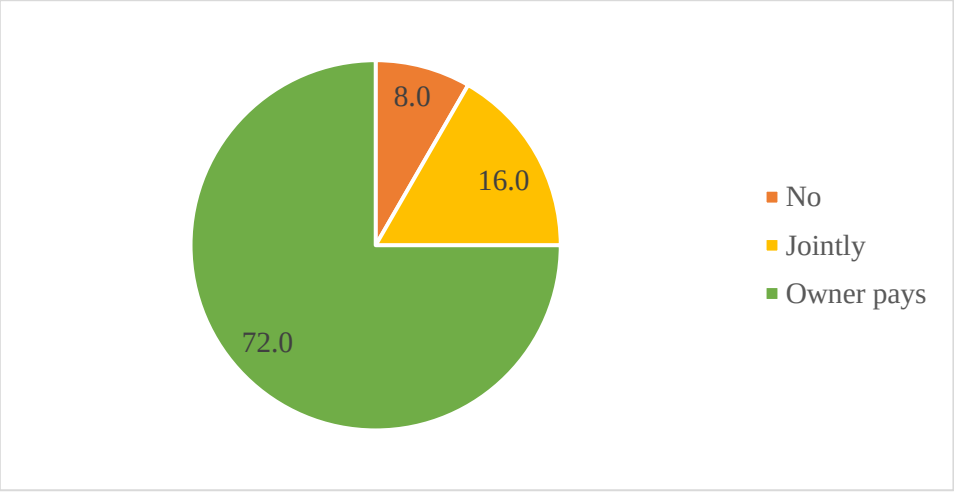
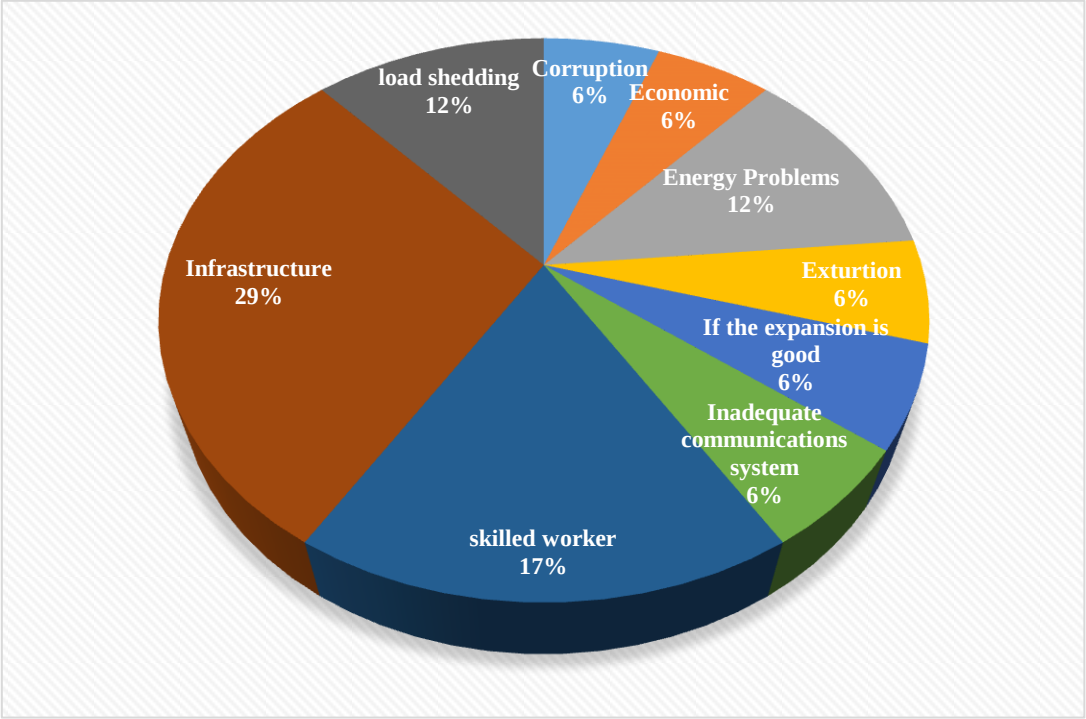


Figure 4.9: Health security of the worker (Source: Field Survey, 2015)

4.12 Problems in the Industries

About 30% (highest) of total industries said that infrastructure is their major problems. Moreover, about one fourth of total industries mentioned that their next major problem is lack of energy (electricity etc.). About 17% of total industries also said that, lack of skilled labor is their major problem. Thus lack of enough infrastructure in this upazila which is mentioned strongly by the industries.

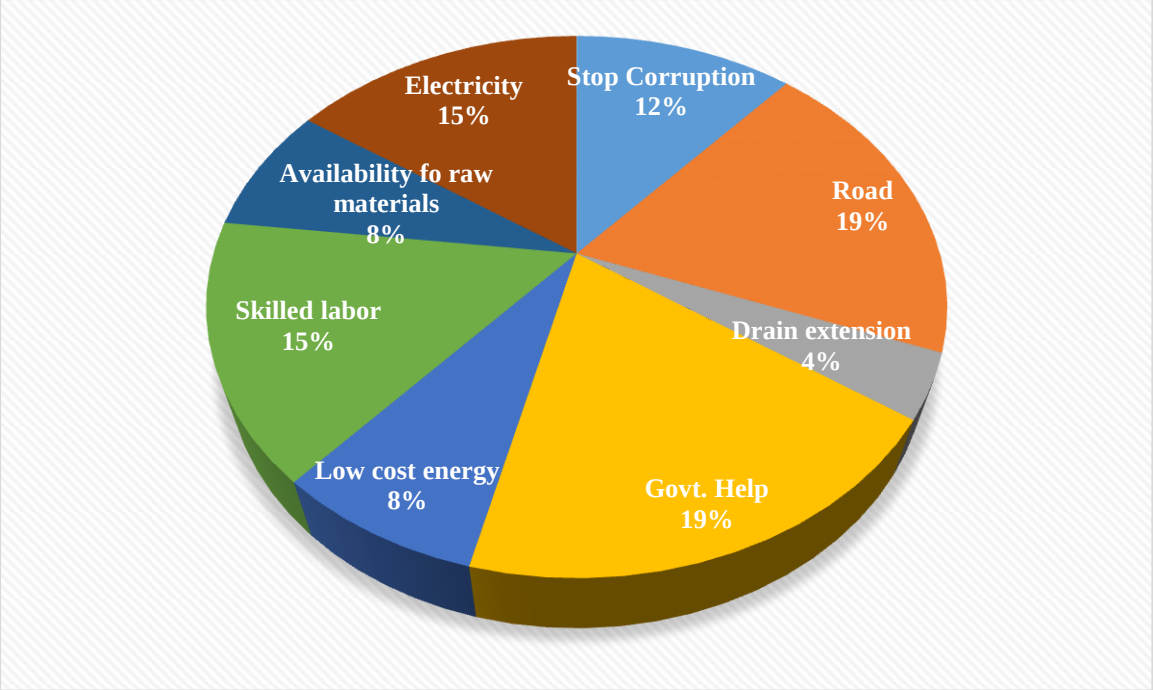
Figure 4.10: Problems in the industry (Source: Field Survey, 2015)



4.13 Suggestions to Solve the Industrial Problems

About one third of total industries notified that the solution of problems like infrastructure problem (road) and electricity problem would be solved by the government's intervention. About 12% also said that increasing the law and order condition, by lessening the occurrence of corruption could also be a significant solution (Please see figure 4.11).

Figure 4.11: Suggestions to solve industrial problems (Source: Field Survey, 2015)



CHAPTER FIVE: INFORMAL ECONOMIC SURVEY

5.1 Introduction

The major informal types of economic activities in Shibpur are: (1) Poultry; (2) Saw mills; (3) Dairy farms; (4) Fisheries ;(5) Furniture making. The locations of interviewed informal economic units are given below:

Table 5.1 Type of Industries with Location

	Poultry	Saw mill	Dairy farm	Fisheries	Furniture making	Total
Baghaba	3	0	0	0	0	3
Chakradha	1	3	1	1	0	6
Dulalpur	0	1	0	4	0	5
Masimpur	0	2	0	0	0	2
Sadharchor	0	1	0	0	0	1
Shibpur	0	0	0	0	3	3

Source: Field survey 2015

Among 5 fish farms, 4 are in Dulalpur, the rest of one in Chakradha union. It supplies fish based food demand in this upazila. 3 furniture making economic unit is located at Shibpur. There are also two saw mills are found in Masimpur, 1 of each in Dulalpur and Sadharchor union, and 3 in Chakradha union. Those play vital role to develop wood based household and other infrastructure development in Shibpur. Total 3 poultry farms found at Baghaba and 1 in Chakradha that plays vital role to meet the meat supply demand at the area. Apart from these 1 1 dairy farm is located at Chakradha union. This union contain highest number (6) of informal economic units in this upazila.

5.2 Ownership Pattern

Most of the informal economic units (about 85%) ownership pattern is private. Rest of them are owned by shareholders. Thus, most of the employments of this upazila are from private sectors. (Please see figure 4.1).

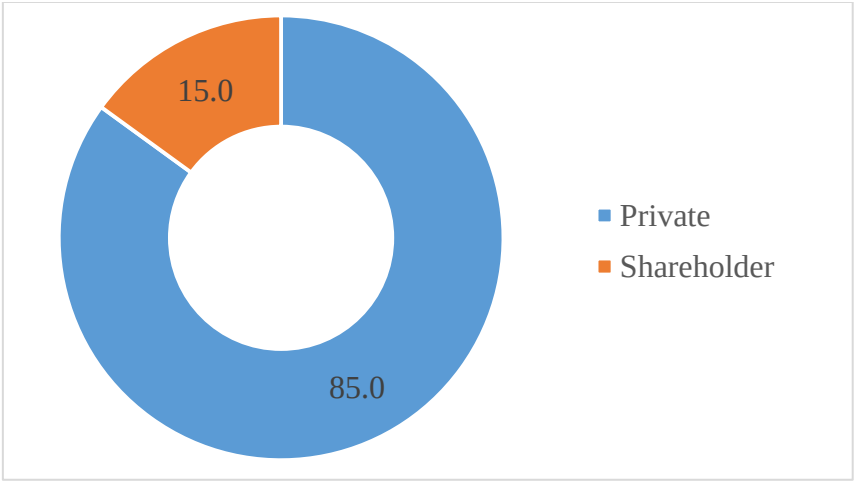


Figure 5.1: Ownership patterns of formal economic units (Source: Field Survey, 2015)

5.3 Area Occupied

It has been found that about same percentage (35%) of total informal economic units needs area more than 0.1 acre but less than 10 acres. This types of economic units are mainly the poultry, dairy, fisheries and saw mills. Among them, the fisheries and some of saw mills mainly need more land (more than 1 acre) than others. About 30% of them needs less than 0.1 acres of land. (Please see figure 4.2)

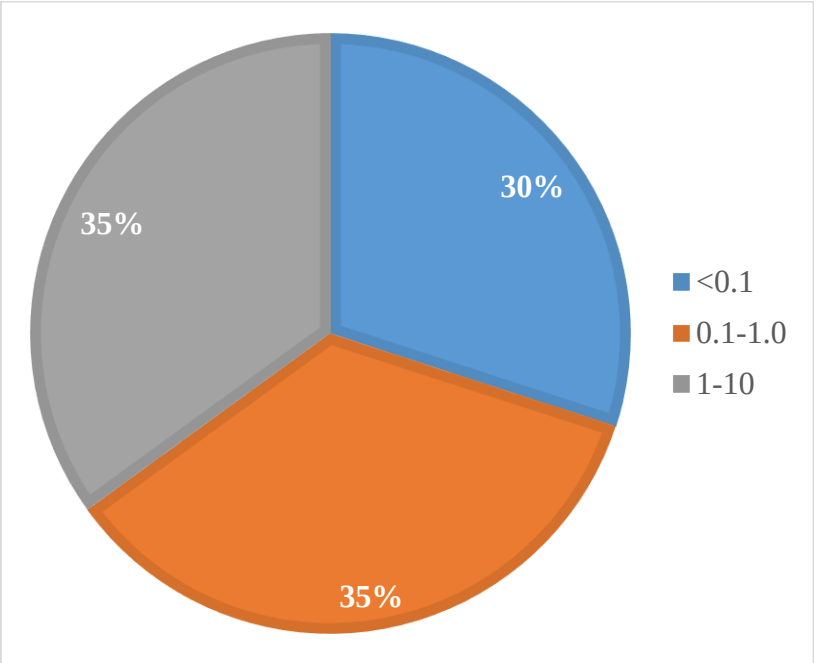


Figure 5.2: Area occupied by formal economic units in acre (Source: Field Survey, 2015)

5.4 Number of Employees

It has been found that except furniture making economic units, almost all of the informal economic units can manage their business with less than 10 people. saw mills need employees between 4 to 6. On the other hand, for furniture making more than 10 people is required.

Table 5.2: Distribution of no. of employees (in percentage) by types of industries

	<10 persons	10-100 persons
Poultry	100.0	
Saw mill	100.0	
Dairy farm	100.0	
Fisheries	100.0	
Furniture making	66.7	33.3

Source: Field Survey, 2015

5.5 Male-Female Ratio in Different Types of Industries

It has been found that, in informal economy also there are significantly low or no participation of women. In poultry and dairy farm, only about one fourth female employees have been found. In rest of the informal economic types, inconsiderable percentage of women is present. Thus awareness program or other appropriate steps should be taken regarding these.

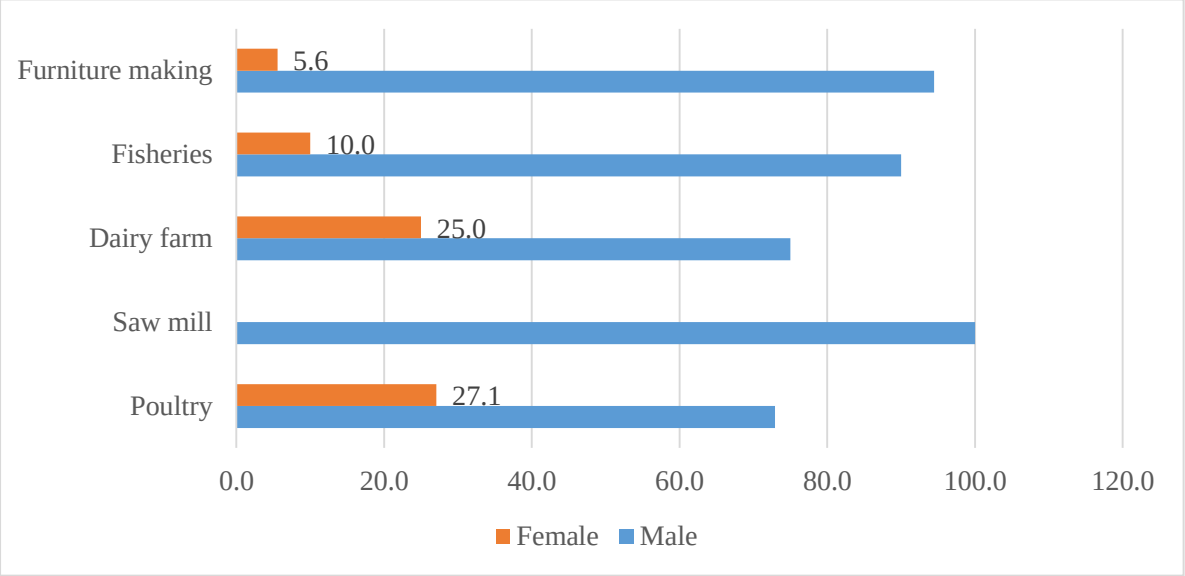


Figure 5.3: Male-Female Ratio in Different Types of Industries (Source: Field Survey, 2015)

5.6 Raw Materials

Major Raw Materials

Major raw materials vary by different types of informal industries. For instance, major raw materials for saw mills is tree, wood and wood powder, whereas Tush, Maize, Soya bean, Kura, Jhinuk, Protein, Medicine and salt, Poultry feed, Maize are the major raw materials for poultry. Again cow is one of the major raw materials for dairy farm. And except saw mills, source of all kinds of raw materials are local market. Thus local markets are sufficient enough to supply the demands for these informal economies. Saw mills about half of their raw materials import from other regions.

Table 5.4: Major raw materials

	Major raw materials
Poultry	*Tush*, Maize, Soya bean, Kura, *Jhinuk*, Protein, Medicine and salt, Poultry feed, Maize
Saw mill	Wood, Tree, Tree Powder
Dairy farm	Cow
Fisheries	Fry, Fish, Fish feed
Furniture making	Wood, Tree, Tree Powder

Source: Field Survey, 2015

Minor Raw Materials

Apart from the major raw materials, poultry farms need some minor raw materials. They need Pituitary Gland Medicine for their farms. In addition, they also mentioned that *tush* another important raw material. Dairy farms said *bhushi* as their minor raw materials. Moreover, fisheries said, Maize, Soyabeen, Oilcake and Bhusi as their minor raw materials. Furniture making informal industries mentioned burnish colors and road as their minor raw materials.

Other Raw Materials

Some of the dairy farms mentioned straw and some of the furniture making economic units mentioned board as their less important raw materials needed for their business.

5.7 Products and Their Market

Products of some Poultry farms are going outside the upazila area to sell their products after meeting demands of the area. Poultry farms exported about 13% of their products outside the upazila. Apart from these, saw mills, dairy farms, fisheries and furniture making economic units' product only support the local needs.

Industries	Local	Others
Poultry	87.5	12.5
Saw mill	100	0
Dairy farm	100	0
Fisheries	100	0
Furniture making	100	0

Table 5.5: Products and Their Market

Source: Field Survey, 2015

In below table production of different informal economic units in this upazila and their yearly price has been given. Here, fisheries produced about 5.5 tons of their product per year which yearly price is highest (about BDT 76,00,000) among other products. Home appliances by furniture makers positioned in second (BDT 37,80,000) in the perspective of yearly price of production. Dairy farms produced about 14.6 tons of their product yearly, which yearly production price is the lowest (6,57,000).

Table 5.6: Average production amount and their yearly price

	Production	Units	Yearly price of products in BDT
Poultry	105600.0	Pcs per year	16,15,000
Saw mill	11350.0	gauge/meter per year	11,98,143
Dairy farm	14.6	tons per year	6,57,000
Fisheries	5.5	tons per year	76,00,000
Furniture making	193.0	Pcs per year	37,80,000

Source: Field Survey, 2015

5.8 Mode of Transportation of Raw Materials

About one third of total informal economic units use Van/Rickshaw as their primary mode of transportation for raw materials. This is because, as discussed earlier the major source of raw materials are the local markets. Moreover, about one-fourth of total informal economic units also used tempo/*nosimon* as their primary mode of transportation. In addition, about the same percentage (25%) of informal economic units also used truck as their primary mode of communication.

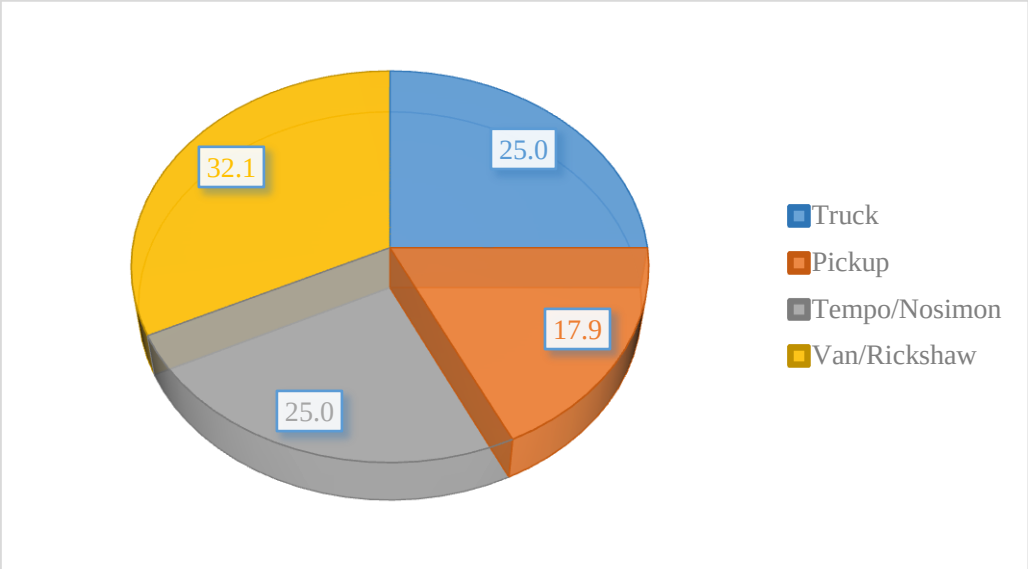


Figure 5.4: Mode of transportation of raw materials (Source: Field Survey, 2015)

5.9 Solid Waste, Management and Environment

From the survey it has been found that fisheries make highest amount (10 tons) of solid waste. Saw mill and only poultry farms make about 2 tons of solid waste yearly. And rest of the types of industries produce less than one tons of waste. Only dairy farm's half of total waste is liquid waste. For rest of the types the whole waste is solid waste. About 30% of total informal economic units dispose the waste into roadside. But the alarming is that about 70% of them also use agricultural land as waste disposal site (please see figure 4.5). Moreover, the waste contained both of refined (40%) and non-refined (60%) waste.

Table 5.7: Average waste produced

	Waste Produced (tons per year)
Poultry	0.097
Saw mill	0.43
Dairy farm	0.2
Fisheries	10
Furniture making	0.06

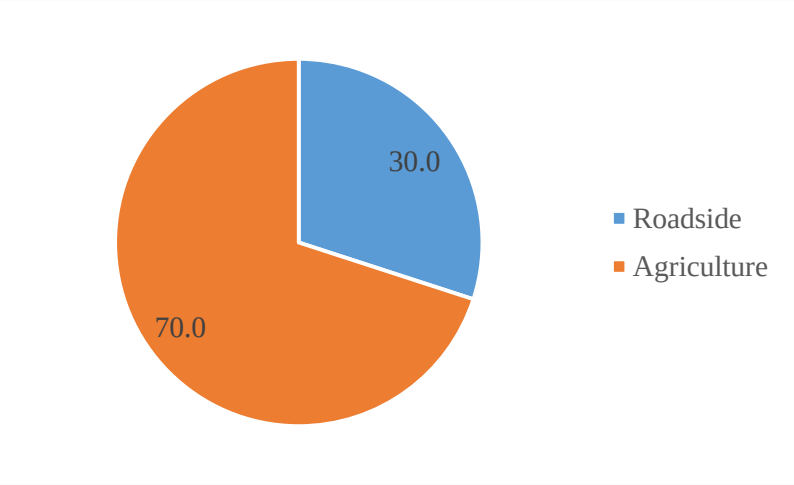


Figure 5.5: Waste disposal site (Source: Field Survey, 2015)

Moreover, approximately more than two third of total informal economic units said they do not have any waste treatment system (please see figure 5.6). Thus, the waste disposal condition of the industries of this upazila is unhealthy and unplanned. Necessary steps should be taken regarding these.

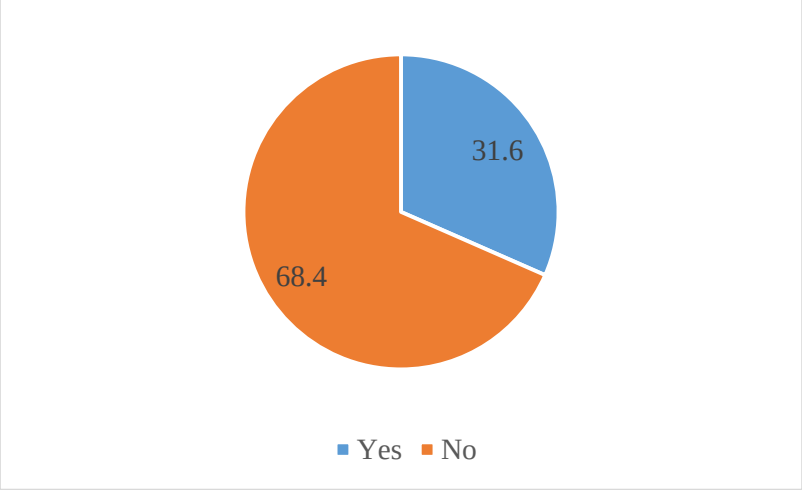


Figure 5.6: Availability of waste treatment system (Source: Field Survey, 2015)

Regarding measures taken against pollution generated by the organization about 35% of informal economic units (poultry farms, fisheries) mentioned that they dumped the waste under the soil, thus it could produce the fertilizer.

But alarming is that, about half of total industries mentioned that they do not take any measurements regarding against pollution (please see figure 4.7). In addition, not a single economic units completed their Environmental Impact Assessment (EIA) report and do not have any environmental clearance (please see figure 5.7)

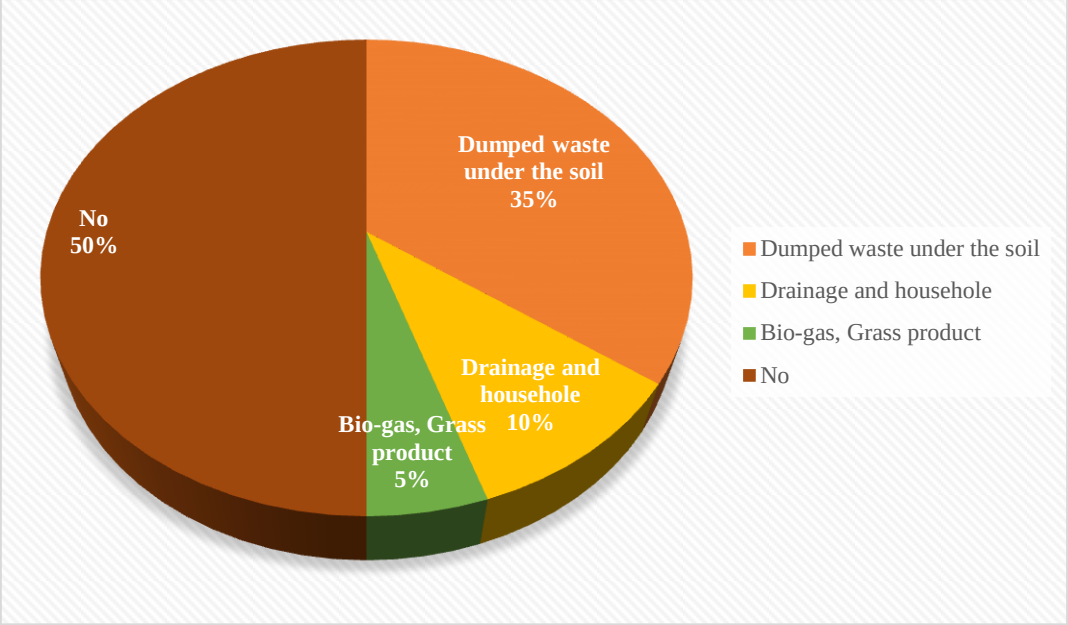


Figure 5.7: Measures taken against pollution (Source: Field Survey, 2015)

5.10 Health Security of the Worker

Most of the workers of industries (about three fourth of total) owner pays on health security of the workers. And for the 15% cases the organization pay the health expenditures if it happens on working time. Thus, in this upazila, workers get their rights of treatment in most of the time.

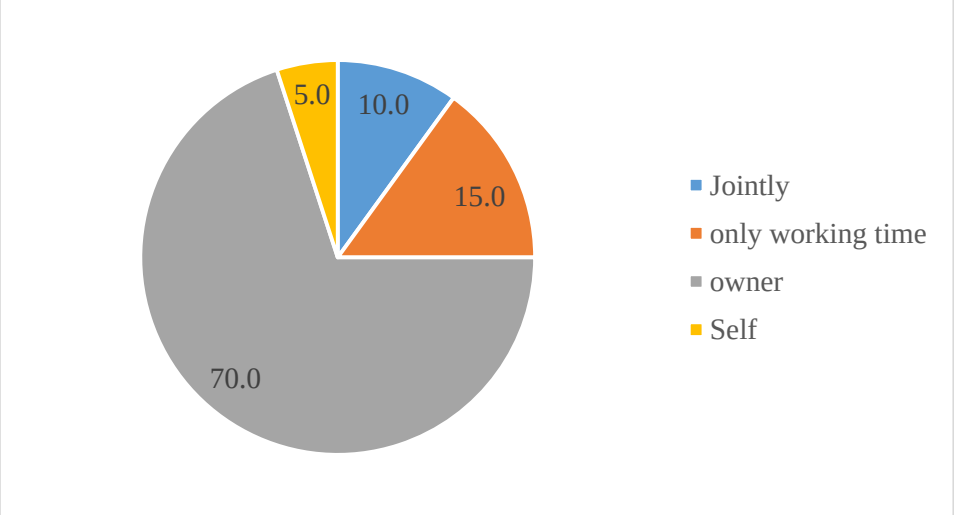


Figure 5.8: Health security of the worker (Source: Field Survey, 2015)

5.11 Problems in the Industries

About more than half (highest) of total informal economic units said that lack of skilled labor is there major problem. About 30% of them also mentioned that their next major problems infrastructure problem. Thus there are lack of skilled labor in this upazila which is mentioned strongly by the industries. The least priority for the major problems towards them is electricity problem. Extortion

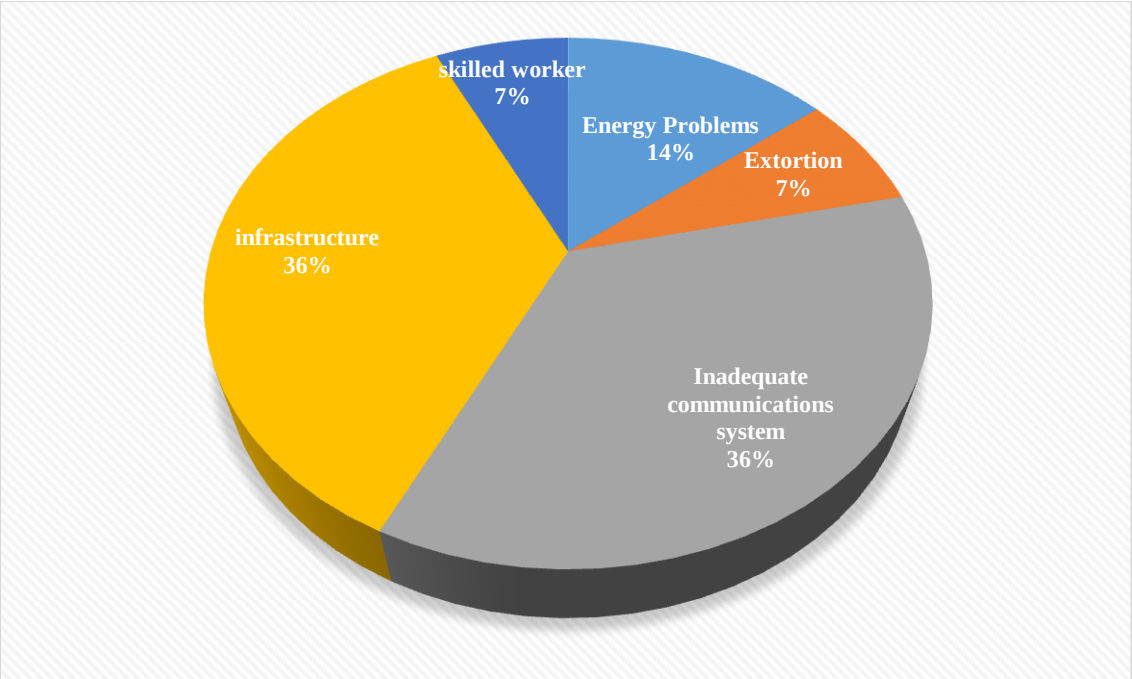


Figure 5.9: Problems in the industry (Source: Field Survey, 2015)

5.12 Suggestions to Solve the Problems

About more than one third of the total economic units notifies that the solution of above mentioned problem could be governments helps towards them by providing loan on easy terms. About one fourth of them also mentioned availability of low cost and good quality medicine also help them a lot. About 17% of them also required infrastructure development which includes roads and others. About 8% of them also wants training for the worker, thus they can get the skilled labors for their economy.

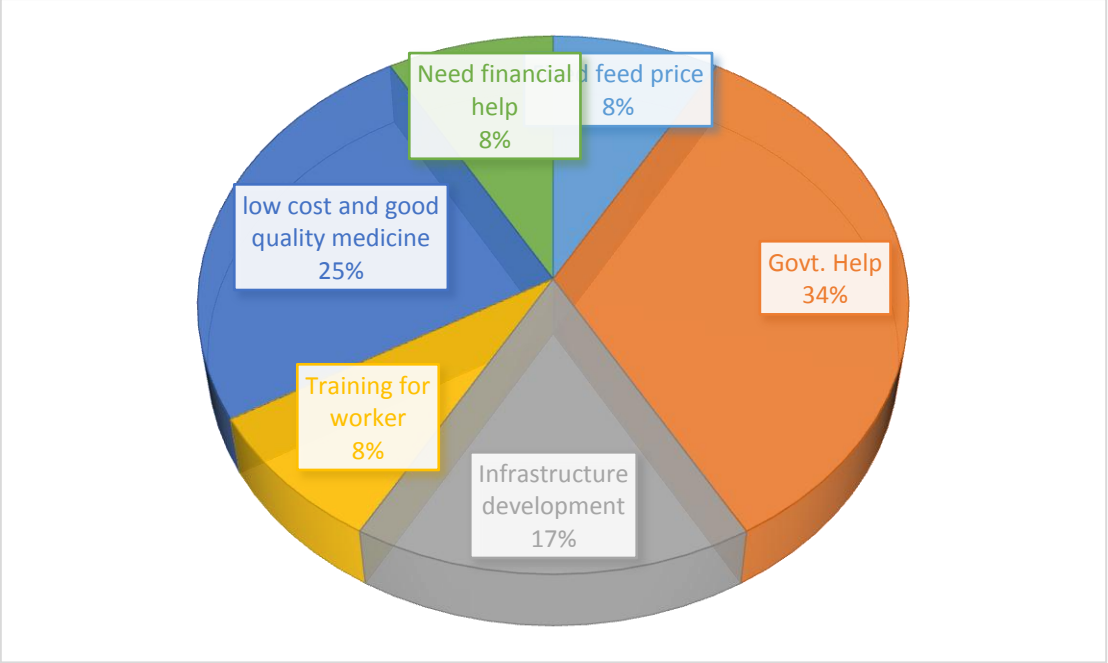


Figure 5.10: Suggestions to solve industrial problems (Source: Field Survey, 2015)

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Annexure-I

(Sample of Formal-Informal Economic Survey Questionnaire)

গৃহায়ন ও গনপূর্ত মন্ত্রনালয়

নগর উন্নয়ন অধিদপ্তর

প্রিপারেশন অব ডেভেলপমেন্ট প্লান ফর ফোরটিন উপজেলাস -প্যাকেজ-০২ এর আওতায়

শিবপুর ও রায়পুরা উপজেলা এবং ঈশ্বরগঞ্জ উপজেলার উন্নয়ন পরিকল্পনা প্রণয়ন কার্যক্রম

পরামর্শক প্রতিষ্ঠান : যৌথভাবে শেল্‌টেক কনসালটেন্ট প্রাঃ লিঃ ও আর্ক বাংলাদেশ লিঃ

আনুষ্ঠানিক -অনানুষ্ঠানিক অর্থনৈতিক জরিপ প্রশ্নমালা-২০১৫

প্রশ্নমালা নংঃ ..... জরিপের তারিখঃ ..... সময়ঃ .....
সাক্ষাৎকার গ্রহণকারীর নামঃ ..... সাক্ষাৎকার গ্রহণকারীর স্বাক্ষর ঃ .....

- **অধ্যায়-৪ঃ <u>শিল্প কারখানা (বৃহৎ, ক্ষুদ্র, মাঝারি ও কুটির)</u>**

৪.১ শিল্প কারখানা / প্রতিষ্ঠানের নাম ঃ

৪.২শিল্প কারখানা / প্রতিষ্ঠানের ঠিকানা ঃ

৪.৩ মালিকানার ধরনঃ ☐ ব্যক্তিগত মালিকানা ☐ লিমিটেড কোম্পানী ☐ অংশীদারী প্রতিষ্ঠান

৪.৪. মালিক/ব্যবস্থাপনা পরিচালক/ অংশীদারের নামঃ

৪.৫ প্রতিষ্ঠানের ধরন ঃ

☐ নির্মাণ সামগ্রী	☐ দুগ্ধ খামার	☐ মৎস্য প্রক্রিয়াকরণ	☐ ওয়ার্কসপ
☐ রাসায়নিক দ্রব্যাদি	☐ ট্রেডিং হাউস	☐ করাত কল	☐ আটা মিল
☐ সুতা ও বস্ত্র শিল্প	☐ ব্যাংক	☐ নারিকেলের খোসার আঁশ ভিত্তিক শিল্প প্রতিষ্ঠান	☐ চামড়াজাত শিল্প
☐ কুটির শিল্প	☐ বীমা	☐ হস্ত শিল্প	☐ সিমেন্ট কারখানা
☐ গ্যাস	☐ চিংড়ি ঘের	☐ ইট ভাটা	☐ ওয়ারহাউস
☐ খাদ্য প্রক্রিয়াজাতকরণ	☐ রাইস মিল	☐ বরফ কল	☐ পাটজাত দ্রব্য প্রক্রিয়াকরণ
☐ পোল্ট্রি	☐ দোকান	☐ গার্মেন্টস	☐ মৎস খামার
☐ আসবাবপত্র প্রস্তুতকরণ	☐ প্রিন্টিং প্রেস	☐ প্লাস্টিক ইন্ডাস্ট্রি	☐ অন্যান্য

৪.৬ আয়তন (একর)ঃ

৪.৭ কর্মকর্তা ও কর্মচারীর সংখ্যা ঃ

(ক) সর্বমোট সংখ্যা ঃ পুরুষঃ .... মহিলা ঃ .....

(খ) প্রশাসনিক কর্মকর্তা ও কর্মচারীর সংখ্যা ঃ

(গ) শ্রমিক ও অন্যান্য কর্মচারীর সংখ্যা ঃ

৪.৮ কাঁচামাল সংক্রান্ত তথ্য ঃ

ক্রমিক নং	ব্যবহৃত কাঁচামাল	কাঁচামালের উৎস	
		স্থানীয় (%)	আমদানীকৃত (%)

৪.৯. উৎপাদিত পণ্য ঃ

(ক) উৎপাদিত পণ্যের প্রকার ঃ

☐ কুটির শিল্প ☐ প্রক্রিয়াজাত সাদা মাছ ☐ দুধ ও দুগ্ধজাত খাবার ☐ গৃহস্থালির পণ্যসামগ্রী
☐ ইট ভাটা ☐ পাটজাত দ্রব্য ☐ প্যাকেটজাত খাবার ☐ প্লাস্টিকের পণ্য
☐ বোতলকৃত তরল প্রাকৃতিক গ্যাস ☐ ডিম ☐ সুতা ও বস্ত্র ☐ অন্যান্য (উল্লেখ করুন) ঃ
☐ 'স' মিল

(খ) উৎপাদিত পণ্য বাজারজাতকরণ ঃ

বিবরণ	পরিমাণ (%)
স্থানীয় বাজার	
সারা দেশ	
রপ্তানীর জন্য স্থানীয় রপ্তানীকারককে সরবরাহ	
সরাসরি রপ্তানী *(দেশের নাম)*	

৪.১০. কাঁচামাল ও উৎপাদিত পণ্য বাজারজাতকরণে ব্যবহৃত পরিবহন ঃ

সড়ক	রেলপথ	জলপথ
১. ট্রাক/ আচ্ছাদিত ট্রাক/ট্রেইলার	বাংলাদেশ রেলওয়ে	১. কার্গো
২. বাস		২. ট্রলার
৩. পিকআপ		৩. নৌকা
৪. মাইক্রোবাস/ কার		৪. অন্যান্য
৫. টেম্পু/ বেবিট্যাক্সি		
৬. ভ্যান/ রিক্সা		
৭. ঠেলাগাড়ী		

৮. অন্যান্য		

৪.১১. বর্জ্য ব্যবস্থাপনা ঃ

(ক) দৈনিক বর্জ্য উৎপাদনের পরিমাণ ও ধরন ঃ ☐ টন

সলিড _____ % লিকুইড _____ %

(খ) বর্জ্য অপসারণঃ ☐ পরিশোধিত ☐ অপরিশোধিত

(গ) বর্জ্য অপসারণের স্থানঃ

☐ রাস্তার পাশে ☐ খোলা মাঠ ☐ খাল ☐ নদী ☐ কৃষিজমি

(গ) বর্জ্য অপসারণ স্থানের মালিকানাঃ

☐ নিজস্ব ডাম্পিং গ্রাউন্ড ☐ সরকারি স্থান ☐ বেসরকারি মালিকানাধীন জায়গা

৪.১২. বর্জ্য পরিশোধন ব্যবস্থা আছে কি না? ☐ হ্যাঁ ☐ না

৪.১৩. প্রতিষ্ঠান থেকে সৃষ্ট পরিবেশ দূষণ রোধের ব্যবস্থার বিবরণঃ

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৪.১৪. EIA (এনভায়রনমেন্টাল ইমপ্যাক্ট এসেসমেন্ট) করেছেন কি না? ☐ হ্যাঁ ☐ না

৪.১৫. শিল্প কারখানার শ্রমিকদের পেশাগত স্বাস্থ্য নিরাপত্তা ব্যবস্থার বিবরণ ঃ

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৪.১৬. শিল্প কারখানার পরিবেশ বিষয়ক ছাড়পত্র আছে কিনা (বিবরণসহ) ঃ

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৪.১৭. কর্মকর্তা / কর্মচারীদের বাসস্থান সম্পর্কিত তথ্যঃ ☐ নিজস্ব ☐ ভাড়াবাড়ী ☐ অন্যান্য

৪.১৮. প্রতিষ্ঠানে উৎপাদিত পণ্যের পরিমাণ (বাৎসরিক) ঃ

..... পিস
..... টন
..... গজ / মিটার

৪.১৯. উৎপাদিত পণ্যের মূল্য (বাৎসরিক) ঃ ..... টাকা

৪.২০. শিল্প কারখানার সমস্যা ঃ

☐ অবকাঠামোগত সমস্যা ☐ অপ্রতুল যোগাযোগ ব্যবস্থা ☐ জ্বালানি সংকট ☐ দক্ষ শ্রমিকের অভাব
☐ বর্জ্য অপসারণ সমস্যা ☐ চাঁদাবাজি ☐ দূর্নীতি ☐ শ্রমিক অসন্তোষ

৪.২১. সমস্যা সমাধানের পরামর্শ থাকলে তার বিবরণ ঃ

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Annexure-II: List of Surveyors

SL.	Name	Designation	Date Start	Date End
1	Tarek Khan	Supervisor	12/08/2015	11/09/2015
2	Rubaiat Islam	Supervisor	12/08/2015	11/09/2015
3	Ahmed Riyadh	Supervisor	12/08/2015	11/09/2015
4	Kawsar Hamid	Supervisor	12/08/2015	11/09/2015
5	Layes Mia	Surveyor	12/08/2015	11/09/2015

Annexure-II: List of Photographs

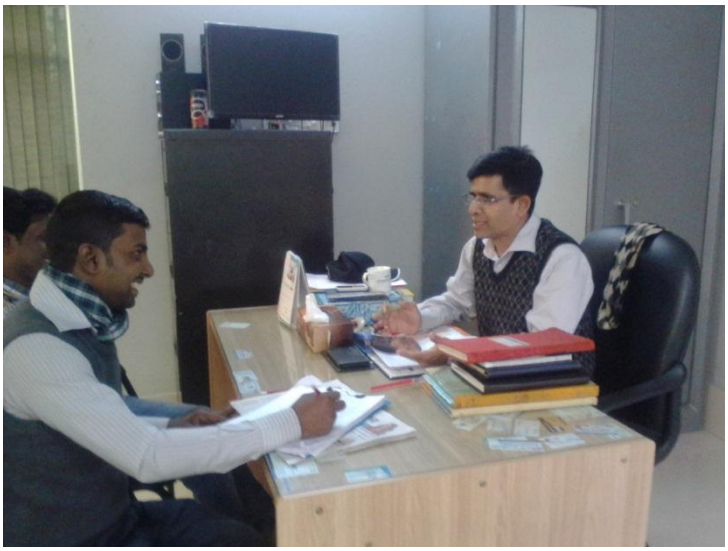

Plate-1: Industrial data collection at Shibpur Upazila

Plate-2 : Industrial data collection at Shibpur Upazila

Government of the People's Republic of Bangladesh
Ministry of Housing and Public Works
Urban Development Directorate (UDD)

Preparation of Development Plan for Fourteen Upazilas

Package-02
(Ishwarganj Upazila, Mymensingh; Raipura Upazila and Shibpur Upazila, Narsingdi)

DRAFT SURVEY REPORT

Formal-Informal Economic Survey of Shibpur Upazila, Narsingdi

August, 2016

Joint Venture of

Sheltech Consultants Pvt. Limited
And
Arc-Bangladesh Limited

Government of the People's Republic of Bangladesh
Ministry of Housing and Public Works
Urban Development Directorate (UDD)

Preparation of Development Plan for Fourteen Upazilas

Package-02
(Ishwarganj Upazila, Mymensingh; Raipura Upazila and Shibpur Upazila, Narsingdi)

DRAFT SURVEY REPORT

Transportation Survey of Shibpur Upazila, Narsingdi

August, 2016

Joint Venture of

Sheltech Consultants Pvt. Limited
And
Arc-Bangladesh Limited

JV of SCPL-ABL
Preparation of Development Plan for Fourteen Upazilas Project (Package-02)

Ref: SCPL-ABL/UDD/2016/ Transportation Survey Report/ Shibpur Upazila Date:

To
The Project Director
"Preparation of Development Plan for fourteen Upazilas" Project
Urban Development Directorate
82, Segunbagicha, Dhaka, 1000.

Subject: Submission of the Final Transportation Survey Report of Shibpur Upazila, Narsingdi

Dear Sir,
We are pleased to submit herewith the Final Transportation Draft Survey Report of **Shibpur Upazila, Narsingdi** for your kind information and further action.

Thanking you and assuring you of our best services.

Your Sincerely,

(Dr. Nurul Islam Nazem) (Dr. Shahid Mamun)
Team Leader, Package -2 Transportation Expert, Package -2

Encl: As stated.

Copy to:
1. Project Manager, Package-2, UDD
2. Director, Sheltech Consultants Pvt. Limited
3. Chairman, Arc-Bangladesh limited, Dhaka

1/E/2 Paribagh (Mazar Road), Shahbagh, Dhaka-1000, Bangladesh
Phone: +880-2-9611171 Fax: +880-2-9611172
Email: scpl.mail@gmail.com

Executive Summary

Shibpur is well connected with the communication network of the country. The national Highway N-02 from Katchpur to Sylhet has passes over at southern part of the Upazila. It is well connected by National and Regional Highway originating from different Districts/Upazilas like Narsingdi, Belabo, Monohardi, Palash, Gazipur etc. At present the national and regional highways are playing very important role in communication network. Besides the number of Zila roads and internal local roads are also providing regional connectivity. Total road length in this Upazila is 919.22 km. of which around 80.98 Km is Upazila road, around 78.14km is union road, 146.26 km is village road-A and km is village road B. (LGED-2016)

The survey reveals that no public or private bus service is available for intra-city movement. Rickshaw/van, bicycle and motorcycles are common prime modes for intra city movement. Water transport network has no significant importance in carrying out both passenger and goods in Shibpur. There are main bus stoppages in the study area, namely Itakhola Bus stoppage, Mannan Bhuiya Chattar stoppage, Shibpur Bus Stoppage, C & B Bazar Bus stoppage, Chaitannaya Bus Stoppage. At present, there is no defined truck terminal at Shibpur Upazila but informally Itakhola using as truck-stand. Till now, there is no Railway line in Shibpur Upazila.

Though there is no significant traffic congestion within the Upazila but the consultants identified some important places for traffic congestion. The Traffic Congestion areas of the Upazila are Itakhola Moor and Shibpur Bus Stand.

There is 6 (six) intersections and Two important link within the Upazila. Within all links the highest PCU passing through the link on Off-Day is 1797 PCU at Itakhola-Narsingdi link and the lowest on On-Day is 83 at Kamrabo-Belabo link. Within all vehicles passes through the different link of the intersection above 80% are motorized vehicle and up-to 20% are non-motorized vehicle except Lakpur Bazar Intersection. In lakpur Bazar intersection within all vehicles passes through the different links are 68% motorized vehicle and 32% are non-motorized vehicle

Within all the trips passes over the Upazila have originated and distributed within Shibpur and Narsingdi sadar upazila. The rest of the trips go to the other places such as Dhaka, Bhairab Monohordi and Habiganj. Around 43.8% of the trip are generating for work purpose, 21.9% for educational purpose, 25.6% for shopping and 3% because of social purposes such as visiting relatives, social programs etc.

In the passenger survey shows the relation between age-group and male and female who travel. In the age-group of 16-20, Male and Female travel respectively 81.80% and 18.20%. In every age-group the percentages of male travelers are more than the female. In case of below 15 age-group 100% travelers are male. In the 31-40 and 41-50 age-groups the percentages of female travelers are increasing.

This is a submission of the traffic and transportation survey report as a part of Survey Report as per TOR of the project and mainly describes the traffic and transportation survey activities performed as per TOR.

Abbreviation/Acronyms

BR - Bangladesh Railway
DC - District Commissioner
LGED - Local Government Engineering Department
OD - Origin and Destination
PCE - Passenger Car Equivalent
PCU - Passenger Car Unit
PRA - Participatory Rural Appraisal
RHD - Roads and Highway Department
TAZ - Traffic Analysis Zone
TOR - Terms of Reference
UDD - Urban Development Directorate

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CHAPTER 1: INTRODUCTION

1.1 Introduction

The role of transportation in the development of civilization is inevitable. Transportation is a non-separable part of any development. It showcases a very intense relation to the style of life, the range and location of activities and the goods and services which will be available for consumption. Transportation plays different roles in the up gradation of a civilization. None of its role can be neglected. The future progress of a city depends mostly how the transportation of that area functions. In master plan transportation planning is the main element around which other facilities and development revolves. In the preparation of Development plan for Shibpur Upazila, the consultant has done transportation survey which has great implications on the Development Plan.

To analyze the present scenario of traffic and depict the future traffic demand and forecast, several relevant survey has done in the study area which will analyze the traffic trends.

1.2 Understanding the Existing Road Infrastructures and Facilities

An inventory of road, railway, water way and airway network, regional transport network system and its linkage with Upazila area, information on pedestrian facilities, bus/ rail/ water way routes and parking facilities has been conducted and the base map will be upgraded with this information for providing traffic and transportation policy. A survey has provided to gather current traffic information not readily available from other sources and other relevant data have been collected form LGED, RHD and Upazila Parishad. The following data will be focused on this traffic study:

Road Geometrics

- ✓ Curves and grades (if significant enough to affect capacity or traffic operations);
- ✓ Number of lanes, lane usage, and presence and type of medians;
- ✓ Lane, median, and shoulder widths;

Traffic Control

- ✓ Traffic signals and phasing;
- ✓ Traffic signs (particularly regulatory signs and posted speed limits);
- ✓ Marked and unmarked crosswalk locations;

Traffic

- ✓ Presence and needs of children, elderly persons, disabled, transportation disadvantaged, pedestrians, and bicyclists;
- ✓ Sidewalks, bicycle lanes, and multi-use paths;
- ✓ Transit stop locations and amenities, transit schedules, and types of transit vehicles in service;
- ✓ Travel times (e.g., queues at intersections);

Land Use/Access

- ✓ Driveways for major vehicle generators or truck generators (collect the same information as would be collected for side streets);
- ✓ Adjacent land use, density, and occupancy;

Others

- ✓ Pavement conditions;
- ✓ Presence and type of on-street parking and parking regulations

1.3 Methodology of Traffic and Transportation Survey

Authentic and viable road infrastructure and vehicle volume information is vital for planning of road infrastructures and policies. The traffic and transportation survey has subdivided into following surveys:

1. Traffic Volume Count Survey
2. Origin and Destination(O D) Survey
3. Passenger Interview Survey
4. Regional Transportation Network Survey

1.3.1 Reconnaissance Survey

Before performing traffic and transportation survey, a reconnaissance survey has been carried out to identify where the above mentioned surveys will be done. According to the judgment and local knowledge, survey locations points have been selected. For this study, survey has been done on the basis of Hat Day and Non Hat Day.

1.3.2 Sample Size Determination

Sample Size determination is important task on which the study's time frame, outputs depend. In transportation survey, the consultant has to determine how many questionnaire surveys will be done. In Shibpur Upazila, the number of households is 65,094. Sample size is calculated by taking confidence interval 13% and confidence level 95%. The following sampling equation has been applied:

$$n = \frac{z^2 p(1-p)}{c^2}$$

(Cochran, 1963)

Z = Z value
p = percentage picking a choice, expressed as decimal
c = confidence interval, expressed as decimal

These sample size was adjusted by using the following formula:

$$n = \frac{n_0}{1 + \frac{n_0}{N}}$$

Where nis requiring sample size and N is no. of Household of Upazila. So, the required sample size is 63 for O D Survey, Passenger Interview and Regional Transportation Survey.

1.3.3 Conducting Traffic and Transportation Survey

- ✓ **Traffic Volume Count**

Traffic volume studies are conducted to determine the number, movements, and classifications of roadway vehicles at a given location. These data can help to identify critical flow time periods, determine the influence of large vehicles or pedestrians on vehicular traffic flow, or document traffic volume trends. For this study, Manual counting method has been applied for acquiring the required data. Manual counts are typically used to gather data for determination of vehicle classification, turning movements, direction of travel, pedestrian movements, or vehicle occupancy. The selection of study method should be determined using the count period. The count period should be representative

of the time of day, day of month, and month of year for the study area. The count period should avoid special event or compromising weather conditions (Sharma, 1994). Count periods may range from 5 minutes to 1 year. Typical count periods are 15 minutes or 2 hours for peak periods, 4 hours for morning and afternoon peaks, 6 hours for morning, midday, and afternoon peaks, and 12 hours for daytime periods (Robertson, 1994). For this survey, sixmajor intersections have been identified. The intersections are: C & B Bazar Bus Stand, Chaitannya Bus Stand, Itakhola Bus Stand, Kamrabo Intersection, Lakhpur Bazar and Mannan Bhuiyan Chattar. In addition, survey has been also carried out in three roadway segments respectively Thana Moar, Dulalpur Moar and Syed Nagar Bus Stand. (Please see **Figure 1.1,Map 1.1& Map 1.2**) Hat Day and Non Hat Day has been taken into consideration for each intersection and roadway segment. Peak hour and off peak hour have been varied in each intersection and roadway segment depending on its impact on the Upazila. The volume of traffic using the road in a given interval of time is one of the elemental measures of road traffic that is also termed as flow and expressed in vehicles per hour or vehicles per day. But the roads normally comprise different types of vehicles offering different degrees of interference to other traffic. However, it is obligatory to bring all types of vehicles to a common unit. The normal practice to convert the flow into common unit is Passenger Car Equivalence (PCE) by using certain equivalency factors. The flow is then expressed as PCE per hour or PCE per day. The Table 1.1 and Table 1.2 the Survey Schedule for Traffic Volume Count Survey and PCE value for the traffic volume calculation.

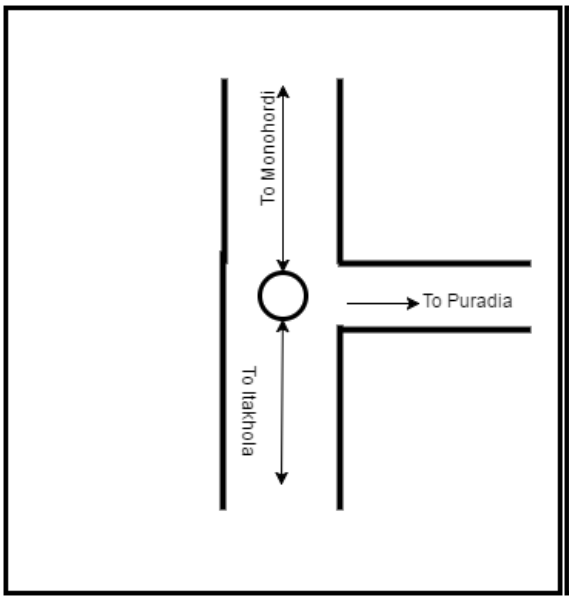
Table 1.1: Traffic Volume Count Survey Schedule

Intersection/ Segment Name		**Working days**
Intersections	C & B Bazar Bus Stand	7/01/2016
	Chaitannya Bus Stand	10/01/2016
	Itakhola Bus Stand	8/01/2016 & 11/01/2016
	Kamrabo Intersection	10/01/2016
	Lakhpur Bazar	9/01/2016
	Mannan Bhuiyan Chattar	6/01/2016
Roadway Segments	Thana Moar	10/01/2016
	Syed Nagar Bus Stand	8/01/2016
	Dulalpur Moar	9/01/2016

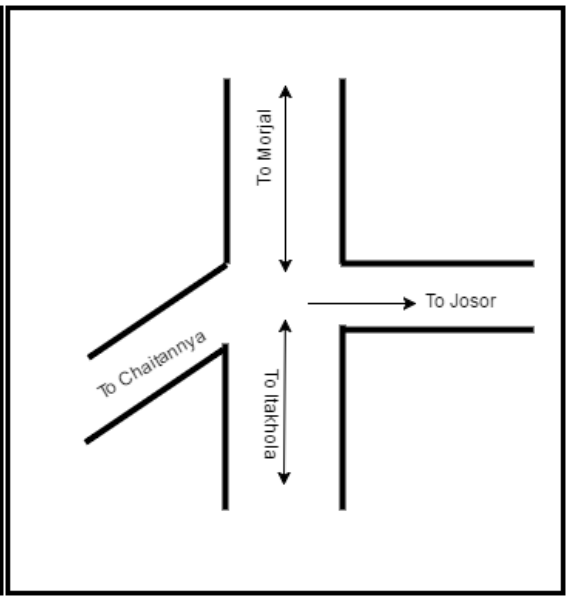
Table 1.2: Considered List of PCE value for various vehicles

Sl. No.	**Vehicle Categories**	**PCE**
1	Passenger Car	1.00
2	Light Goods Vehicle	1.00
3	Truck	3.00
4	Bus	3 .00
5	Auto-Rickshaw	0.75
6	Motor-cycle, moped, scooter	0.75
7	Paddle Cycle	0.50

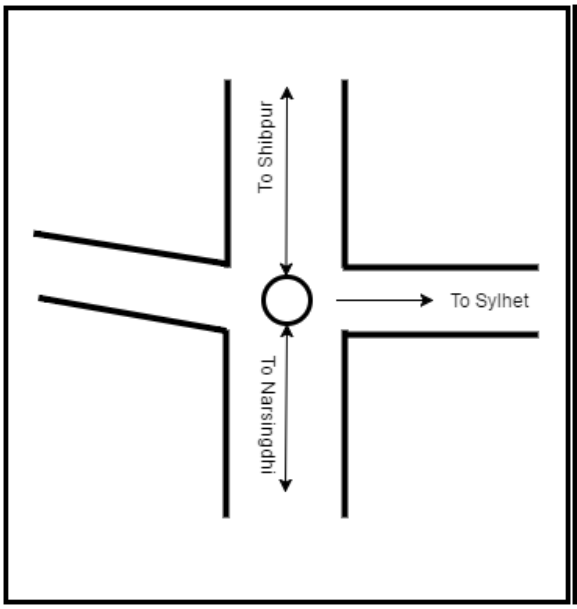
Source: Ministry of Communications, 2000.



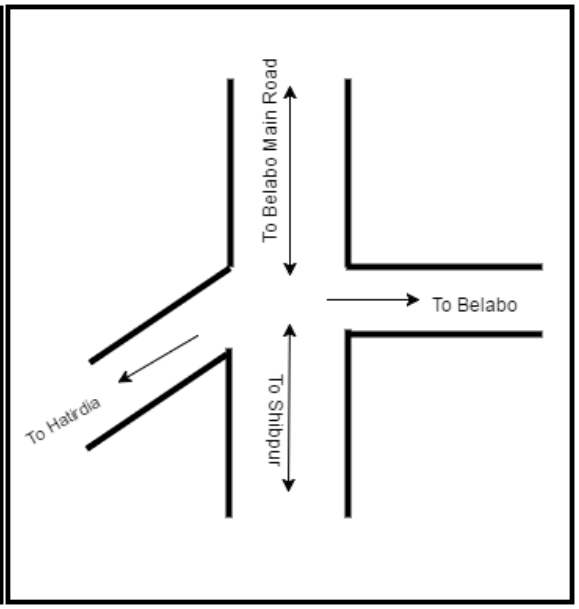
C & B Bazar Intersection



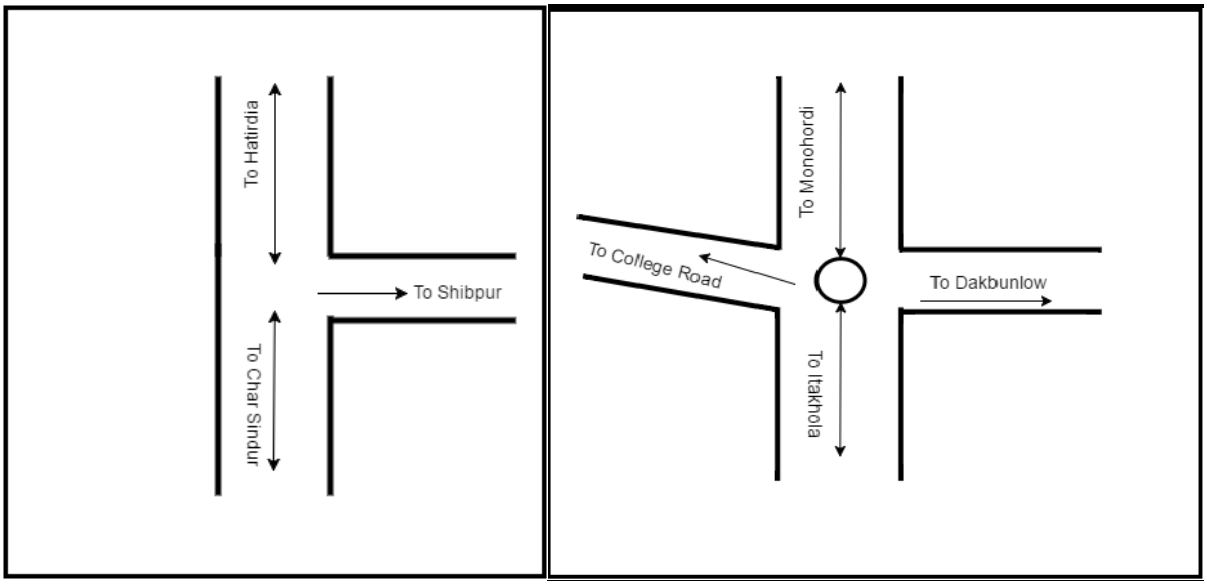
Chaitannaya Bus Stand



Itakhola Bus Stand



Kamrabo Intersection



Lakpur Intersection **Mannan Bhuiyan Chattar**

Figure 1.1: Six Major Intersections for Traffic Volume Count

- ✓ **Origin and Destination (O D) Survey**

Origin Destination (O-D) survey provides a detailed picture of the trip patterns and travel choices ofa study area. The survey data related to households, individuals and trips allows stakeholders to understand travel patterns and characteristics; measure trends; provide input to travel demand model development, forecasting, and planning for area-wide transportation infrastructure needs and services; and, monitor progress in implementing transportation policies. Origin Destination (O-D) Survey has been conducted using the standard format incessantly for 2 days. The survey was accomplished by enumerators who were locally recruited and adequately oriented and trained by experienced supervisors. Three independent shifts having 2 enumerators and 1 supervisor each had given the responsibility to carry out the origin destination survey at some selected locations such as C & B Bazar Bus Stand, Chaitannya Bus Stand, Itakhola Bus Stand,Syed Nagar Bus Stand etc. (Please see **Map 1.2**) The survey has carried out through random questionnaire according to the sample size.

- ✓ **Passenger Interview Survey**

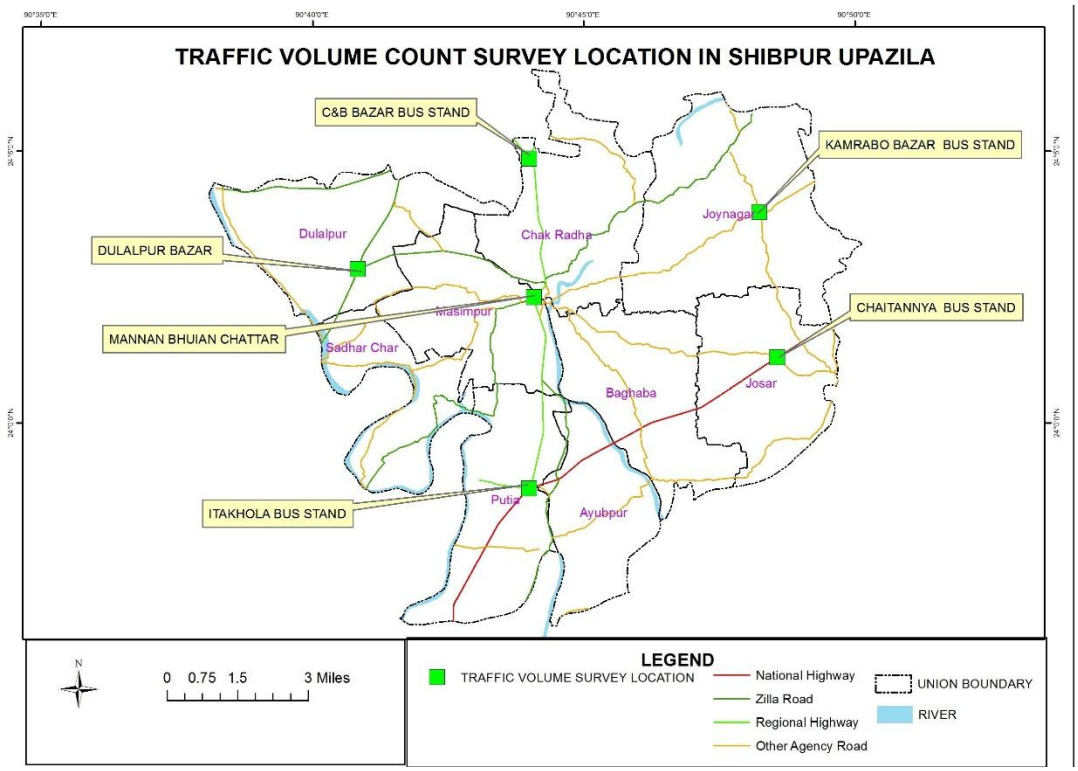
Passenger Interview Survey has done to know about the travel behavior of the passengers. In order to ensure the findings of the survey were representative, random sampling method was applied on this on-board face-to-face interview survey. Target respondents were picked by a random process. Passenger Interview Survey has been carried out in Bus Terminal, Bus stoppages etc. Bus Passenger Interview Survey has been conducted using the standard format incessantly for 4 days at Shibpur Bus Stand, C & B Bazar Bus Stand, Itakhola Bus Stand, Lakhpur Bazar, Dulalpur Moar. The survey was accomplished by enumerators who were locally recruited and adequately oriented and trained by experienced supervisors.(Please see **Map 1.2**)

- ✓ **Regional Transportation Network Survey**

Regional Transport is an enabler for growth but it can also be a catalyst for urban sprawl. It has implications not only for mobility and quality of life but also for the economic prosperity of cities. Regional Transport survey has been done to better understand the transport and mobility challenges and priorities for planning, infrastructure and service requirements over the short and longer term. For this survey, few locations have been considered where it will be easy to know the regional impact and regional transport network. The selected survey locations are: Shibpur Bus Stand, Itakhola Bus Stand and random questionnaire survey has been applied. (Please see **Map 1.4**)

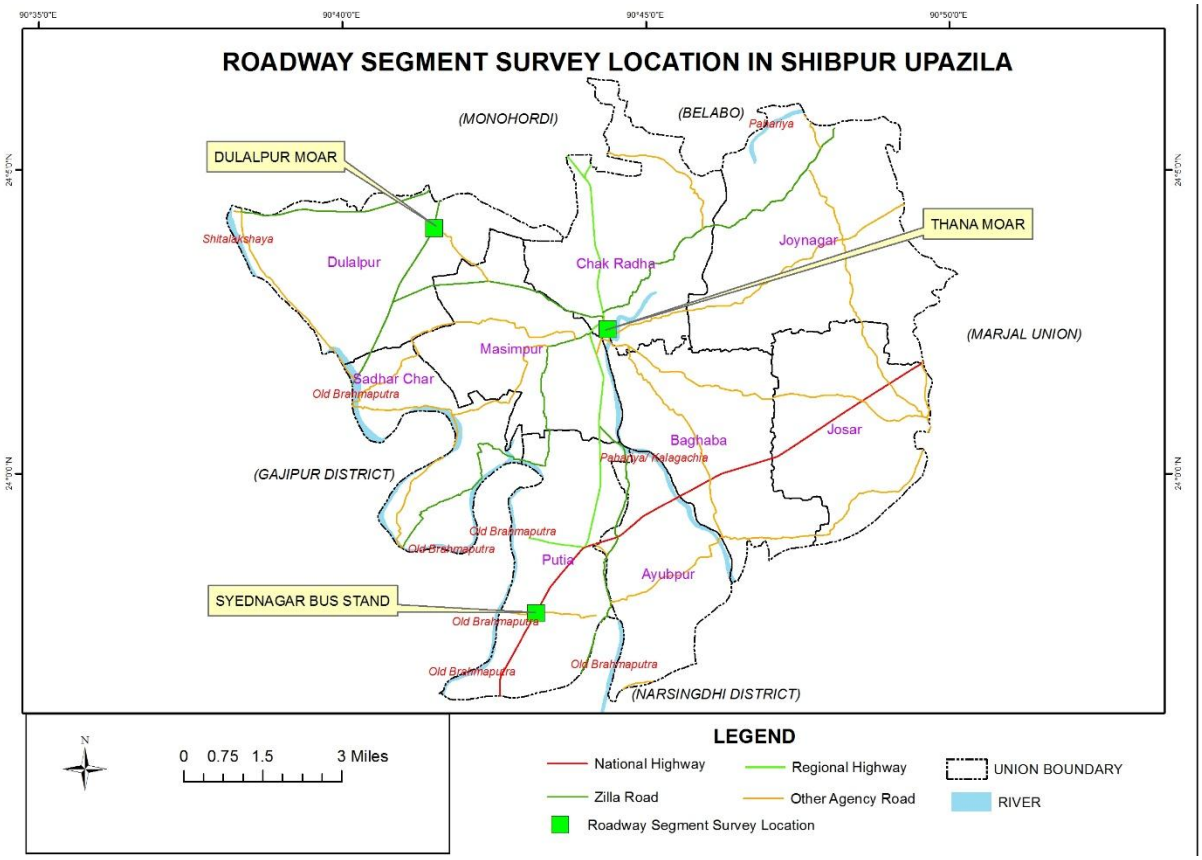
Table 1.3: Output and methodology of the conducted survey

Survey	Data	Methodology
Traffic Volume Count	Details of vehicle classification, fluctuation of flow, specific vehicular movements, road features, no. of vehicle per hour.	• Manual counting method • Hat Day and Non Hat Day • Peak Hour and Off Peak Hour
O D survey	Origin zones, destination zones, internal and external origin and destinations.	• Simple Random Survey after determining the sample size. • Before conducting the interview, the questionnaire prepared for interviewing the travelers which is approved by UDD.
Passenger Interview Survey	Trip destination, trip purpose, mode of transport, cost, distance etc.	• Simple Random Survey • At first, the questionnaire has been prepared to cover all information required for the survey according to the TOR. • The questionnaire has been approved by UDD and finally a sample of passengers has been selected for collecting data through approved questionnaire.
Regional Transport Network Survey	Urban growth, accessibility with nearer areas, communication and infrastructure facilities, potentiality of the area etc.	• Simple Random Survey after determining sample size through approved questionnaire. (Please see **Appendix-C** for approved Questionnaire Format of all transport Surveys)



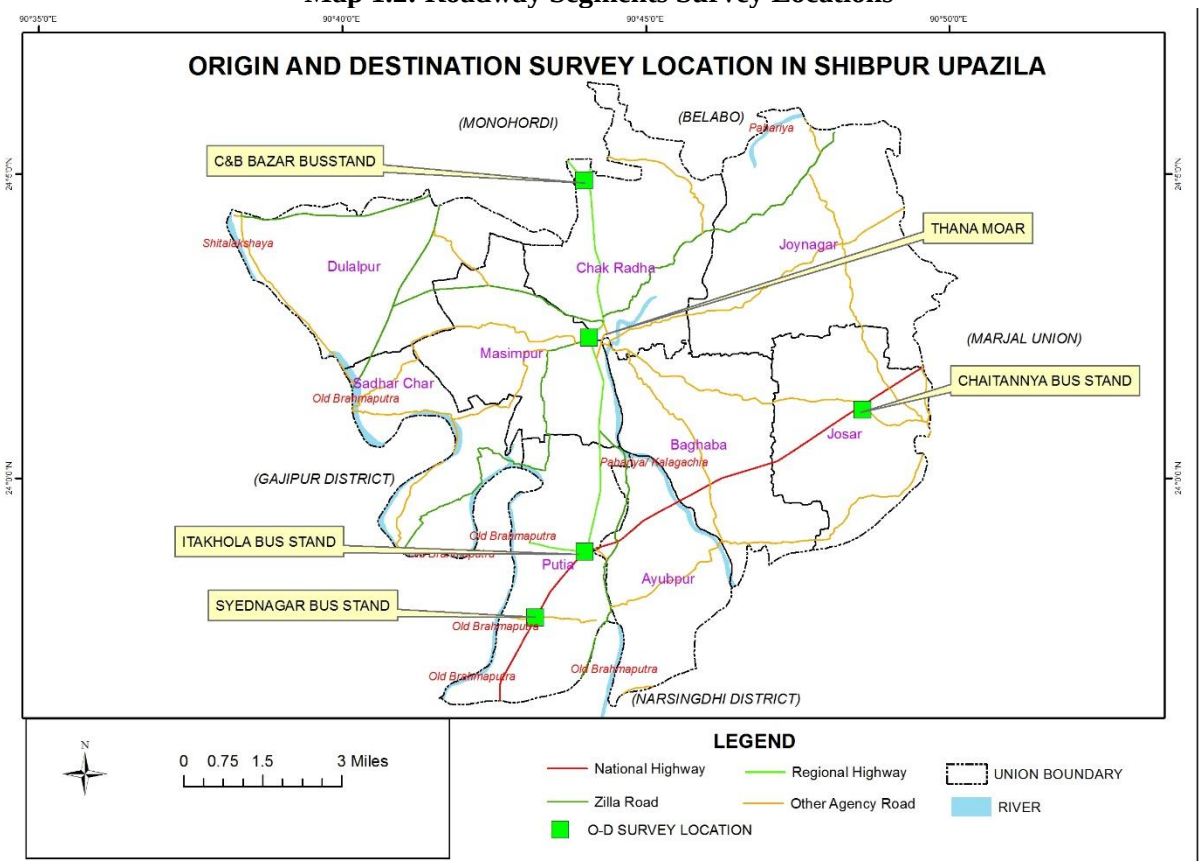
Source: Traffic and Transportation Survey, 2016.

Map 1.1: Traffic Volume Survey Locations



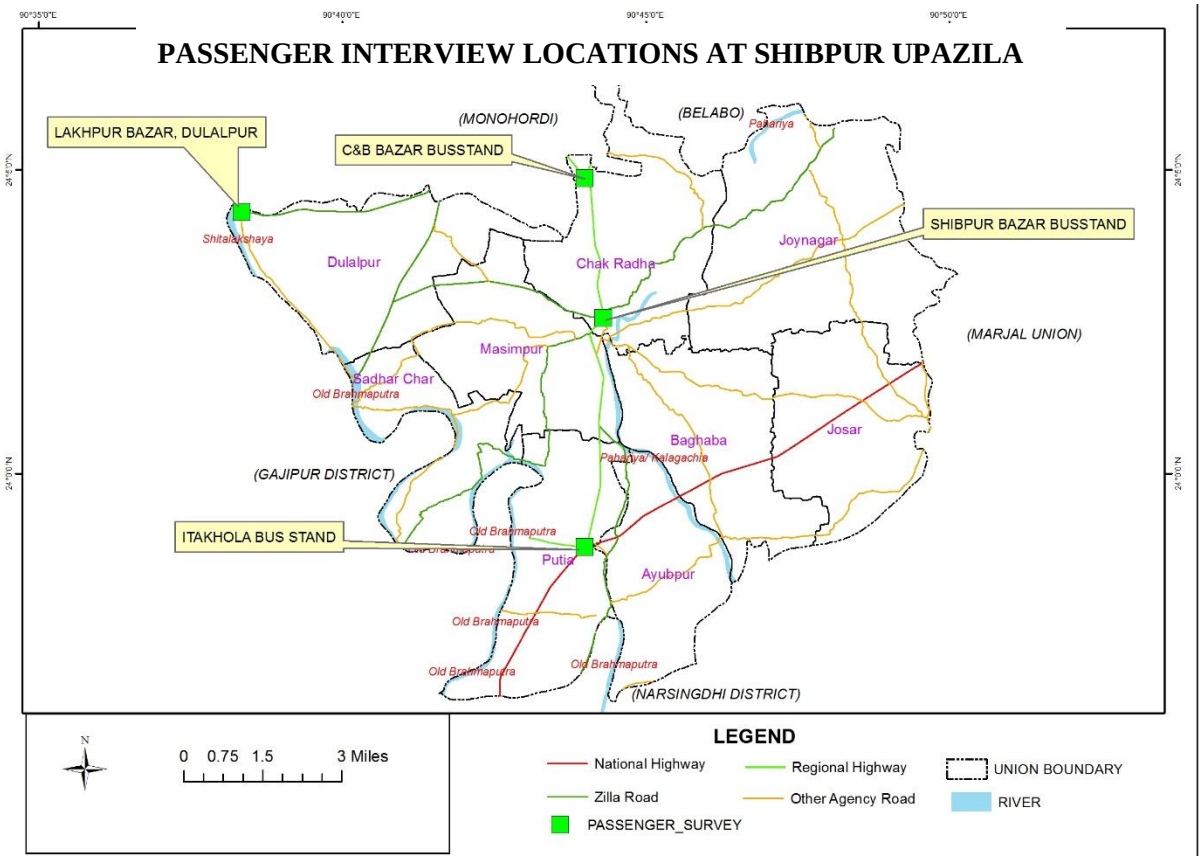
Source: Traffic and Transportation Survey, 2016.

Map 1.2: Roadway Segments Survey Locations



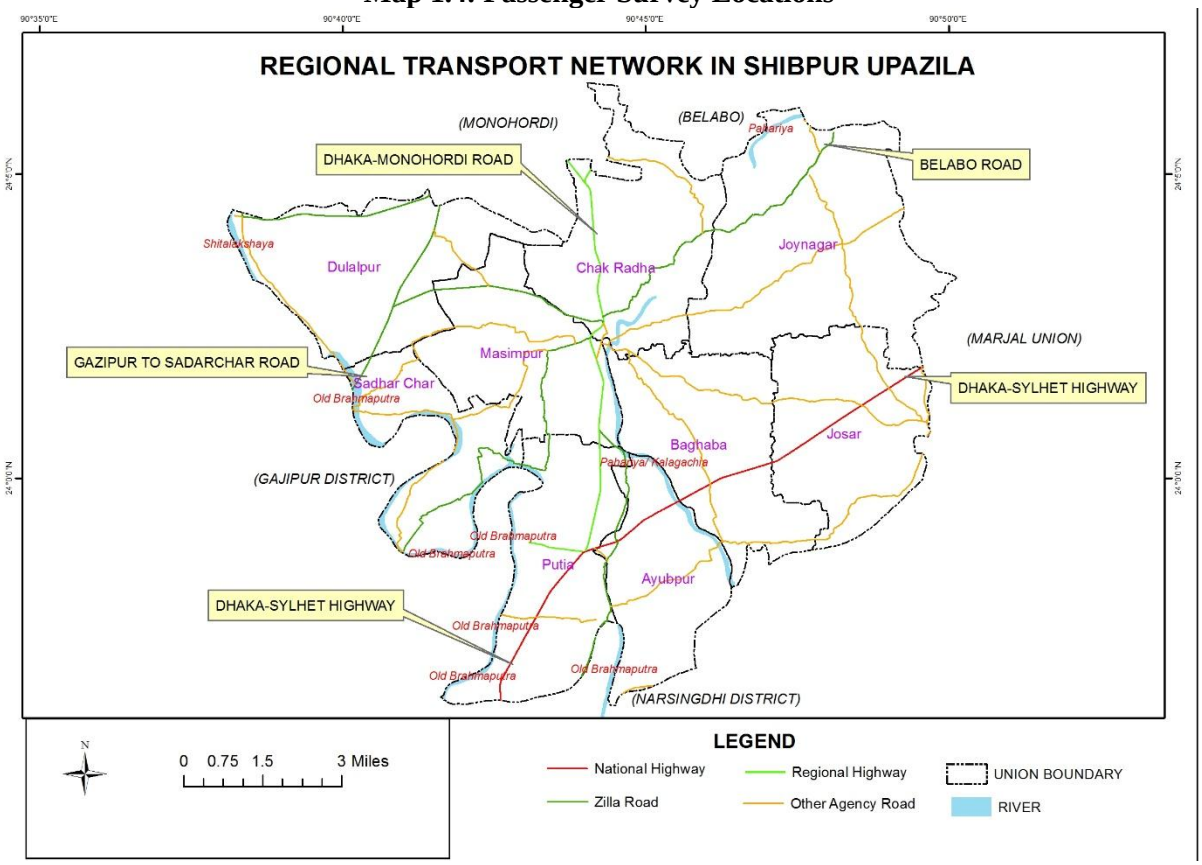
Source: Traffic and Transportation Survey, 2016.

Map 1.3: Origin Destination Survey Locations



Source: Traffic and Transportation Survey, 2016.

Map 1.4: Passenger Survey Locations



Source: Traffic and Transportation Survey, 2016.

Map 1.5: Regional Survey Location

1.4 Formulation and Mobilization of Survey Team

1.4.1 Orientation &Meeting

In order to carry out various surveys related with traffic and transportation, at first an orientation program was held at Shibpur Upazila Office (January, 2016) for giving a clear concept about the objectives of the project and different type of surveys. The Transport expert has attended the orientation program and Mr. Uday Sankar Das (Senior Planner, UDD) was present on that orientation program on the behalf of UDD.

1.4.2 Guidance to the Survey Members

After giving orientation, the consultants have provided guidelines to the survey members who are representatives of the Consultancy firm. The survey members have been guided by proper understanding of Questionnaire formats of different types of survey formats, time schedule of conducting survey, location of conducting survey etc.

1.4.3 Selection of Survey Locations

Considering the intensity, linkage and movement of traffic, different survey locations have been selected to conduct different types of survey including Volume Count, O-D Survey, Pedestrian, Passenger Survey etc. Major intersections, Major Roads, Bus Terminal and Railway Station have been identified for conducting different types of Survey. Details of survey locations have been given in corresponding type of survey.

1.4.4 Formation of Survey Team

The transport surveys have been carried out according to the consent of Transport Expert. The surveyors were deployed sufficiently according to the need of each survey locations; the consultant team has considered the previous working experience of similar types of survey activities and educational qualifications. The following table represents the team formations for traffic and transportation survey at Shibpur Upazila.

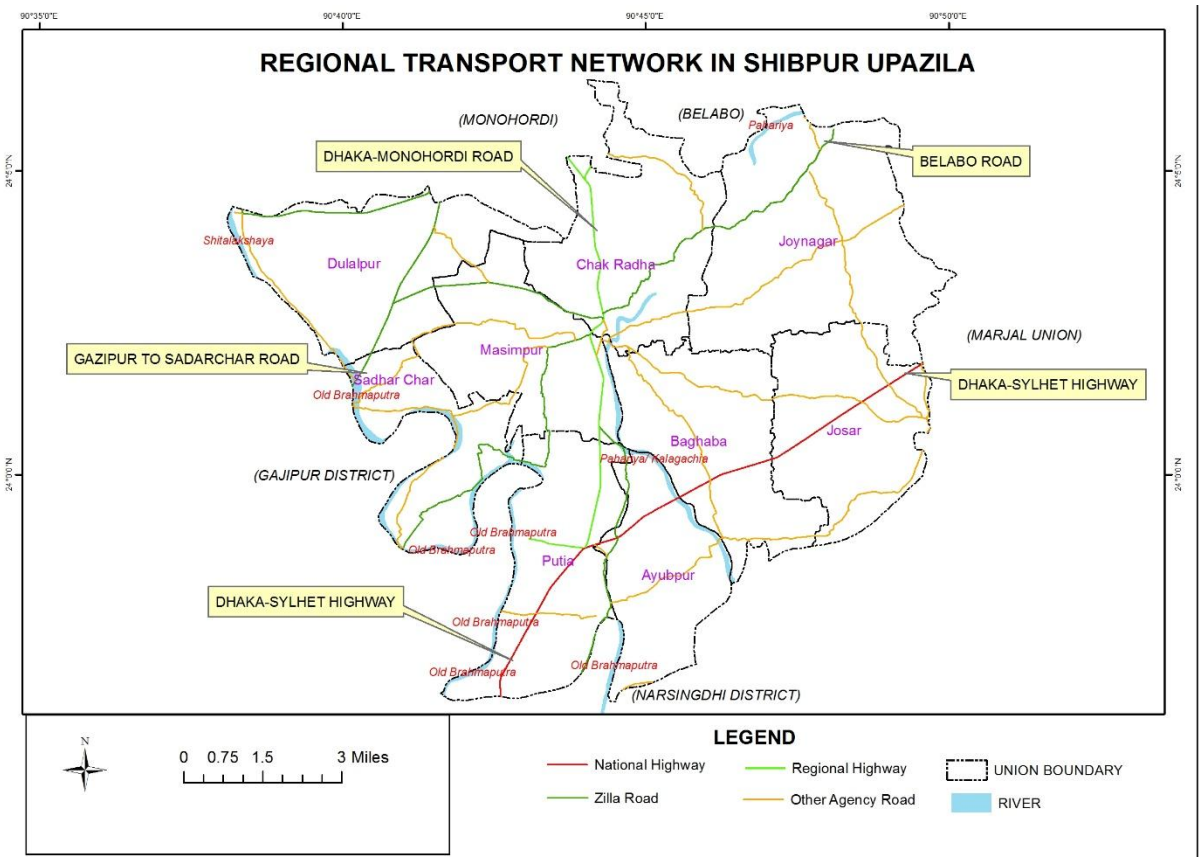
Table 1.4: List of members in Traffic and Transportation Survey

Sl. No.	Name	No.	Activities
1	**Transport Expert** Dr. Md. Shahid Mamun	1	Planning, preparation of questionnaire and overall supervision of the survey activities and subsequent report preparation.
2	**Planner** K. M Abul Bashar	1	Training and supervision of field level activities.
3	Mustaq Ahmed & Md. Halim	2	Data base format preparation and supervision of data entry activities.
4	**Survey Supervisor** Md. Rubayet Hossain, Md. Tarek Khan, K. M Kawser Hamid &Ahmed Riyad	4	Inspection of Field Survey.
5	**Enumerators**	16	Field Survey
6	**Data Entry Operators**	10	Data Entry in Excel, Analysis and presentation in tabular format.

CHAPTER 2: EXISTING CIRCULATION NETWORK AND INFRASTRUCTURE

2.1 Regional Connectivity

Shibpur Upazila under the jurisdiction of Narsingdi District occupies an area of 217.71sq. km. which is located between 23°56' and 24°07' north latitudes and between 90º38' and 90º50' east longitudes. The Upazila is bounded on the north by Monohardi Upazila on the east by Raipura and Belabo Upazila s on the south by Narsingdi Sadar Upazila s and on the west by Palash Upazila and Kapasia and Kaliganj Upazila of Gazipur Zila. (BBS, 2012) The national Highway N-02 from Katchpur to Sylhet has passes over at southern part of the Upazila. It is well connected by National and Regional Highway originating from different Districts/Upazilas like Narsingdi, Belabo, Monohardi, Palash, Gazipur etc. At present the national and regional highways are playing very important role in communication network. Besides the number of Zila roads and internal local roads are also providing regional connectivity. (Please see **Map 2.1**)



*Source: Traffic and Transportation Survey, 2016***.**

Map 2.1: Regional Connectivity Map

2.2 Road Network

2.2.1 Existing Road Network

Shibpur Upazila has great significance in the context of road network. Regional Highway and Railway has gone through it which makes the Upazila Center more viable. The detailed road network has shown in **Map 2.2**. Which will be further updated by physical feature survey.

Table 2.1: Existing Road Infrastructure of ShibpurUpazila

Road Type	Earthen Road (km)	Pavement Road (km)	Total Length (km)
Upazila Road	1.19	79.79	80.98
Union Road	2.50	75.64	78.14
Village Road-A	31.31	114.95	146.26
Village Road-B	462.44	151.41	613.84

Source: LGED, 2016.

2.2.2 Functional Classification of Road

Considering the significance of road function, the road will be classified into primary, secondary, collector and access road which will be revealed after the physical feature survey. Each category of road has its particular functions to perform. Access road carries traffic from buildings to the collector road and collector road carry traffic to the major road and vice versa. In reality, however, it is almost impossible to maintain this hierarchical use of roads except in an entirely planned area.

2.2.3 Major Road Inventory of Shibpur Upazila

The Regional Highway and several Zila Road has passed through Shibpur Upazila. The major roads of Shibpur Upazila has shown in Table 2.2.

Table 2.2: Major Roads of ShibpurUpazila

Road ID	Name of the Road	Length of Road (km)
R211	Itakhola-Motkhola-Kotiadi Road	45
R212	Akdaria (C&B Bazar)-Shekher Bazar-Puradia-Agarpur Road	22
Z3710	Netrokona-Bishiura-Shibpur Road	27
Z2044	Shibpur (Itakhola-Katiadi Regional Highway)-Dulalpur-Lakpur-Monohardi (Hatirdia) Road	25
Z2035	Shibpur-Daripura-Kamrabo (Belabo) Road	15

Source: RHD, 2016.

2.3 Waterway Network

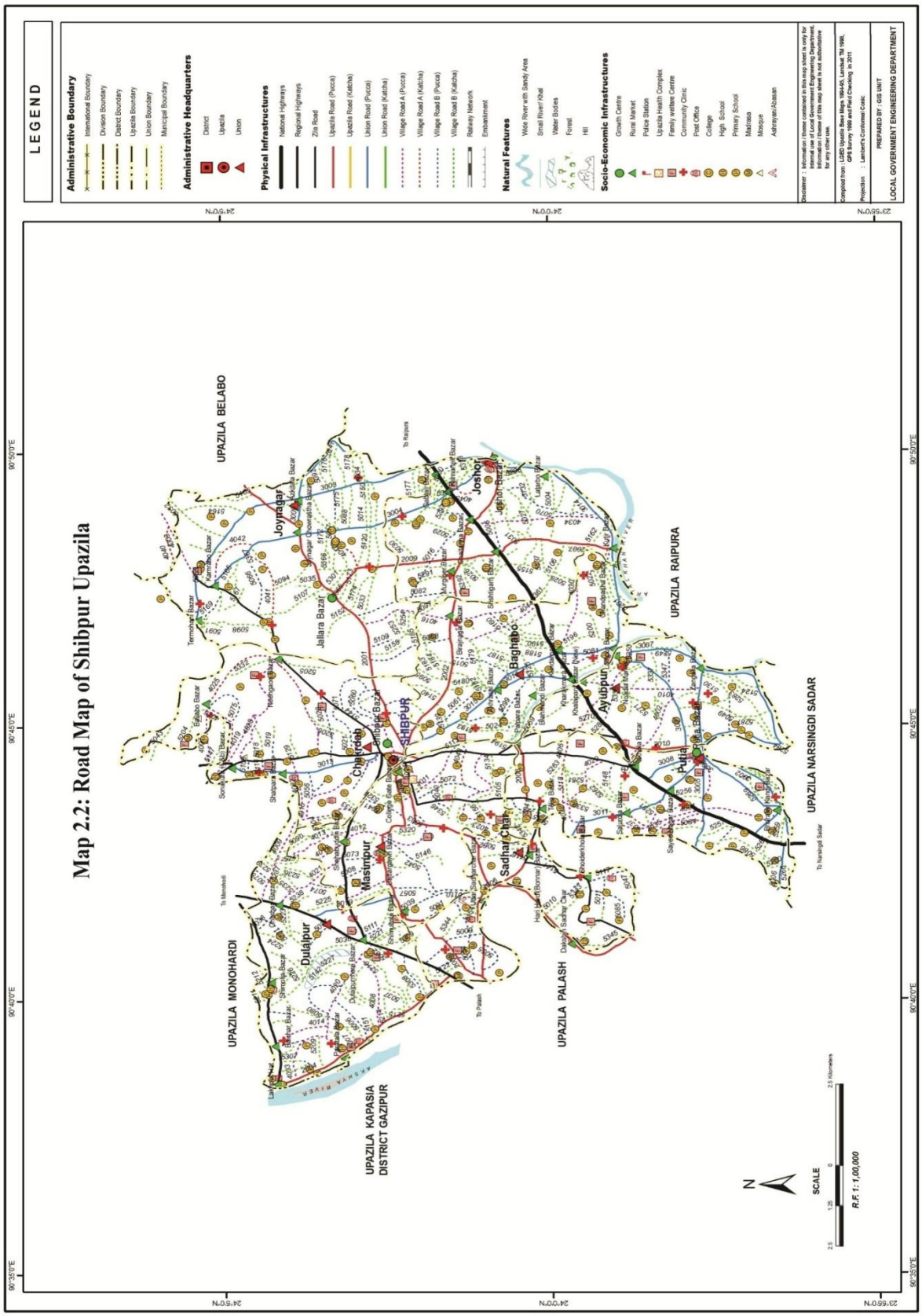
The main rivers are Shitalakshya, Arial Khan, Brahmaputra and Paharia flow through the Upazila, the water way is used for peoples' daily commuting.

2.4 Railway Network

Shibpur Upazila is not connected with the railway network.

2.5 Air Network

Shibpur has no provision of air service.



Map 3.1: Road Map of Shibpur Upazila

CHAPTER 3: ANALYSIS OF SURVEY FINDINGS

3.1 Traffic Volume Count Survey

Traffic volume count survey has been done in six important intersections and three road way segments in Shibpur Upazila. As different areas have different impacts, the peak time and off peak time vary according to its activities. The surveyed locations are given below:

- C & B Bazar Bus Stand,
- Chaitannya Bus Stand,
- Itakhola Bus Stand,
- Kamrabo Intersection,
- Lakhpur Bazar,
- Mannan Bhuiyan Chattar,
- Thana Moar,
- Dulalpur Moar,
- Syed Nagar Bus Stand

3.1.1 Traffic flow at Surveyed Intersections

Traffic flow varies according to the significance of the intersections. The vehicles are diverted to the different link through the intersections. In the study area, it has been shown that traffic flows are varied in the intersections.

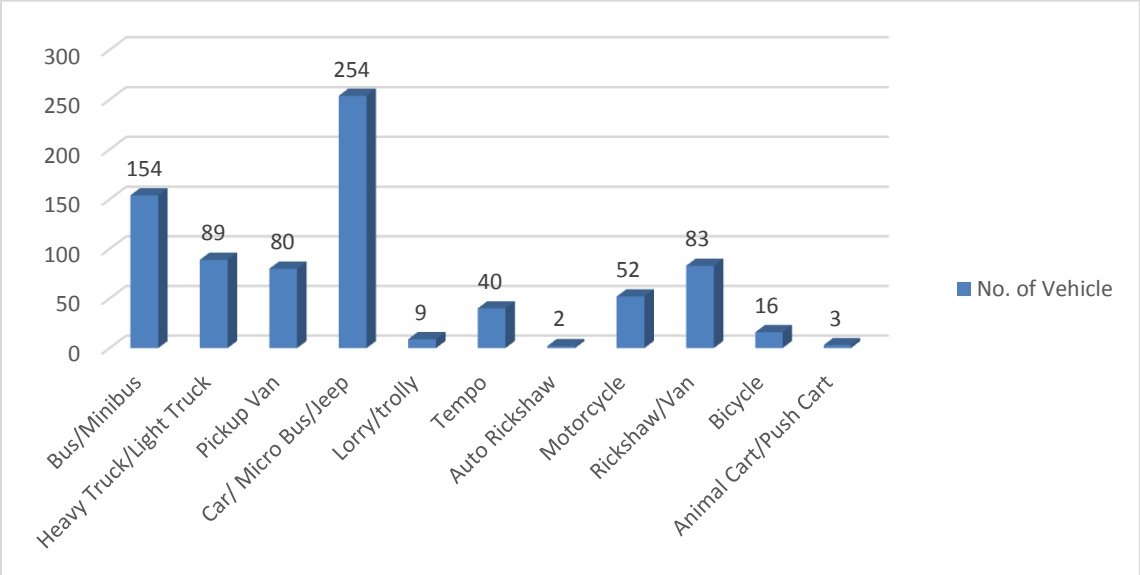


Figure 3.1: Traffic Flow at Itakhola Intersection

Source: Traffic and Transportation Survey, 2016

From the above bar chart, it has shown that Itakhola intersection is experienced different type of vehicle every day. The above data represents the frequency of traffic mode per hour. It can depict that Car or Micro Bus has marked as the highest at the intersection numerically 254. And similarly Bus or Mini bus is passing at a considerable rate which is 154. The other vehicles movement is fluctuated at the Itakhola Intersection.

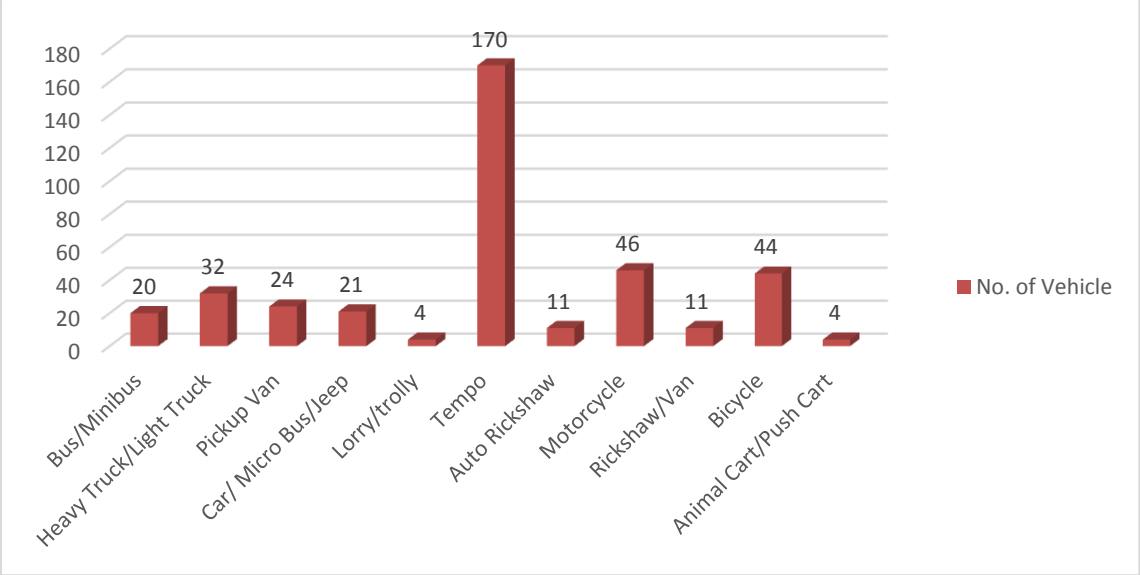


Figure 3.2: Traffic Flow at C & B Bazar Intersection

Source: Traffic and Transportation Survey, 2016

At the C & B Bazar Intersection, Motorized and Non-Motorized vehicles are implying at the same rate. But it has great impact of Tempo. People are using this type of vehicle more. Bicycle is also emerged as one of the frequent transport vehicles.

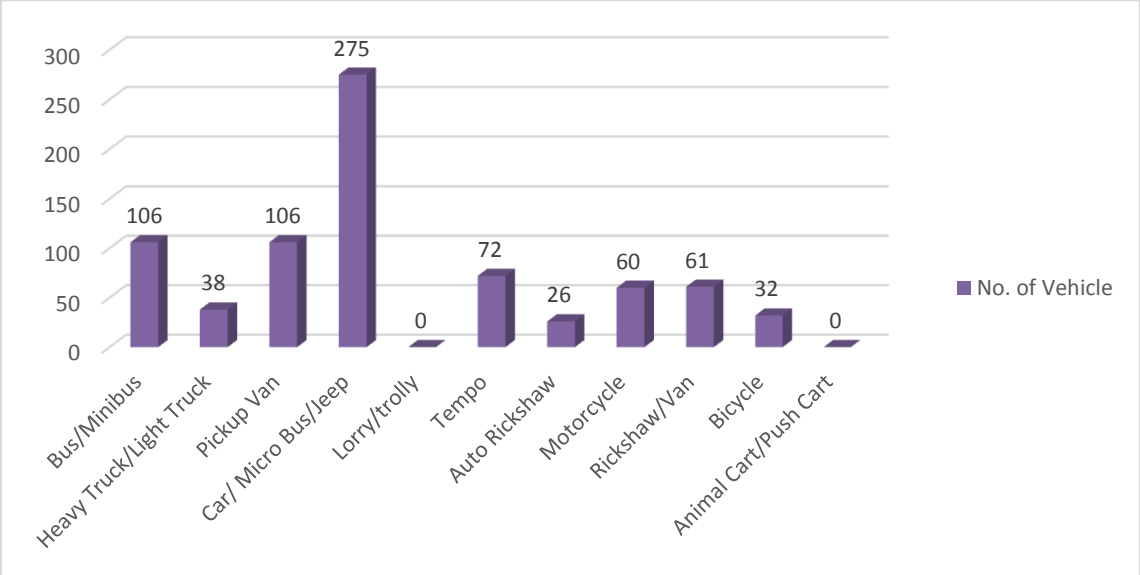


Figure 3.3: Traffic Flow at Chaitannya Bus Stand Intersection

Source: Traffic and Transportation Survey, 2016

Traffic modes are used at different rate at Chaitannya Bus Stand. From the above figure, it can be asserted that Bus is using as the main transport option for the people. On the other way, people are using Car or Micro Bus for their commuting purposes. NMV vehicles are also implying at different rate at the study area having considerable amount.

3.1.2 Motorized and Non-Motorized Vehicle

In the surveyed intersections, Motorized and Non-Motorized Vehicles are flowed at different rate. At a glance, MV and NMV vehicles are flowed respectively more than 70% and within 30%. In the following figures, percentages of MV and NMV are shown at important intersections.

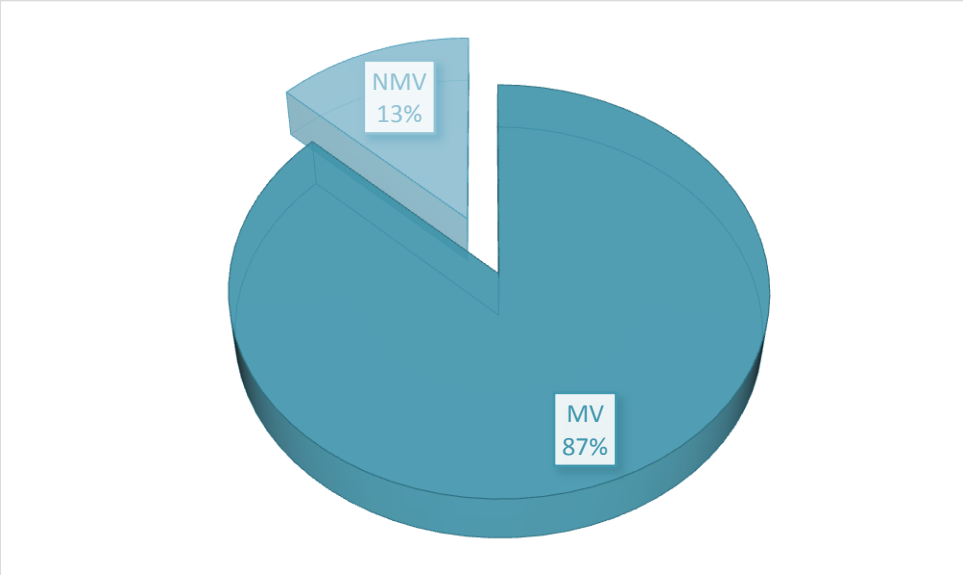


Figure 3.4: Traffic Flow at Itakhola Intersection

Source: Traffic and Transportation Survey, 2016

From the figure, it can depict that Itakhola is one of the busiest intersections at the Shibpur Upazila. And MV vehicles are flown at 87% of the total vehicles.

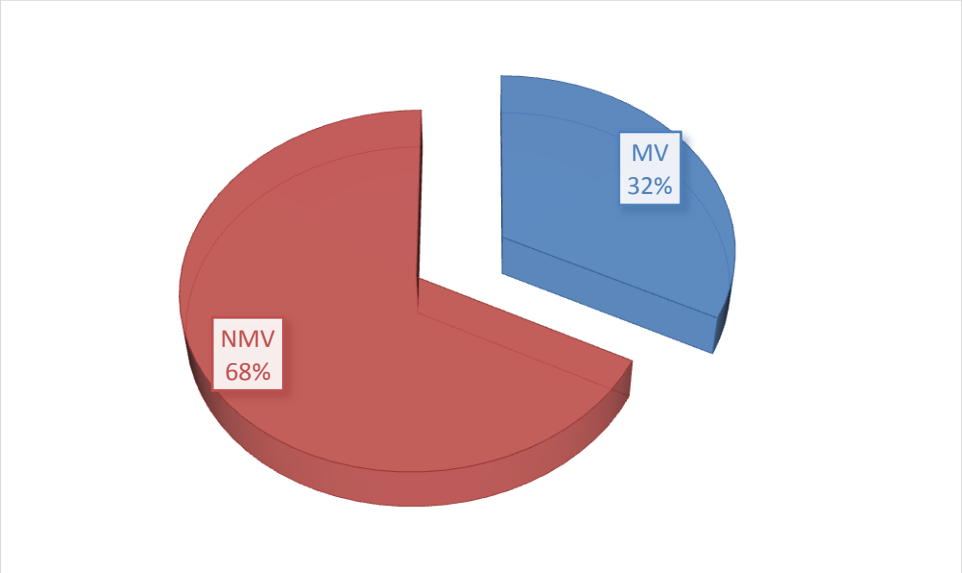


Figure 3.5: Traffic Flow at Lakpur Bazar Intersection

Source: Traffic and Transportation Survey, 2016

Lakpur Bazar has higher percentages of NMV vehicle. Bazar or Hat has higher demand of NMV vehicle, So Lakpur Bazar are experiencing 68% NMV of total vehicles.

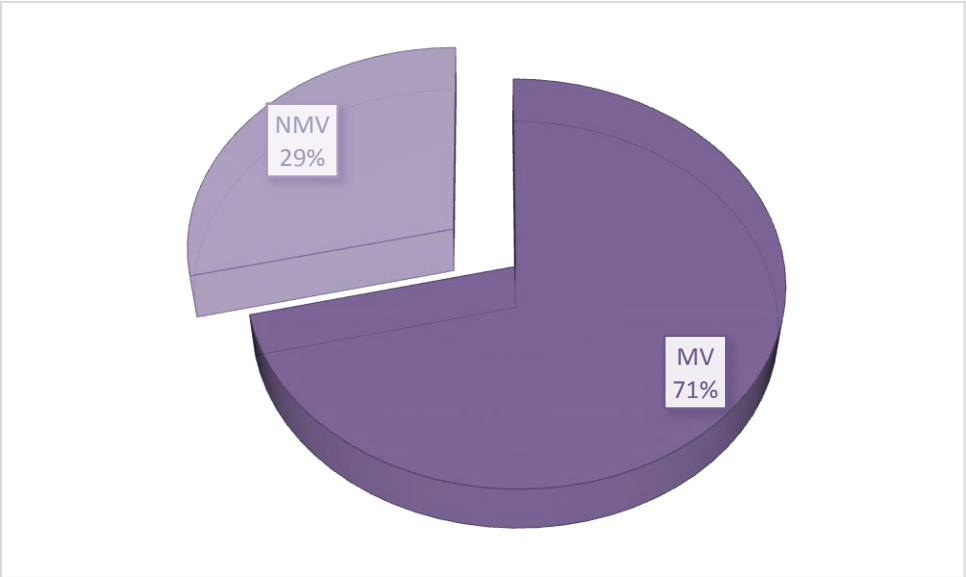


Figure 3.6: Traffic Flow at Kamrabo Intersection

Source: Traffic and Transportation Survey, 2016

From the above figure, it has been shown that MV and NMV are flowing at respectively 71% and 29% of the total vehicles at Kamrabo intersection.

3.1.3 Traffic flow status at Shibpur Upazila

Table 3.1: PCE and Traffic Volume at Intersections

Intersection	Link	Average Vehicle/Hour	Average PCE/Hour
C & B Bazar	C & B Bazar-Itakhola	473	533.17
	C & B Bazar-Monohordi	370	431.92
	C & B Bazar-Puradia	187	178.92
Itakhola	Itakhola-Sylhet	767	1337.92
	Itakhola-Narsingdi	1049	1797.83
	Itakhola-Shibpur	493	785.08
Kamrabo	Kamrabo-Hatirdia	236	295.58
	Kamrabo-Shibpur	247	283.25
	Kamrabo-Belabo	78	83.08
	Kamrabo-Belabo Main Road	183	213.08
Chaitannya Bus Stand	Chaitannya Bus Stand-Josor	174	201.00
	Chaitannya Bus Stand-Itakhola	674	981.08
	Chaitannya Bus Stand-Morjal	657	931.92
	Chaitannya Bus Stand-Chaitannya	149	155.17
Lakpur Bazar	Lakpur Bazar-Shibpur	145	131.50
	Lakpur Bazar-Hatirdia	176	172.42
	Lakpur Bazar-Chor sindur	195	184.08
Mannan Bhuiyan Chattar	Mannan Bhuiyan Chattar-Itakhola	849	992.67
	Mannan Bhuiyan Chattar-Monohordi	843	2528.00
	Mannan Bhuiyan Chattar-College Road	357	424.33
	Mannan Bhuiyan Chattar-Dakbunglow Road	388	427.67

Source: Traffic and Transportation Survey, 2016

The above table gives an overall idea about the total traffic flow where Itakhola and Mannan Bhuiyan Chattar are the busiest roads. The detail traffic flows are given at **Appendix-A**.

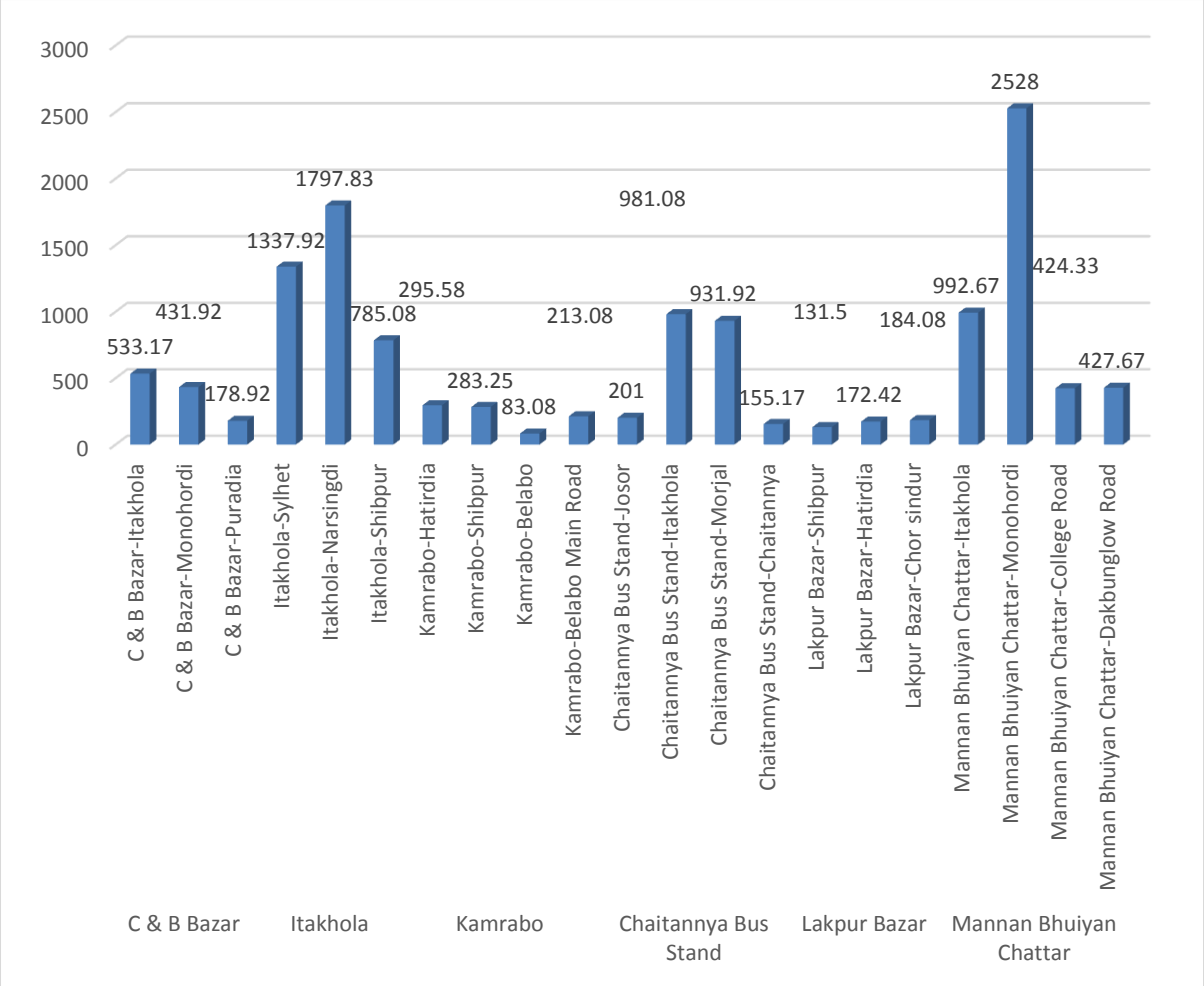


Figure 3.7: Average PCE at Links of Six Intersections

Source: Traffic and Transportation Survey, 2016

From the above figure, it has been seen that PCE value of traffic flow is 1797.83 at the link of Itakhali to Narsingdi. The highest PCE value is at the Mannan Bhuiyan Intersection which is 2528 at the link of Mannan Bhuiyan Chattar to Monohordi. And at the other links traffic flows are fluctuated.

3.1.4 Traffic Volume and PCE at Roadway Segments

Table 3.2: Traffic Volume and PCE at Roadway Segments

Roadway Segment Name	Link Name	Average Vehicle/Hour	Average PCE/Hour
Dulalpur Moar	Chor sindur-Monohordi	254	264.08
Syed Nagar Bus Stand	Narsingdi-Sylhet	729	1230.50
Thana Moar	Baniyadi-Joynogor Road	249	310.25

Source: Traffic and Transportation Survey, 2015

At Roadway Segments, Traffic vehicles are flown at the rate of 729 per hour at the Syed Nagar Bus Stand. At other road segments traffic flows are comparatively low.

3.1.6 Pedestrian Survey

Pedestrian is an important part of traffic. In case of designing an intersection or roadway, it is necessary to survey the pedestrian. In the traffic survey, pedestrian count has done in every link of three intersections which have summarized below.

Table 3.3: Pedestrian flow at selected intersections

Intersection	Link	Average Pedestrian/ Hour	Average Pedestrian/ Minute
C & B Bazar	C & B Bazar-Itakhola	250	4
	C & B Bazar-Monohordi	395	7
	C & B Bazar-Puradia	303	5
Itakhola	Itakhola-Sylhet	239	4
	Itakhola-Narsingdi	262	4
	Itakhola-Shibpur	301	5
Kamrabo	Kamrabo-Hatirdia	22	0
	Kamrabo-Shibpur	31	1
	Kamrabo-Belabo	45	1
	Kamrabo-Belabo Main Road	33	1
Lakpur Bazar	Lakpur Bazar-Shibpur	243	4
	Lakpur Bazar-Hatirdia	265	4
	Lakpur Bazar-Chor sindur	286	5
Mannan Bhuiyan Chattar	Mannan Bhuiyan Chattar-Itakhola	41	1
	Mannan Bhuiyan Chattar-Monohordi	59	1
	Mannan Bhuiyan Chattar-College Road	61	1
	Mannan Bhuiyan Chattar-Dakbunglow Road	49	1

Source: Traffic and Transportation Survey, 2015

From the table, it is seen that pedestrian movement is comparatively higher at C & B Bazar. In three link of C & B Bazar, pedestrians are moved more than 5 persons per minute. In Lakpur Bazar has the same significance of pedestrian movement. At other intersections pedestrians are moved at more than 1 person per minute.

3.2 Origin and Destination Findings

Origin and Destination Survey has been reflected different desired issues such as types of mode used in study area, origin and destination pattern, behavior etc. The output of the O D Survey has been depicted in below paragraphs.

3.2.1 Trip Distribution Pattern

The number of O D survey has been carried out 43 where trip distribution pattern can easily determine. From the survey, it has been seen that people lean to travel internally within Unions and also travel other Upazilas and Districts. The following tables represent the trip distribution pattern of Shibpur Upazila respectively within Unions and other Upazila s/Districts.

Table 3.4: Origin Destination Matrix within Unions of Shibpur Upazila

Destination / Origin	Chakradha	Josor	Masimpur	Pourashava	Putia	Total
Chakradha	0	0	0	1	1	2
Josor	0	0	1	1	0	2
Masimpur	0	0	0	0	1	1
Pourashava	1	0	1	0	0	2
Putia	0	2	0	1	0	3
Total	1	2	2	3	2	10

Source: Traffic and Transportation Survey, 2016.

From the above table, it has been seen that people travel main center of the Upazila from almost every union. As Pourashava is the main concentration of works, people prone to visit here for their purposes. On the survey day, the findings have found some concentration of areas where people are commuting. From the above matrix, Putia and Pourashava has more travelers on that day. From the matrix, we can know that how trips distributed throughout the Upazilas.

Table 3.5: Origin Destination Matrix surrounding Upazilas /Districts of ShibpurUpazila

Destination / Origin	Bhairab	Dhaka	Habiganj	Hatirdia	Madhobdi	Monohordi	Narsingdi	Sylhet	Vela nagar	Total
Bhairab	0	2	0	0	0	0	0	0	0	2
Dhaka	1	0	0	0	0	0	0	0	0	1
Habiganj	0	1	0		0	0	0	0	2	3
Hatirdia	1	0		0	0	0	1	0	0	2
Madobdi	0	0	0	1	0	0	0	0	1	2
Monohordi	0	3	0	0	0	0	1	0	0	4
Narsingdi	0	0	0	0	0	0	0	0	0	0
Sylhet	0	2	0	0	0	0	1	0	0	3
Velanagar	0	0	0	0	0	0	1	0	0	1
Total	2	8	0	1	0	0	4	0	3	18

Source: Traffic and Transportation Survey, 2016.

The above matrix represents that Narsingdi is marked as the Destination point in most cases. And most trip is originated from Monohordi which is 4 on the survey day. On the same way, Sylhet, Vela nogor, Habiganj have the concentrations of trip distributions.

3.2.2 Mode Choice

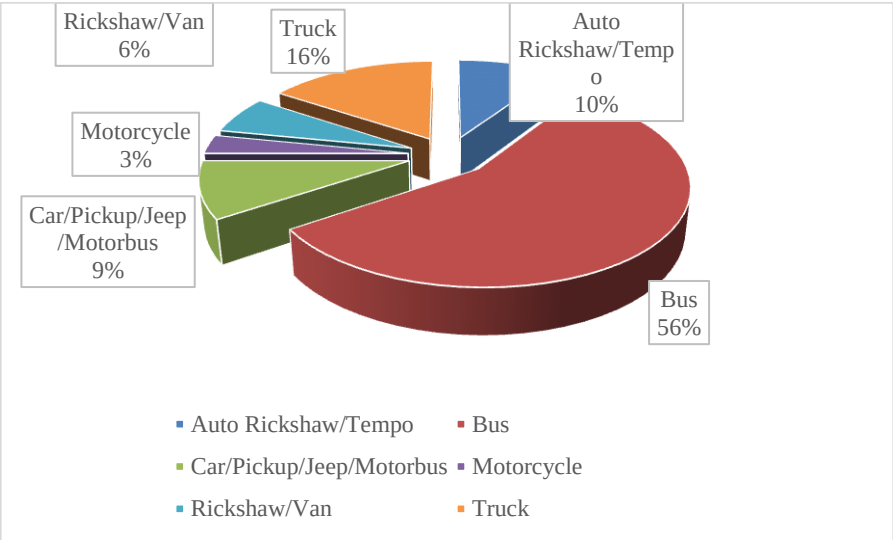


Figure 3.8: Types of Mode

Source: Traffic and Transportation Survey, 2016.

The pie chart depicts the mode choice of passengers during travel. The above data significantly presents that 56% passengers chose bus to travel. 16% use truck and which is mostly for loading and unloading goods. 9% passengers use car/pickup/jeep/motorbus. 6% use rickshaw and van whereas only 3% chose motorcycle to travel.10% passengers chose auto rickshaw/tempo.

3.2.3 Purpose of Trip

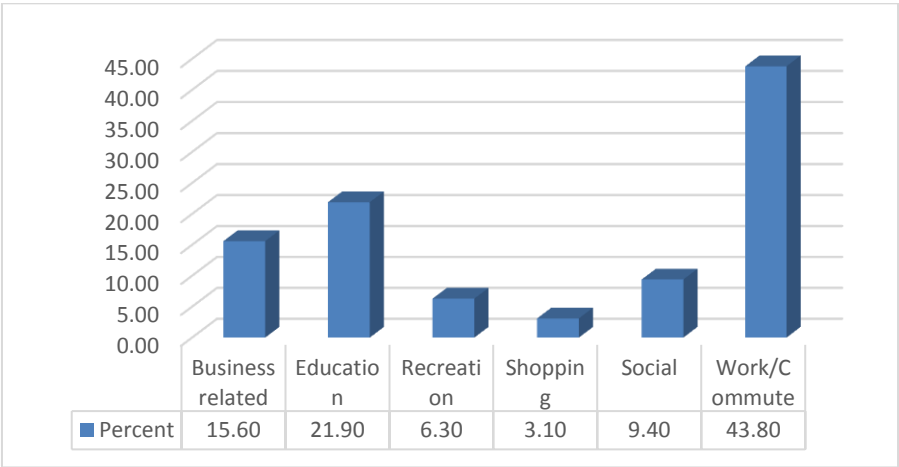


Figure 3.9: Trip purposes of surveyed respondents

Source: Traffic and Transportation Survey, 2016.

The bar chat represents the purpose of trip of different passengers. The data of the chart clearly shows that mostly people travel due to work purpose and which percentage is 43.8%. 21.9% travel due to education purpose.15.6% travel to meet their business needs. 3% because of social purposes such as visiting relatives, social programs etc.

3.2.4 Origin Destination Behavior

Table 3.6: Nature of Origin and Destination

Origin		Destination	Type of Destination						Total
			Recreational	Residence	School/College/University	Shopping	Social	Workplace	
Type of Origin	**Residence**	Frequency	2	0	5	1	2	12	22
		Percentage	9.10%	0.00%	22.70%	4.50%	9.10%	54.50%	100.00%
	School/College/University	Frequency	0	1	0	0	0	0	1
		Percentage	0.00%	100.00 %	0.00%	0.00%	0.00%	0.00%	100.00%
	Social	Frequency	0	1	0	0	0	0	1
		Percentage	0.00%	100.00 %	0.00%	0.00%	0.00%	0.00%	100.00%
	Workplace	Frequency	0	6	0	0	0	2	8
		Percentage	0.00%	75.00%	0.00%	0.00%	0.00%	25.00%	100.00%
	Total	Frequency	2	8	5	1	2	14	32
		Percentage	6.30%	25.00%	15.60%	3.10%	6.30%	43.80%	100.00%

Source: Traffic and Transportation Survey, 2016

The above cross table shows the origin-destination data of the passengers. From residence most of the people travel to workplaces which percentage is 54.50%. 22.70% travel to school/college/universities from residence. From school/college/universities 100% people travel to residence. From the residence people's destinations are different. People travel for social purposes also have the same destination which is residence and its percentage is 100%. 75% people travel to residence from work places and 25% to another work places.

3.2.5 Passengers Occupancy in different vehicle mode

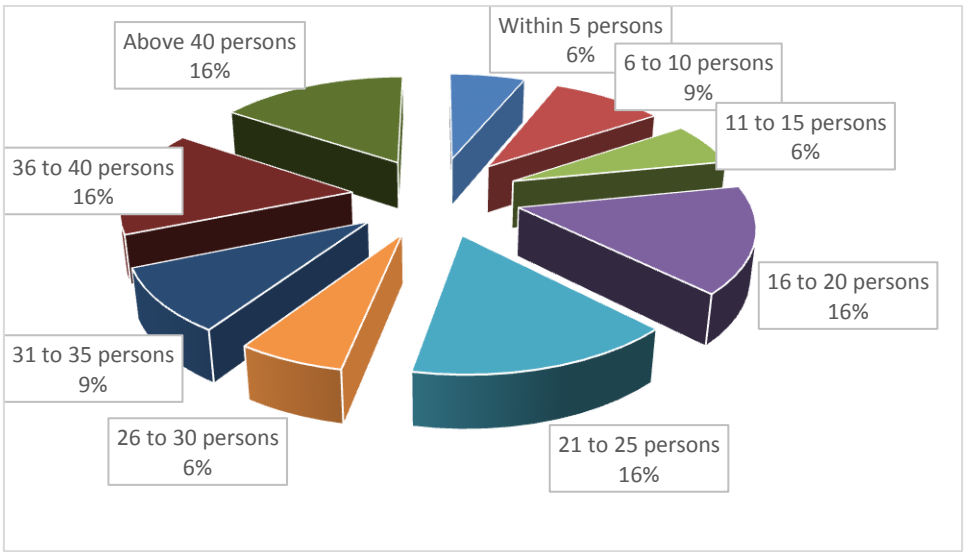


Figure 3.10: Passengers Occupancy in Different Modes

Source: Traffic and Transportation Survey, 2016.

The pie chat represents the density of passengers in different vehicles. Form the percentages it is visible that mostly people travel in big vehicles which can carry above 40 persons and which percentage is 16%. Secondly people travel in relatively less big vehicle from the first one such as 16 to 20 persons and which percentage is also 16% and other vehicles which can carry 30 to 40 persons also have the same percentage. 9% travel in such vehicle which can carry 31 to 35 persons, 6 to 10 persons respectively.6% travel in vehicles which have capacity to carry 6 to 10 persons.

3.2.6 Major Prioritized Problems

Table 3.7: Major problems in Transportation

Comments	Frequency	Percent
Damaged of Road	5	16.67
Encroachment along the roadside	1	3.33
Excessive fare	1	3.33
Incompatible Roads	1	3.33
Incompatible vehicle plying	1	3.33
Insufficiency of Street lightening	1	3.33
Insufficiency of Traffic police	1	3.33
Narrow Road	2	6.67
Police harassment	4	13.33
Theft	1	3.33
Traffic jam	12	40.00
Total	30	100.00

Source: Traffic and Transportation Survey, 2016.

The data of the above table shows the major problems that passengers face during travel. On the basis of the opinions of the passengers the problems are prioritized. People mostly think that traffic jam is the major problem and which percentage is 40%.16.67% people gave their opinion on the problem of damaged road. 13.33% think that police harassment is the major problem.6.67% think that narrow road is the main problem. 3.33% think that theft, insufficiency of traffic police, incomputable vehicle plying, incomputable roads, excessive fare are the major problems respectively.

3.3 Passenger Interview Survey Findings

Passenger's Interview Survey has bene conducted for Bus, Boat and Train. As people mostly travel by bus, the findings reflect the about the transport communication through bus. The findings are when people prefer buses, travel cost, travel distance, types of modes for getting into buses through Bus terminal or bus stoppages.

3.3.1 Age group according to the Gender

Table3.8:Age Sex Structure of the Respondents

Age \ Sex			Sex		Total
			Female	Male	
Age Group	Below 15	Frequency	0	1	1
		Percent	0.00%	100.00%	100.00%
	16-20	Frequency	2	9	11
		Percent	18.20%	81.80%	100.00%
	21-30	Frequency	6	22	28
		Percent	21.40%	78.60%	100.00%
	31-40	Frequency	10	16	26
		Percent	38.50%	61.50%	100.00%
	41-50	Frequency	3	6	9
		Percent	33.30%	66.70%	100.00%
	Above 51	Frequency	2	5	7
		Percent	28.60%	71.40%	100.00%
	Total	Frequency	23	59	82
		Percent	28.00%	72.00%	100.00%

Source: Traffic and Transportation Survey, 2016.

The above cross table shows the relation between age-group and male and female who travel. In the age-group of 16-20, Male and Female travel respectively 81.80% and 18.20%. It is noticeable that in every age-group the percentages of male travelers are more than the female. In case of below 15 age-group 100% travelers are male. In the 31-40 and 41-50 age-groups the percentages of female travelers are increasing.

3.3.2 Trip Purpose

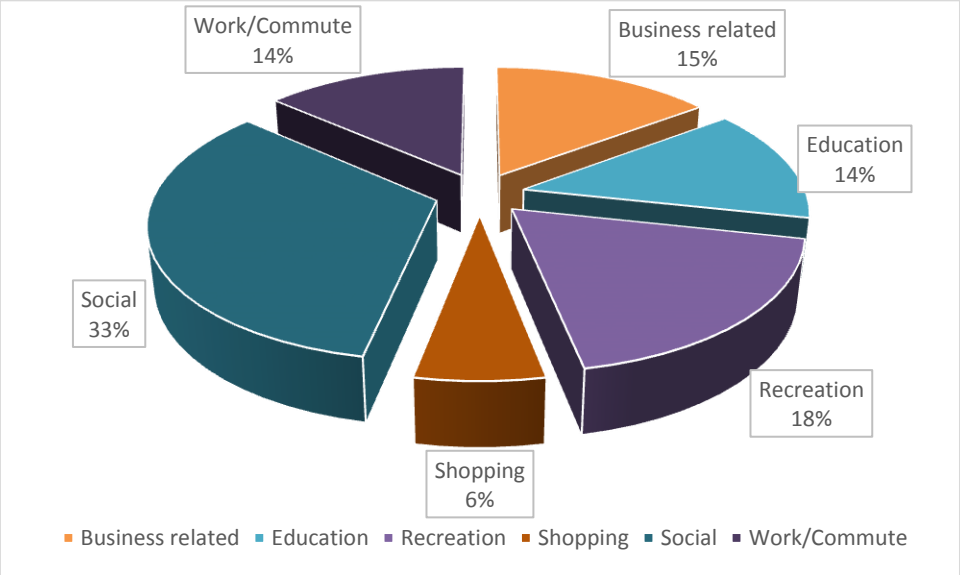


Figure 3.11: Purpose of Trip

Source: Traffic and Transportation Survey, 2016.

The pie chart depicts the percentages of bus passengers who travel by bus for different purposes. The data reveals that 33% bus passengers travel by bus because of social purposes. 18% bus passengers use bus due to recreation purpose. 15% and 14% passengers use bus because of business and work purposes respectively. Only 6% passengers use bus for shopping.

3.3.3 Types of Mode

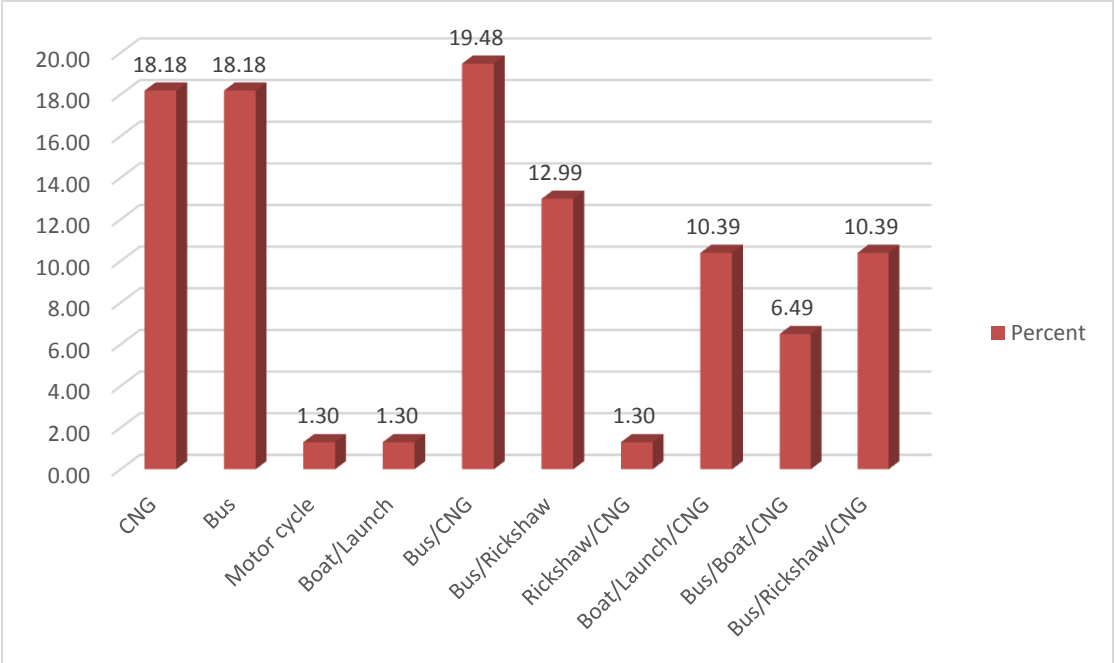


Figure 3.12: Types of Mode used in a Trip

Source: Traffic and Transportation Survey, 2016.

The bar chart represents the types of modes used by the passengers. From the data it is visible that 38.96% passengers use one type of mode to complete their journey. 61.04% passengers use two or

three types of modes to finish their journey. The data also shows that people are using all kinds of modes in Shibpur. But more than half of the passengers use more than one type of modes to reach to their destination. (Please see **Appendix-B**)

3.3.4 Trip Distribution by Passengers

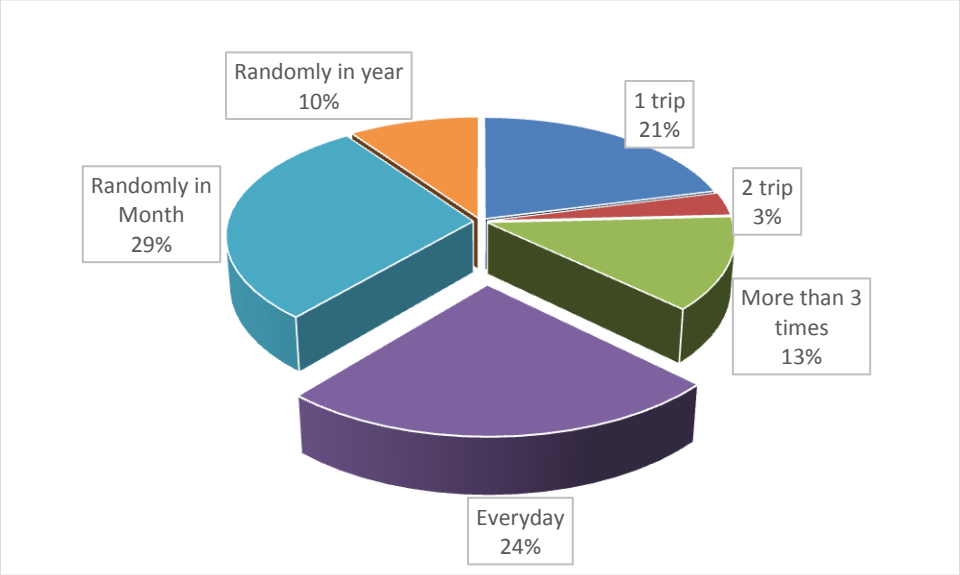


Figure 3.13: Trip Frequency

Source: Traffic and Transportation Survey, 2016.

The pie chart shows the trip distribution by passengers. From the data it is shown that 29% people arrange trip randomly in month. 24% people make a trip everyday.10% people travel randomly in a year. 13% people make more than 3 trips and 3% people make 2 trips.

3.3.5 Trip production according to the trip purpose

Table 3.9: Trip Production according to the Trip Purpose

Trip Frequency / Trip Purpose		Trip per week						Total
		1 trip	2 trips	More than 3 trips	Every day	Randomly in Month	Randomly in year	
Trip Purpose	Business related	3	1	1	7	0	0	12
	Education	0	0	6	2	1	0	11
	Recreation	2	0	0	1	1	0	15
	Shopping	2	1	0	0	0	0	5
	Social	4	0	0	1	12	5	27
	Work/Commute	2	0	1	4	3	1	11
	Total	13	2	8	15	18	6	81

Source: Traffic and Transportation Survey, 2016.

The data of the table depicts that most of the people travel due to business purposes every day in a week. For education purpose people make trip more than 3 times in a day. For recreation purpose people every day. For social purposes most people travel randomly in month.

3.3.6 Travel cost according to the trip purpose

Table 3.10: Travel cost according to the Trip Purpose

Trip Purpose \ Travel Cost			Travel Cost						Total
			Within 50 taka	51 to 100 taka	101 to 150 taka	151 to 200 taka	251 to 300 taka	More than 300 taka	
Trip Purpose	Business related	Frequency	11	0	1	0	0	0	12
		Percent	91.70 %	0.00%	8.30%	0.00%	0.00 %	0.00 %	100.00 %
	Education	Frequency	10	0	1	0	0	0	11
		Percent	90.90 %	0.00%	9.10%	0.00%	0.00 %	0.00 %	100.00 %
	Recreation	Frequency	11	3	0	1	0	0	15
		Percent	73.30 %	20.00 %	0.00%	6.70%	0.00 %	0.00 %	100.00 %
	Shopping	Frequency	4	0	0	1	0	0	5
		Percent	80.00 %	0.00%	0.00%	20.00 %	0.00 %	0.00 %	100.00 %
	Social	Frequency	17	2	4	2	1	1	27
		Percent	63.00 %	7.40%	14.80 %	7.40%	3.70 %	3.70 %	100.00 %
	Work/Commute	Frequency	7	2	1	1	0	0	11
		Percent	63.60 %	18.20 %	9.10%	9.10%	0.00 %	0.00 %	100.00 %
	Total	Frequency	61	7	7	5	1	1	81
		Percent	74.40 %	8.50%	8.50%	6.10%	1.20 %	1.20 %	100.00 %

Source: Traffic and Transportation Survey, 2016.

The cross table shows the relation between trip purpose and travel cost. 91.7% people pay for travel within 50tk for business purpose. It is noticeable that for different types of purposes passengers pay cost within 50 taka which depicts that people try to stay close to their activity area. For work purpose 63.6% people pay within 50tk and 18.2% pay 51 to 100tk. For shopping purpose also people pay within 50 taka.73.3% people pay within 50tk for recreation and 20.0% pay 51 to 100tk for recreation.

3.3.7 Travel Cost according to the distance

Table 3.11: Travel cost according to the distance

Travel Distance \ Travel Cost			Travel Cost						Total
			Within 50 taka	51 to 100 taka	101 to 150 taka	151 to 200 taka	251 to 300 taka	More than 300 taka	
Total Distance	Within 5 km	Frequency	4	0	0	0	0	0	4
		Percent	100.00 %	0.00%	0.00%	0.00%	0.00 %	0.00 %	100.00 %
	6 to 10 km	Frequency	12	0	0	0	0	0	12
		Percent	100.00 %	0.00%	0.00%	0.00%	0.00 %	0.00 %	100.00 %
	11 to 15 km	Frequency	6	0	0	0	0	0	6
		Percent	100.00 %	0.00%	0.00%	0.00%	0.00 %	0.00 %	100.00 %
	16 to 20 km	Frequency	13	3	0	0	0	0	16
		Percent	81.30%	18.80 %	0.00%	0.00%	0.00 %	0.00 %	100.00 %
	21 to 30 km	Frequency	6	1	0	0	0	0	7
		Percent	85.70%	14.30 %	0.00%	0.00%	0.00 %	0.00 %	100.00 %
	31 to 40 km	Frequency	8	1	2	0	0	0	11
		Percent	72.70%	9.10%	18.20 %	0.00%	0.00 %	0.00 %	100.00 %
	41 to 50 km	Frequency	3	1	1	0	0	0	5
		Percent	60.00%	20.00 %	20.00 %	0.00%	0.00 %	0.00 %	100.00 %
	More than 51 km	Frequency	8	1	4	5	1	1	20
		Percent	40.00%	5.00%	20.00 %	25.00 %	5.00 %	5.00 %	100.00 %
	Total	Frequency	60	7	7	5	1	1	81
		Percent	74.10%	8.60%	8.60%	6.20%	1.20 %	1.20 %	100.00 %

Source: Traffic and Transportation Survey, 2016

From the above data of the cross table it is visible that most of the people are supporting to pay within 50tk cost to travel to different distant places. Such as within 5km, 6 to 10km and 11 to15km all respondents pay within 50 taka as travel cost. From the table it is noticeable that to go to a more distant place people pay within 50k which percentage varies from 81.3% to 40.0%. The highest the passengers pay to travel to different distant places 150 taka.

3.4 Regional Transport Survey

Regional transport network survey has been done for Buses, Trucks and Trains which are coming into study area and going out form study area. From the survey, we can know the carrying capacity of the buses, types of goods carrying by trucks, connectivity pattern with other Upazila s and Districts.

Regional Bus Survey has been carried out in Shibpur Bus Stand and Itakhola Bus Stand. Most of the buses have more than 40 persons carrying capacity. Buses are originating and commuting in different areas. Trucks are coming into study area or going out form study area for goods carrying purposes such as vegetables, agricultural products like paddy; departmental products etc. (Please see **Appendix-B**)

CHAPTER 4: FINDINGS FROM PRA AND SOCIO ECONOMIC ABOUT TRANSPORTATION

4.1 Findings from Socioeconomic survey

4.1.1 Mode of Communication

As there are very limited number of waterways are available almost all of the households' main mode of communication is road. It also represents that road condition in Shibpur Upazila is good. A small percentage of total households also traveled by train for long distance travel as they think it is more safe mode of communication than others (please see Figure:4.1) .

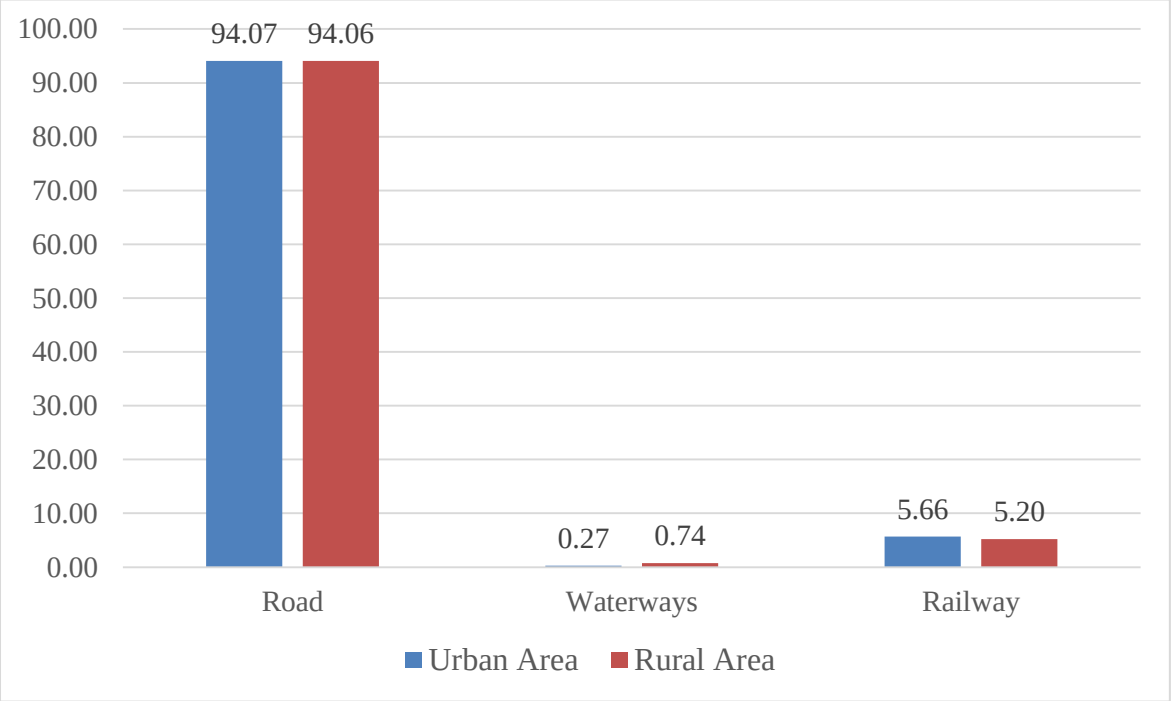


Figure 4.1: Mode of Communication (Source: Field Survey, 2015)

4.1.2 Types of Road

In urban area about three fourth of total road is bituminous road. Concrete made roads are the second highest in urban area which represents that in urban area road condition of Shibpur Upazila is satisfactory. Besides, in rural area, the percentage of bituminous made or concrete made road percentage is almost same which represents that road condition in both of urban and rural area is almost the same. In rural area a significant percentage of roads are katcha that represents the fact that some steps could be taken for the development of these road (please see Figure: 4.2).

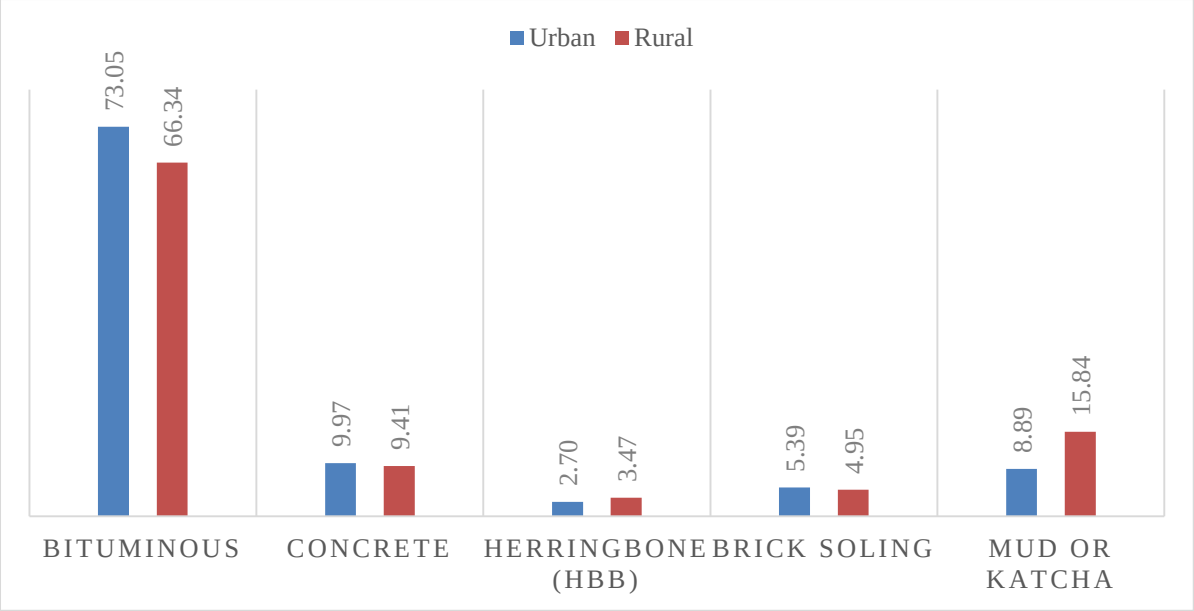


Figure 4.2: Types of Road (Source: Field Survey, 2015)

4.1.3 Mode of Access to Main Road

It has been found that about two third of total households in urban area got access to main road through footpath, whereas in rural area about the percentage is about half of the total respondents. This is because in urban area, there are sufficient establishments has been made as footpath than in rural area. In rural area most of the households went to main road by *Halot* or field boundary (please see Figure: 4.3).

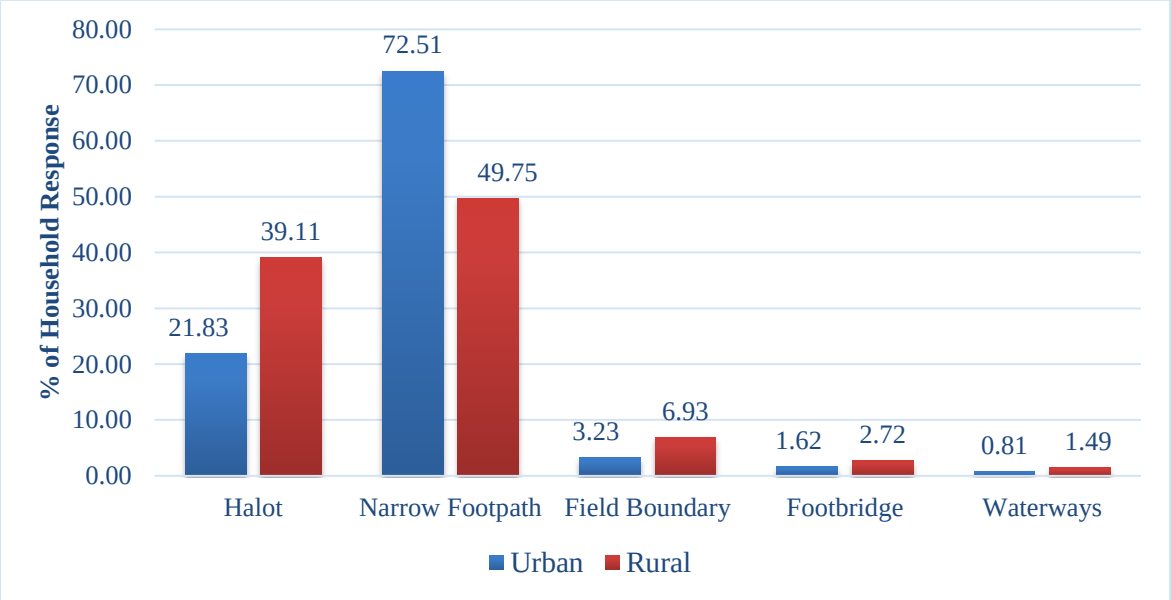


Figure 4.3 : Mode of Access to Main Road (Source: Field Survey, 2015)

4.1.4 Condition of Road

In urban area, about one third or total road's condition is good, on the other hand, more than about half of total roads have been reported as deteriorated. This represents the situation that there is not enough maintenance for urban road though about two third of total urban road is made by bituminous. On the other hand, the percentage of deteriorated road is lower in rural area than urban area, but there

are about four times higher destroyed roads in rural area which needs quick maintenance before totally destroyed condition. The percentage of seasonal waterlogged road in rural area is about three times higher for than urban area. Besides, the percentage of good roads is also not much significant in rural areas than urban area. In a nutshell, it can be easily understood that enough maintenance of road is not present in both of rural and urban area. But the condition in rural area is worse than urban area (please see Figure: 4.4).

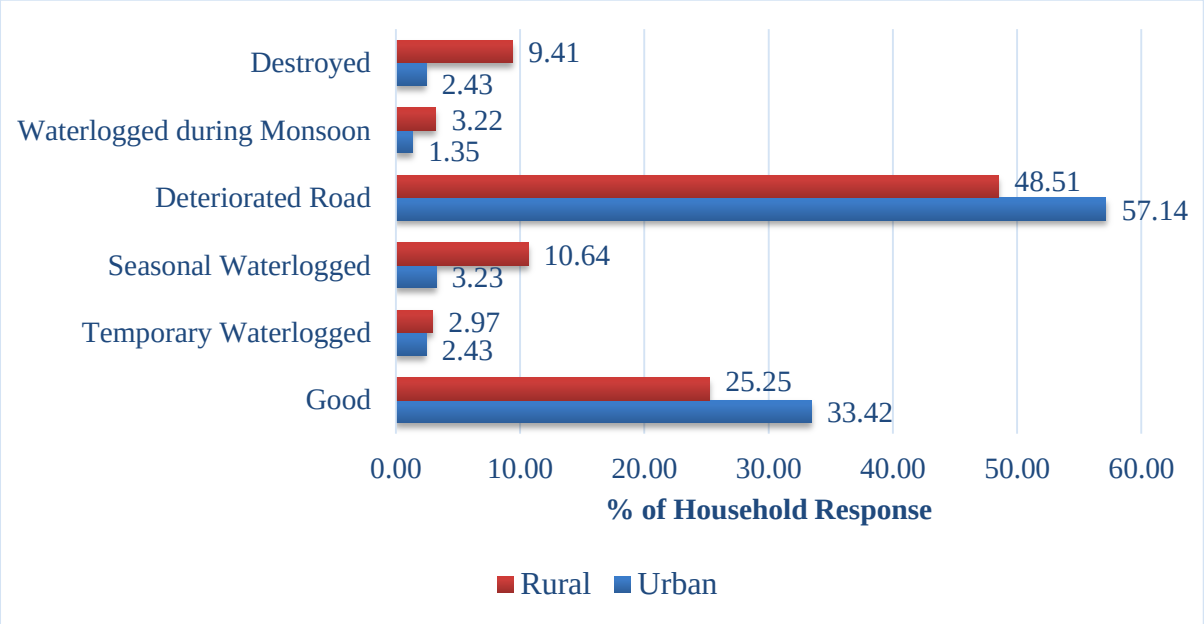


Figure 4.4: Condition of Road Source: Field Survey, 2015

4.1.5 Maintenance of Road

As from the previous section discussion, it has been proved that enough road maintenance has not been carried out in both of urban and rural area, the below Figure:4.5 again proved that. There is almost never annual maintenance has been carried out for both of urban and rural area. For about half of the cases irregular maintenance has been occurred. In urban area for about one fourth of the cases roads are being maintained periodically 2-3 years. But the percentage is almost half in rural area than in urban area. In rural area almost about one fourth of the cases roads are being again made by after extremely damaged. Thus, it can be said that effective regular maintenance should be carried out in both of urban and rural area by the responsible authorities

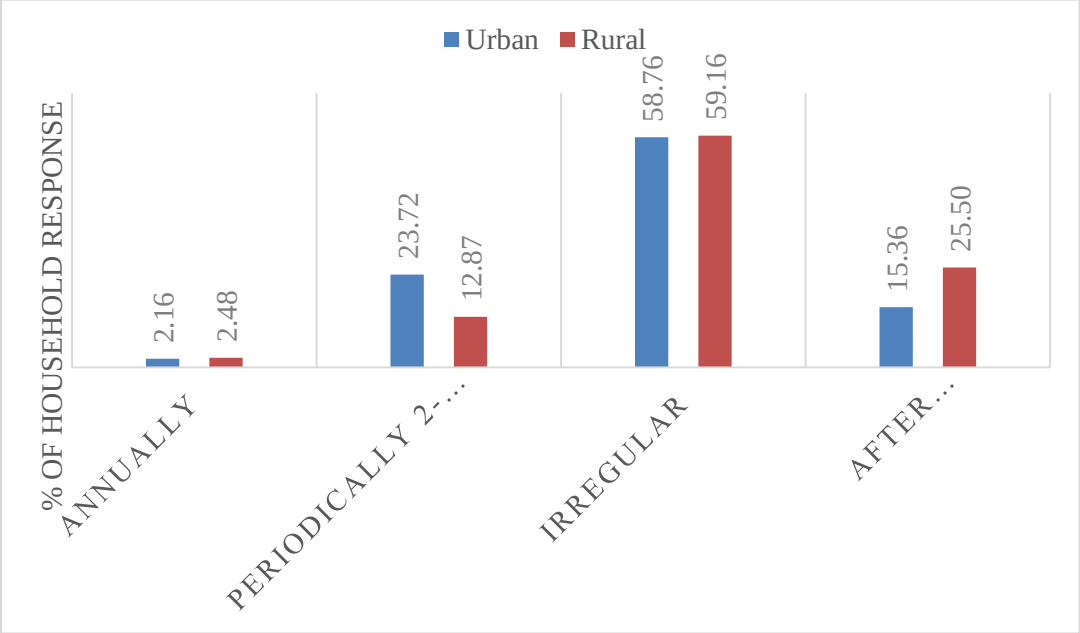


Figure 4.5: Maintenance of Road (Source: Field Survey, 2015)

4.2.0 Findings from PRA

PRA (Participatory Rural Appraisal) is an innovative approach to empower the people by sharing information and making decisions regarding the Development Project and to involve the local people in the planning process by letting the local people identify their own problems, potentials, development needs and planning priorities for next 20 years. In the PRA Session, different types of problems have identified where transportation problem was significant.

The findings related to traffic and transportation of the PRA Session of Shibpur Upazila are summarized below:

- Poor communication system and broken road
- Poor transportation system
- Develop modern transportation system
- Development of transportation

CHAPTER 5: CONCLUSION

The findings from transport and traffic management survey are of vital issue in preparing master plan for the study area. The survey reveals that no public or private bus service is available for intra-city movement. Rickshaw/van, bicycle and motorcycles are common prime modes for intra city movement. Water transport network has no significant importance in carrying out both passenger and goods in Shibpur. The survey results of the Transportation and Traffic Management has become the basis for further analysis and interpretation in the process of preparing master plan for Shibpur Upazila. In future, care should be taken not only to the conditions of the roads and vehicles but also to the traffic management. Transport study provides special attention to urban transportation planning as it greatly influences the location decisions and travel behavior of people, goods and services. Transportation is critical for the efficiency of towns contributing to their productivity and economic growth. A good network of roads and other transportation mode coupled with an efficient transport management system makes a substantial contribution to the "working efficiency" of cities and towns and enables them to become catalysts for social and economic development. On the other hand, the impact of a poorly designed urban transport system is manifested in terms of traffic congestion, delays, accidents, high energy consumption, high pollution of the environment and inequitable access to services. A well-planned transportation system results in orderly urban growth, greater use of urban public transport, lower vehicular pollution, and shorter auto trips.A comprehensive transportation study is undertaken to investigate the existing transportation infrastructure, transportation modes and modal share scenario of Shibpur Upazila. Accordingly, the transportation study is conducted to determine the present travel patterns and the characteristics of existing transportation facilities to forecast the future travel demand and develop a transportation plan.

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Urban Development Directorate
PREPARATION OF DEVELOPMENT PLAN FOR FOURTEEN UPAZILAS (PACKAGE: 02): UDD

Bus/ Boat or Launch/ Train Passenger Interview Survey Questionnaire

Name of Upazila : .....
Date : …….
Time of Interview : .....
Location of Interview point : .....

A. Present Address of the respondent

B. **Sex:** (a) Male (b) Female

C. Age: 1. Below 15 years 2. 16-20 Years 3. 21-30 Years 4. 31-40 Years 5. 41-50 Years 6. Above 51 Years

D. Where did your trip begin? .....

E. Where did your trip end point? .....

F. What was the purpose of your trip?

1. Work/Commute 2. Business related 3. Shopping 4. Education 5. Social 6. Recreation

G. No. of trips in a week? .....

H. How many times you changed modes to complete this trip?

1	2	3

I. What are types of modes you used to complete the trip?

1. Bus **2.** Motor cycle **3.** Rickshaw **4.** Van **5.** Rail **6.** Boat/Launch **5.** On foot **6.** Others (specify)

J. Total travel time of the trip? .....(In min/hour)

K. Total costs of the trip? ..... (In Taka)

L. Total distances of the trip? ..... (In k.m.)

M. Any comments on transportation? .....

Name of Enumerator: ..... Name of Supervisor: .....…….
Signature of Enumerator: …….. Signature of Supervisor: ....…….

Urban Development Directorate
PREPARATION OF DEVELOPMENT PLAN FOR FOURTEEN UPAZILAS
(PAGKAGE-02):UDD

Traffic and Transportation Survey

Traffic Volume Count Tally Sheet

(24 Hours long) Weather condition

Name of Upazila:

Date: ……

Route Name: ……

Hours counted: **Start ……**am/pm**, Finish ……**.am/pm

Traffic Direction: From ……to……. Intersection Name: ……..

Type of traffic	Number of Traffic	Total
Bus/Minibus		
Heavy Truck/ Light Truck		
Car/Micro-bus/Jeep		
Auto Rickshaw/Tempo/Nosimon		
Motorcycle		
Rickshaw/Van		
Bicycle		
Animal cart/Push cart		
Pedestrian		
Others (specify)		

Name of Enumerator ……

Signature of Enumerator ……

Name of Supervisor …….

Signature of Supervisor …….

Urban Development Directorate
PREPARATION OF DEVELOPMENT PLAN FOR FOURTEEN UPAZILAS
(Package: 02): UDD

Roadside Interview Survey (O-D Survey) Questionnaire

Time: Every half an Hour Interval (24 hours clock)

Name of Upazila: Date: …….

Route Name: …… Hours counted: **Start ……**am/pm**, Finish ……**.am/pm

Traffic Direction: From ……to…….

A. Vehicle Type:

1. Truck 2. Bus 3. Car/Pickup/Jeep/Motorbus 4. Auto Rickshaw/Tempo 5. Motorcycle 6. Rickshaw/Van 7. Bicycle

B. Where did your trip begin? City/Town.....

C. What type of place is your trip start point?

1. Residence 2. Workplace 3. Shopping 4. School/College/University 5. Social 6. Recreational

D. Where did your trip end? City/Town.....

E. What type of place is your trip end point?

1. Residence 2. Workplace 3. Shopping 4. School/College/University 5. Social 6. Recreational

F. What was the purpose of your trip?

1. Work/Commute 2. Business related 3. Shopping 4. Education 5. Social 6. Recreation

G. How many people were in the vehicle including the driver? No. of people.....

H. Any comments on Transportation?

Name of Enumerator: …… Name of Supervisor: …….
Signature of Enumerator: …… Signature of Supervisor: ……...

Urban Development Directorate

PREPARATION OF DEVELOPMENT PLAN FOR FOURTEEN UPAZILAS
(PACKAGE: 02): UDD

Pedestrian Interview Survey Questionnaire

Name of Upazila : .....
Date : …….
Time of Interview : .....
Location of Interview point : .....

A. Present Address of the respondent

B. **Sex:** (a) Male (b) Female

C. Age: 1. Below 15 years | 2. 16-20 Years | 3. 21-30 Years | 4. 31-40 Years | 5. 41-50 Years | 6. Above 51 Years

D. Where did your trip begin? .....

E. Where did your trip end point? .....

F. What was the purpose of your trip?

1. Work/Commute 2. Business related 3. Shopping 4. Education 5. Social 6. Recreation

G. Total distances of the trip? ..... (In k.m.)

H. Any comments on transportation? .....

Name of Enumerator: ..... Name of Supervisor: .....……

Signature of Enumerator: …….. Signature of Supervisor: ....……

Urban Development Directorate
PREPARATION OF DEVELOPMENT PLAN FOR FOURTEEN UPAZILAS
(PACKAGE: 02): UDD

Questionnaire on Regional Transportation Network System

Name of Upazila : .....
Date of survey : …….

A. Information of trip going out from study area to other region (upazila/district)

1) Type of Mode (Bus/Truck/Train/Water way):

(Response will be collected from every mode)

2) Name of trip destination point (Upazila/District):
3) No. of trips per day (hour basis)
4) Average no. of passengers carried by per mode (per trip):
5) Types of goods carried by per mode (per trip):

B. Information of trip coming into study area from other region (upazila/district)

1) Type of Mode (Bus/Truck/Train/Water way):

(Response will be collected from every mode)

2) Name of trip origin point (Upazila/District):
3) No. of trips per day (hour basis)
4) Average no. of passengers carried by per mode (per trip):
5) Types of goods carried by per mode (per trip):
6) Stoppage area inside the upazila area

TRAFFIC VOLUME CALCULATION

A) Itakhola Moor Intersection

Table A-1: Hourly Traffic Volume according to the vehicles types for Itakhola – Sylhet link on January 01, 2016 at 9:30am

Mode of Transport		PCU	Sylhet-Narsingdi	Narsingdi-Sylhet	Sylhet-Shibpur	Shibpur-Sylhet	Total Vehicle	Total PCU	Percentage
	Bus/Minibus	3	60	92	0	2	154	462	19.69
	Heavy Truck/Light Truck	3	43	30	6	10	89	267	11.38
	Pickup Van	1	36	36	6	2	80	80	10.23
	Car/ Micro Bus/Jeep	1	105	147		2	254	254	32.48
	Lorry/trolly	1	3		6		9	9	1.15
	Tempo	0.75	30	1	6	3	40	30	5.12
	Auto Rickshaw	0.75	1	1			2	1.5	0.26
	Motorcycle	0.75	17	21	8	6	52	39	6.65
MV	Total MV						680	1142.5	86.96
	Rickshaw/Van	2	49	18	7	9	83	166	10.61
	Bicycle	0.5	10			6	16	8	2.05
	Animal Cart/Push Cart	4			3		3	12	0.38
NMV	Total NMV						102	186	13.04
	Grand Total						782	1328.5	100

Table A-2: Hourly Traffic Volume according to the vehicles types for Itakhola – Sylhet link on January 01, 2016 at 11:30am

	Mode of Transport	PCU	Sylhet-Narsingdi	Narsingdi-Sylhet	Sylhet-Shibpur	Shibpur-Sylhet	Total Vehicle	Total PCU	Percentage
	Bus/Minibus	3	75	97	0	0	172	516	22.48
	Heavy Truck/Light Truck	3	42	33	7	17	99	297	12.94
	Pickup Van	1	20	29	8	2	59	59	7.71
	Car/ Micro Bus/Jeep	1	70	140	18	3	231	231	30.20
	Lorry/trolly	1	2	4	1		7	7	0.92
	Tempo	0.75	31	4	2	3	40	30	5.23
	Auto Rickshaw	0.75	3			1	4	3	0.52
	Motorcycle	0.75	21	19	13	3	56	42	7.32
MV	Total MV						668	1185	87.32
	Rickshaw/Van	2	40	13	15	4	72	144	9.41
	Bicycle	0.5	10	4	7	4	25	12.5	3.27
	Animal Cart/Push Cart	4					0	0	0.00
NMV	Total NMV						97	156.5	12.68
	Grand Total						765	1341.5	100

Table A-3: Hourly Traffic Volume according to the vehicles types for Itakhola – Sylhet link on January 01, 2016 at 3:00 pm

Mode of Transport		PCU	Sylhet-Narsingdi	Narsingdi-Sylhet	Sylhet-Shibpur	Shibpur-Sylhet	Total Vehicle	Total PCU	Percentage
	Bus/Minibus	3	85	82	0	4	171	513	22.68
	Heavy Truck/Light Truck	3	47	31	7	14	99	297	13.13
	Pickup Van	1	26	37	11	1	75	75	9.95
	Car/ Micro Bus/Jeep	1	79	78	5	4	166	166	22.02
	Lorry/trolly	1	2		8		10	10	1.33
	Tempo	0.75	35	5	12	3	55	41.25	7.29
	Auto Rickshaw	0.75	5	8		2	15	11.25	1.99
	Motorcycle	0.75	2	22	8	5	37	27.75	4.91
MV	Total MV						628	1141.25	83.29
	Rickshaw/Van	2	46	19	16	12	93	186	12.33
	Bicycle	0.5	19		6	8	33	16.5	4.38
	Animal Cart/Push Cart	4					0	0	0.00
NMV	TotalNMV						126	202.5	16.71
	Grand Total						754	1343.75	100

Table A-4: Hourly Traffic Volume according to the vehicles types for Itakhola – Sylhet link on January 11, 2016 at 10:30 am

Mode of Transport		PCU	Sylhet-Narsingdi	Narsingdi-Sylhet	Sylhet-Shibpur	Shibpur-Sylhet	Total Vehicle	Total PCU	Percentage
	Bus/Minibus	3	173	69	0	0	242	726	26.36
	Heavy Truck/Light Truck	3	95	17		8	120	360	13.07
	Pickup Van	1	38	54		1	93	93	10.13
	Car/ Micro Bus/Jeep	1	112	68	6	4	190	190	20.70
	Lorry/trolly	1	6	1			7	7	0.76
	Tempo	0.75	45	2	7	5	59	44.25	6.43
	Auto Rickshaw	0.75	45	4	2	1	52	39	5.66
MV	Motorcycle	0.75	60	28	9	3	100	75	10.89
	Total MV								
NMV	Rickshaw/Van	2	26	3		3	32	64	3.49
	Bicycle	0.5	5	2	5	1	13	6.5	1.42
	Animal Cart/Push Cart	4	10				10	40	1.09
	Total NMV								
	Grand Total						918	1644.75	100

Table A-5: Hourly Traffic Volume according to the vehicles types for Itakhola – Sylhet link on January 11, 2016 at 12:30 pm

Mode of Transport		PCU	Sylhet-Narsingdi	Narsingdi-Sylhet	Sylhet-Shibpur	Shibpur-Sylhet	Total Vehicle	Total PCU	Percentage
	Bus/Minibus	3	83	62	0	0	145	435	23.77
	Heavy Truck/Light Truck	3	56	27	4	9	96	288	15.74
	Pickup Van	1	23	47	3		73	73	11.97
	Car/ Micro Bus/Jeep	1	100	84	6	4	194	194	31.80
	Lorry/trolly	1					0	0	0.00
	Tempo	0.75	45	2		2	49	36.75	8.03
	Auto Rickshaw	0.75	1				1	0.75	0.16
	Motorcycle	0.75	20	8		1	29	21.75	4.75
MV	Total MV						587	1049.25	96.23
	Rickshaw/Van	2	9	4	2	4	19	38	3.11
	Bicycle	0.5	1		1	2	4	2	0.66
	Animal Cart/Push Cart	4					0	0	0.00
NMV	Total NMV						23	40	3.77
	Grand Total						610	1089.25	100

Table A-6: Hourly Traffic Volume according to the vehicles types for Itakhola – Sylhet link on January 11, 2016 at 4:00 pm

Mode of Transport		PCU	Sylhet-Narsingdi	Narsingdi-Sylhet	Sylhet-Shibpur	Shibpur-Sylhet	Total Vehicle	Total PCU	Percentage
	Bus/Minibus	3	95	106	1	0	202	606	29.79
	Heavy Truck/Light Truck	3	47	27	3	4	81	243	11.95
	Pickup Van	1	21			3	24	24	3.54
	Car/ Micro Bus/Jeep	1	115	138		5	258	258	38.05
	Lorry/trolly	1	3			1	4	4	0.59
	Tempo	0.75	30	2		3	35	26.25	5.16
	Auto Rickshaw	0.75	2	1		1	4	3	0.59
	Motorcycle	0.75	23	18	6	6	53	39.75	7.82
MV	Total MV								
	Rickshaw/Van	2	6	2		6	14	28	2.06
	Bicycle	0.5	2			1	3	1.5	0.44
	Animal Cart/Push Cart	4					0	0	0.00
NMV	Total NMV								
	Grand Total						678	1233.5	100

Table A-7: Hourly Traffic Volume according to the vehicles types for Itakhola – Narsingdi link on January 01, 2016 at 9:30 am

	Mode of Transport	PCU	Narsingdi -Sylhet	Sylhet- Narsingdi	Narsingdi -Shibpur	Shibpur- Narsingdi	Total Vehicle	Total PCU	Percentage
	Bus/Minibus	3	92	60	41	22	215	645	19.76
	Heavy Truck/Light Truck	3	30	43	25	10	108	324	9.93
	Pickup Van	1	36	36	16	10	98	98	9.01
	Car/ Micro Bus/Jeep	1	147	105	23	32	307	307	28.22
	Lorry/trolly	1		3			3	3	0.28
	Tempo	0.75	1	30	29	6	66	49.5	6.07
	Auto Rickshaw	0.75	1	1	6	2	10	7.5	0.92
	Motorcycle	0.75	21	17	28	20	86	64.5	7.90
MV	Total MV						893	1498.5	82.08
	Rickshaw/Van	2	18	49	57	38	162	324	14.89
	Bicycle	0.5		10	11	12	33	16.5	3.03
	Animal Cart/Push Cart	4					0	0	0.00
NMV	Total NMV						195	340.5	17.92
	Grand Total						1088	1839	100

Table A-8: Hourly Traffic Volume according to the vehicles types for Itakhola – Narsingdi link on January 01, 2016 at 11:30 am

	Mode of Transport	PCU	Narsingdi -Sylhet	Sylhet- Narsingdi	Narsingdi -Shibpur	Shibpur- Narsingdi	Total Vehicle	Total PCU	Percentage
	Bus/Minibus	3	97	75	28	21	221	663	21.15
	Heavy Truck/Light Truck	3	33	42	16	19	110	330	10.53
	Pickup Van	1	29	20	13	11	73	73	6.99
	Car/ Micro Bus/Jeep	1	140	70	43	42	295	295	28.23
	Lorry/trolly	1	4	2	6		12	12	1.15
	Tempo	0.75	4	31	26	12	73	54.75	6.99
	Auto Rickshaw	0.75		3	1	3	7	5.25	0.67
	Motorcycle	0.75	19	21	31	22	93	69.75	8.90
MV	Total MV						884	1502.75	84.59
NMV	Rickshaw/Van	2	13	40	34	37	124	248	11.87
	Bicycle	0.5	4	10	17	6	37	18.5	3.54
	Animal Cart/Push Cart	4					0	0	0.00
	Total NMV						161	266.5	15.41
	Grand Total						1045	1769.25	100

Table A-9: Hourly Traffic Volume according to the vehicles types for Itakhola – Narsingdi link on January 01, 2016 at 3:00 pm

	Mode of Transport	PCU	Narsingdi-Sylhet	Narsingdi	Narsingdi-Shibpur	Shibpur-Narsingdi	Total Vehicle	Total PCU	Percentage
MV	Bus/Minibus	3	82	85	31	37	235	705	23.18
	Heavy Truck/Light Truck	3	31	47	23	17	118	354	11.64
	Pickup Van	1	37	26	14	11	88	88	8.68
	Car/ Micro Bus/Jeep	1	78	79	18	51	226	226	22.29
	Lorry/trolly	1		2			2	2	0.20
	Tempo	0.75	5	35	24	9	73	54.75	7.20
	Auto Rickshaw	0.75	8	5	5	7	25	18.75	2.47
	Motorcycle	0.75	22	2	23	26	73	54.75	7.20
	Total MV						840	1503.25	82.84
NMV	Rickshaw/Van	2	19	46	24	41	130	260	12.82
	Bicycle	0.5		19	11	14	44	22	4.34
	Animal Cart/Push Cart	4					0	0	0.00
	Total NMV						174	282	17.16
	Grand Total						1014	1785.25	100

B) Mannan Bhuiyan Chattar Intersection

Table B-1: Hourly Traffic Volume according to the vehicles types for Itakhola – Monohordi link on January 06, 2016 at 1:30 pm

	Mode of Transport	PCU	Dakbunglow Road-Itakhola	Itakhola-Dakbunglow Road	Dakbunglow Road-Monohordi	Monohordi-Dakbunglow Road	Total Vehicle	Total PCU	Percentage
	Bus/Minibus	3	0	0	0	0	0	0	0.00
	Heavy Truck/Light Truck	3					0	0	0.00
	Pickup Van	1		3		1	4	4	1.18
	Car/ Micro Bus/Jeep	1		1	1	1	3	3	0.88
	Lorry/trolly	1					0	0	0.00
	Tempo	0.75	4	8	3	5	20	15	5.90
	Auto Rickshaw	0.75	12	10	3	6	31	23.25	9.14
	Motorcycle	0.75	23	30	12	15	80	60	23.60
MV	Total MV						424	499.5	57.07
	Rickshaw/Van	2	29	44	13	15	101	202	29.79
	Bicycle	0.5	13	25	13	26	77	38.5	22.71
	Animal Cart/Push Cart	4			23		23	92	6.78
NMV	Total NMV						319	365	42.93
	Grand Total						339	437.75	100.00

C) Chaittana Bus Stand Intersection

Table C-1: Hourly Traffic Volume according to the vehicles types for Chaittana Bus Stand– Jossor link on January 10, 2016 at 11:30 am

	Mode of Transport	PCU	Josor-Itakhola	Itakhola-Josor	Josor-Morjal	Morjal-Josor	Total Vehicle	Total PCU	Percentage
	Bus/Minibus	3	0	0	0	0	0	0	0.00
	Heavy Truck/Light Truck	3	2	2			4	12	2.52
	Pickup Van	1					0	0	0.00
	Car/ Micro Bus/Jeep	1	4	10		2	16	16	10.06
	Lorry/trolly	1					0	0	0.00
	Tempo	0.75	16	6		7	29	21.75	18.24
	Auto Rickshaw	0.75	4	6		2	12	9	7.55
	Motorcycle	0.75	3	22	9	7	41	30.75	25.79
MV	Total MV						102	89.5	64.15
	Rickshaw/Van	2	20	10	3	8	41	82	25.79
	Bicycle	0.5	4	1	3	5	13	6.5	8.18
	Animal Cart/Push Cart	4	1			2	3	12	1.89
NMV	Total NMV						57	100.5	35.85
	Grand Total						159	190	100

D) C & B Bazar Intersection

Table D-1: Hourly Traffic Volume according to the vehicles types for Itakhola - Monohordi link on January 07, 2016 at 9:40 am

Mode of Transport		PCU	Itakhola-Monohordi	Monohordi-Itakhola	Itakhola-Puradia	Puradia-Itakhola	Total Vehicle	Total PCU	Percentage
	Bus/Minibus	3	13	21	0	0	34	102	7.30
	Heavy Truck/Light Truck	3	12	6	5	2	25	75	5.36
	Pickup Van	1	10	3			13	13	2.79
	Car/ Micro Bus/Jeep	1	4	6	2	1	13	13	2.79
	Lorry/trolly	1	1	2			3	3	0.64
	Tempo	0.75	63	65	16	14	158	118.5	33.91
	Auto Rickshaw	0.75	7	5	4	1	17	12.75	3.65
	Motorcycle	0.75	12	24	24	16	76	57	16.31
MV	Total MV						339	394.25	72.75
	Rickshaw/Van	2	5	6	14	12	37	74	7.94
	Bicycle	0.5	20	15	28	21	84	42	18.03
	Animal Cart/Push Cart	4		6			6	24	1.29
NMV	Total NMV						127	140	27.25
	Grand Total						466	534.25	100.00

E) Lakpur Bazar Intersection

Table E-1: Hourly Traffic Volume according to the vehicles types for Lakpur Bazar- Shibpur link on January 09, 2016 at 10:00 am

Mode of Transport		PCU	Shibpur-Chorsindur	Chor sindur-Shibpur	Shibpur-Hatirdia	Hatirdia-Shibpur	Total Vehicle	Total PCU	Percentage
	Bus/Minibus	3	0	0	0	0	0	0	0.00
	Heavy Truck/Light Truck	3					0	0	0.00
	Pickup Van	1	1				1	1	0.64
	Car/ Micro Bus/Jeep	1		1			1	1	0.64
	Lorry/trolly	1	6	6			12	12	7.69
	Tempo	0.75	16	2	14	22	54	40.5	34.62
	Auto Rickshaw	0.75		3			3	2.25	1.92
	Motorcycle	0.75	8	8	9	5	30	22.5	19.23
MV	Total MV						71	56.75	45.51
	Rickshaw/Van	2			6	13	19	38	12.18
	Bicycle	0.5		13	10	13	36	18	23.08
	Animal Cart/Push Cart	4					0	0	0.00
NMV	Total NMV						85	78.5	54.49
	Grand Total						156	135.25	100

F) Kamrabo Bazar Intersection

Table F-1: Hourly Traffic Volume according to the vehicles types for Kamrabo- Hatirdia link on January 10, 2016 at 11:00 am

	Mode of Transport	PCU	Hatirdia-Shibpur	Shibpur-Hatirdia	Hatirdia-Belabo Main Road	Belabo Main Road-Hatirdia	Total Vehicle	Total PCU	Percentage
MV	Bus/Minibus	3	0	0	0	0	0	0	0.00
	Heavy Truck/Light Truck	3	2	3	3	2	10	30	3.75
	Pickup Van	1	1	12	4	1	18	18	6.74
	Car/ Micro Bus/Jeep	1	2	3	2	3	10	10	3.75
	Lorry/trolly	1				2	2	2	0.75
	Tempo	0.75	11	18	17	16	62	46.5	23.22
	Auto Rickshaw	0.75	6	11	7	16	40	30	14.98
	Motorcycle	0.75	5	7	4	7	23	17.25	8.61
	Total MV						165	153.75	61.80
NMV	Rickshaw/Van	2	15	17	20	17	69	138	25.84
	Bicycle	0.5	5	4	7	8	24	12	8.99
	Animal Cart/Push Cart	4	3	3	1	2	9	36	3.37
	Total NMV						102	186	38.20
	Grand Total						267	339.75	100

ORIGIN AND DESTINATION SURVEY

Table B-1: Types of Mood

Types of Vehicle	Frequency	Percent
Auto Rickshaw/Tempo	3	9.4
Bus	18	56.3
Car/Pickup/Jeep/Motorbus	3	9.4
Motorcycle	1	3.1
Rickshaw/Van	2	6.3
Truck	5	15.6
Total	32	100

Table B-2: Trip Purpose

Trip Purpose	Frequency	Percent
Business related	5	15.6
Education	7	21.9
Recreation	2	6.3
Shopping	1	3.1
Social	3	9.4
Work/Commute	14	43.8
Total	32	100

Table B-3: Nature of Origin

Origin Type	Frequency	Percent
Residence	22	68.8
School/College/University	1	3.1
Social	1	3.1
Workplace	8	25
Total	32	100

Table B-4: Nature of Destination

Destination Type	Frequency	Percent
Recreational	2	6.3
Residence	6	18.8
School/College/University	6	18.8
Shopping	1	3.1
Social	3	9.4
Workplace	14	43.8
Total	32	100

Table B-5: Origin and Destination Pattern

Origin \ Destination			Type of Destination						Total
			Recreational	Residence	School/College/University	Shopping	Social	Workplace	
Type of Origin	Residence	Frequency	2	0	5	1	2	12	22
		Percentage	9.10 %	0.00%	22.70%	4.50 %	9.10 %	54.50 %	100.00 %
	School/College/ University	Frequency	0	1	0	0	0	0	1
		Percentage	0.00 %	100.00 %	0.00%	0.00 %	0.00 %	0.00%	100.00 %
	Social	Frequency	0	1	0	0	0	0	1
		Percentage	0.00 %	100.00 %	0.00%	0.00 %	0.00 %	0.00%	100.00 %
	Workplace	Frequency	0	6	0	0	0	2	8
		Percentage	0.00 %	75.00 %	0.00%	0.00 %	0.00 %	25.00 %	100.00 %
	Total	Frequency	2	8	5	1	2	14	32
		Percentage	6.30 %	25.00 %	15.60%	3.10 %	6.30 %	43.80 %	100.00 %

Table B-6: Frequency of Passengers Occupancy

No. of people in vehicle	Frequency	Percent
Within 5 persons	2	6.3
6 to 10 persons	3	9.4
11 to 15 persons	2	6.3
16 to 20 persons	5	15.6
21 to 25 persons	5	15.6
26 to 30 persons	2	6.3
31 to 35 persons	3	9.4
36 to 40 persons	5	15.6
Above 40 persons	5	15.6
Total	32	100

Table B-7: Origin Destination Matrix within Unions of ShibpurUpazila

Origin \ Destination	Chakradha	Josor	Masimpur	Pourashava	Putia	Total
Chakradha	0	0	0	1	1	2
Josor	0	0	1	1	0	2
Masimpur	0	0	0	0	1	1
Pourashava	1	0	1	0	0	2
Putia	0	2	0	1	0	3
Total	1	2	2	3	2	10

Table B-8: Origin Destination Matrix surrounding Upazilas /Districts of ShibpurUpazila

Origin \ Destination	Bhairab	Dhaka	Habiganj	Hatirdia	Madhobdi	Monohordi	Narsingdi	Sylhet	Vela nagar	Total
Bhairab	0	2	0	0	0	0	0	0	0	2
Dhaka	1	0	0	0	0	0	0	0	0	1
Habiganj	0	1	0		0	0	0	0	2	3
Hatirdia	1	0		0	0	0	1	0	0	2
Madobdi	0	0	0	1	0	0	0	0	1	2
Monohordi	0	3	0	0	0	0	1	0	0	4
Narsingdi	0	0	0	0	0	0	0	0	0	0
Sylhet	0	2	0	0	0	0	1	0	0	3
Vela nagar	0	0	0	0	0	0	1	0	0	1
Total	2	8	0	1	0	0	4	0	3	18

PASSENGERS INTERVIEW SURVEY

Table B-9: Trip Purpose of Bus Passengers

Trip Purpose	Frequency	Percent
Business related	12	14.81
Education	11	13.58
Recreation	15	18.52
Shopping	5	6.17
Social	27	33.33
Work/Commute	11	13.58
Total	81	100.00

Table B-10: Modes used by Bus Passengers

Types of Mode	Frequency	Percent
CNG	14	18.18
Bus	14	18.18
Motor cycle	1	1.30
Boat/Launch	1	1.30
Bus/CNG	15	19.48
Bus/Rickshaw	10	12.99
Rickshaw/CNG	1	1.30
Boat/Launch/CNG	8	10.39
Bus/Boat/CNG	5	6.49
Bus/Rickshaw/CNG	8	10.39
Total	77	100.00

Table B-11: Travel Cost for Bus Passengers

Travel Cost	Frequency	Percent
Within 50 taka	61	74.40
51 to 100 taka	7	8.50
101 to 150 taka	7	8.50
151 to 200 taka	5	6.10
251 to 300 taka	1	1.20
More than 300 taka	1	1.20
Total	82	100.00

Table B-12: Travel Distance by Bus Passengers

Total Distance	Frequency	Percent
Within 5 km	4	4.9
6 to 10 km	12	14.8
11 to 15 km	6	7.4
16 to 20 km	16	19.8
21 to 30 km	7	8.6
31 to 40 km	11	13.6
41 to 50 km	5	6.2

More than 51 km	20	24.7
Total	81	100

Table B-13: Frequency of Travelling

Trip per week	Frequency	Percent
1 trip	13	20.97
2 trips	2	3.23
More than 3 times	8	12.90
Everyday	15	24.19
Randomly in Month	18	29.03
Randomly in year	6	9.68
Total	62	100.00

Table B-14: Age pattern of Respondents

Age	Frequency	Percent
Below 15	1	1.25
16-20	11	13.75
21-30	27	33.75
31-40	25	31.25
41-50	9	11.25
Above 51	7	8.75
Total	80	100.00

Table B-15: Age Sex Structure of the Respondents

Age \ Sex			Sex		Total
			Female	Male	
Age Group	Below 15	Frequency	0	1	1
		Percent	0.00%	100.00%	100.00%
	16-20	Frequency	2	9	11
		Percent	18.20%	81.80%	100.00%
	21-30	Frequency	6	22	28
		Percent	21.40%	78.60%	100.00%
	31-40	Frequency	10	16	26
		Percent	38.50%	61.50%	100.00%
	41-50	Frequency	3	6	9
		Percent	33.30%	66.70%	100.00%
	Above 51	Frequency	2	5	7
		Percent	28.60%	71.40%	100.00%
	Total	Frequency	23	59	82
		Percent	28.00%	72.00%	100.00%

Table B-16: Trip Production according to the Trip Purpose

Trip Purpose \ Trip Frequency		Trip per week						Total
		1 trip	2 trips	More than 3 trips	Everyd ay	Randomly in Month	Randomly in year	
Trip Purpose	Business related	3	1	1	7	0	0	12
	Education	0	0	6	2	1	0	11
	Recreation	2	0	0	1	1	0	15
	Shopping	2	1	0	0	0	0	5
	Social	4	0	0	1	12	5	27
	Work/Com mute	2	0	1	4	3	1	11
	Total	13	2	8	15	18	6	81

Table B-17: Travel cost according to the Trip Purpose

Trip Purpose \ Travel Cost			Travel Cost						Total
			Within 50 taka	51 to 100 taka	101 to 150 taka	151 to 200 taka	251 to 300 taka	More than 300 taka	
Trip Purpose	Business related	Frequency	11	0	1	0	0	0	12
		Percent	91.70%	0.00%	8.30%	0.00%	0.00%	0.00%	100.00%
	Education	Frequency	10	0	1	0	0	0	11
		Percent	90.90%	0.00%	9.10%	0.00%	0.00%	0.00%	100.00%
	Recreation	Frequency	11	3	0	1	0	0	15
		Percent	73.30%	20.00%	0.00%	6.70%	0.00%	0.00%	100.00%
	Shopping	Frequency	4	0	0	1	0	0	5
		Percent	80.00%	0.00%	0.00%	20.00%	0.00%	0.00%	100.00%
	Social	Frequency	17	2	4	2	1	1	27
		Percent	63.00%	7.40%	14.80%	7.40%	3.70%	3.70%	100.00%
	Work/Comm ute	Frequency	7	2	1	1	0	0	11
		Percent	63.60%	18.20%	9.10%	9.10%	0.00%	0.00%	100.00%
	Total	Frequency	61	7	7	5	1	1	81
		Percent	74.40%	8.50%	8.50%	6.10%	1.20%	1.20%	100.00%

Table B-18: Travel cost according to the distance

Travel Distance		Travel Cost	Travel Cost						Total
			Within 50 taka	51 to 100 taka	101 to 150 taka	151 to 200 taka	251 to 300 taka	More than 300 taka	
Total Distance	Within 5 km	Frequency	4	0	0	0	0	0	4
		Percent	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
	6 to 10 km	Frequency	12	0	0	0	0	0	12
		Percent	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
	11 to 15 km	Frequency	6	0	0	0	0	0	6
		Percent	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
	16 to 20 km	Frequency	13	3	0	0	0	0	16
		Percent	81.30%	18.80%	0.00%	0.00%	0.00%	0.00%	100.00%
	21 to 30 km	Frequency	6	1	0	0	0	0	7
		Percent	85.70%	14.30%	0.00%	0.00%	0.00%	0.00%	100.00%
	31 to 40 km	Frequency	8	1	2	0	0	0	11
		Percent	72.70%	9.10%	18.20%	0.00%	0.00%	0.00%	100.00%
	41 to 50 km	Frequency	3	1	1	0	0	0	5
		Percent	60.00%	20.00%	20.00%	0.00%	0.00%	0.00%	100.00%
	More than 51 km	Frequency	8	1	4	5	1	1	20
		Percent	40.00%	5.00%	20.00%	25.00%	5.00%	5.00%	100.00%
	Total	Frequency	60	7	7	5	1	1	81
		Percent	74.10%	8.60%	8.60%	6.20%	1.20%	1.20%	100.00%

REGIONAL TRANSPORT SURVEY

Table B-19: Regional Bus Survey

Survey location	Company/ Agency name	Type of Mode	Origin point	Destination point	No. of trips/Day	Average no. of passengers per trip	Major stoppage area inside the Upazila
Shibpur Bus Stand	Meghaloy	Bus	Monohordhi	Dhaka	12	45	Shibpur&Itakhola Bus Stand,
Shibpur Bus Stand	RTB	Bus	Shahebprotap Bazar	C&B Bazar	4	30	Shibpur&Itakhola Bus Stand,
Shibpur Bus Stand	MonohordiParibahan	Bus	Mothkhola	Dhaka	6	45	Shibpur&Itakhola Bus Stand,
Shibpur Bus Stand	BRTC	Bus	Katiadi, Kishoreganj	Dhaka	3	40	Shibpur&Itakhola Bus Stand,
Itakhola Bus Stand	Satata Transport Service	Bus	Dhaka`	Bhairab	12	35	Itakhola&Chaitannya
Itakhola Bus Stand	Tisha	Bus	KuliarChar	Dhaka	8	50	Itakhola&Chaitannya
Itakhola Bus Stand	BadshahParibahan	Bus	Dhaka	Bhairab	30	45	Itakhola&Chaitannya
Itakhola Bus Stand	N.P Paribahan	Bus	1Itakhola, Shibpur	Chatak, Sunamganj	1	40	Itakhola
Itakhola Bus Stand	ENA Paribahan	Bus	Dhaka	Sylhet	30	40	Itakhola
Itakhola Bus Stand	DigantaParibahan	Bus	Itakhola	Moulibazar, Sylhet	1	50	Itakhola
Itakhola Bus Stand	Uttara Paribahan	Bus	Dhaka	Brahmanbaria	1	45	Itakhola
Itakhola Bus Stand		Truck	Shibpur	Dhaka	1		Shibpur Bus Stand
Itakhola Bus Stand		Truck	Shibpur	Dhaka	1		Shibpur Bus Stand

Government of the People's Republic of Bangladesh
Ministry of Housing and Public Works
Urban Development Directorate (UDD)

Preparation of Development Plan for Fourteen Upazilas

Package-02

(Ishwarganj Upazila, Mymensingh; Raipura Upazila and Shibpur Upazila, Narsingdi)

DRAFT SURVEY REPORT

Socio-economic Survey
of
Shibpur Upazila, Narsingdi

August, 2016

Joint Venture
of
SCPL Sheltech Consultants Pvt. Ltd
and
ARC Bangladesh Ltd

JV of SCPL-ABL
Preparation of Development Plan for Fourteen Upazilas Project (Package-02)

Ref: SCPL-ABL/UDD/2016/ Socio-economic Survey Report/Shibpur Upazila Date:

To
The Project Director
"Preparation of Development Plan for fourteen Upazilas" Project
Urban Development Directorate
82, Segunbagicha, Dhaka, 1000.

Subject: Submission of the Final Socio-economic Survey Report of Shibpur Upazila, Narsingdi.

Dear Sir,
We are pleased to submit herewith the Final Socio-economic Draft Survey Report of Shibpur Upazila, Narsingdi for your kind information and further action.

Thanking you and assuring you of our best services.

Your Sincerely,

(Dr. Nurul Islam Nazem) (Md. Azibar Rahman)
Team Leader, Package -2 Socio-economic Expert, Package -2

Encl: As stated.

Copy to:
1. Project Manager, Package-2, UDD
2. Director, Sheltech Consultants Pvt. Limited
3. Chairman, Arc-Bangladesh limited, Dhaka

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Executive Summary

This report aims to explore the socioeconomic condition of Shibpur upazila, Narsingdi. Socio-economic survey tools provide a means of improving understanding of local resource management systems, resource use and the relative importance of resources for households and villages. Shibpur, Narsingdi is a densely industrial area having textile mills, gas field, famous for vegetables and fruits like Latkon and Jackfruits along with several tourist places including Sonay Muri Pahar, Three Domed Mosque (Ashrafpur, 1524) etc. The upazila also show high potentialities of entering in "Demographic Bonus" window soon. Like others area of Bangladesh, middle income people also livesin high percentage. These people are attracted to the urban facilities of urban portion of this upazila, which leads them to make new settlement here. Consequently, the land price is also rising in Shinpur Upazila. People of Both of rural and urban area are satisfied with the water quality, sanitation, retail market location, fire service station, and recreational facilities etc. which are some of the basic needs of living a healthy life. On the other hand, there are poor maintenance found in roads and recreational facilities. But the alarming is about this upazila's education quality. It is deteriorating day by day because of lack enough qualified teacher and high student -teacher ratio. Moreover, there are not enough provision for maternal and child health. So necessary steps should be taken by concerned authorities regarding these problems.

Abbreviation/Acronyms

BDT	Bangladesh Taka
BBS	Bangladesh Bureau of Statistics
BREB	Bangladesh Rural Electrification Board
FPC	Finite Population Correction
GoB	Government of Bangladesh
HDI	Human Development Index
HBB	Herring Bone Bond
HH	House Hold
PDB	Power Development Board
NGO	Non-Government Organization
SDG	Sustainable Development Goal
SPSS	Statistical Packages for the Social Sciences
SCPL	Sheltech Consultants Pvt. Ltd.
SRS	Simple Random Sampling
ToR	Terms of Reference
TL	Team Leader
UDD	Urban Development Directorate

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Chapter 1: Introduction

1.1 Background

This report aims to explore the socioeconomic condition of Shibpur upazila, Narsingdi. Socio-economic survey tools provide a means of improving understanding of local resource management systems, resource use and the relative importance of resources for households and villages. Here the phenomena that lie at the intersection of the social and economic spheres of society are being studied. Moreover, while planning an area, there is a need for information about the level of socio-economic development, the population's quality of life (urban, rural, etc.), local problems, and the peculiarities of people's economic behavior. The main source of such information is intricate and comprehensive social research. Studies are directed towards the analysis of complicated social processes in an area and examine the spectrum of problems concerning changes in social structure and the configuration of social consciousness. It includes family structure, satisfaction with living conditions, housing and communal services, assessment of educational service quality (public schools, vocational training, higher education), quality of medical services etc.

1.2 Location and Background of the Project Area

The Shibpur, the second biggest upazila of Narsingdi zila in respect of area, came into existence in 1918 and was upgraded to upazila in 1984. It is generally believed that in long past it was a centre of worship of God Shib. The upazila might have derived its name as Shibpur from the name of Shib a hero of mythology. Shibpur Upazila (Narsingdi district) is located in between 23°56' and 24°07' North Latitudes and in between 90°38' and 90°50' East Longitudes. It has an area of 206.89 sq. km. It has 9 Wards, 9 Unions, 132 Mouzas and Mahallas, and 194 villages (BBS, 2011). It is bounded by Monohardi Upazila on the North, Raipura, Narsingdi Sadar and Palash Upazilas on the South, Belabo and Raipura Upazilas on the East, Palash and Kapasia Upazilas on the West (please see Figure 1.1). It is formed as Thana on 12 January 1918.

1.3 Importance in the Regional Context

It is a densely industrial area and is home to many textile mills. Narsingdi gas field is located in the Shibpur Upazila under Narsingdi district adjacent to the Dhaka-Sylhet Highway about 45 km away of Northern most East direction from Capital City of Bangladesh, Dhaka. This field is discovered by Petrobangla in 1990. Total recoverable gas reserves of this field re-estimated by Hydrocarbon Unit is 215 billion cubic feet (6.1×109 m3). Commercial gas production is started in 1996 and till 31 August 2006 total 66.304 billion cubic feet (1.8775×109 m3) or 30.84 percent of gas reserves has been recovered. Apart from these there are some historical tourist places like Sona Muri Pahari, Archaeological heritage and relics like Three Domed Mosque (Ashrafpur, 1524), Single Domed Mosque (Kumardi), tomb of Shah Mansur, two copperplate inscriptions (seventeenth century) discovered at village Ashrafpur, a gold coin (Gupta period) discovered at village Baghaba. There are also the graveyard of Shaheed Asad, (the Hero of 1969) at Dhanua (Banglapedia, 2016).

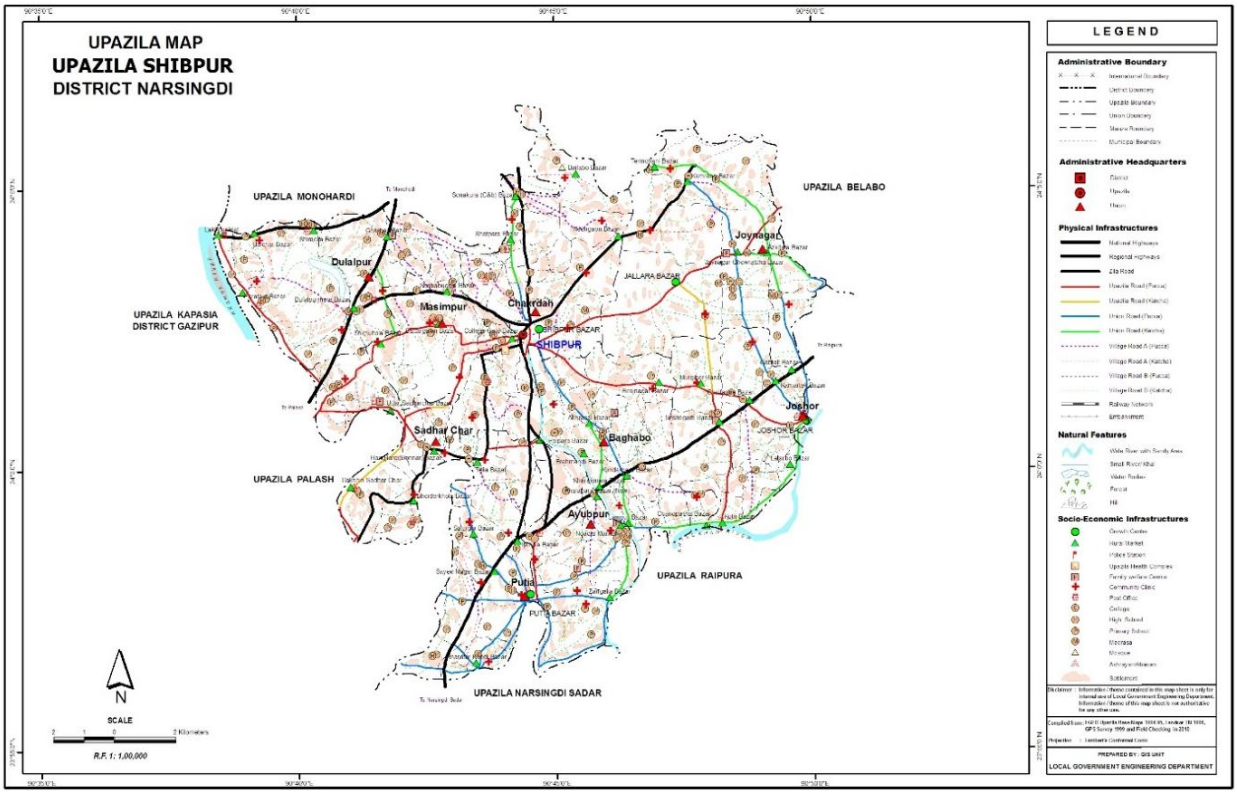

Figure 1.1 Upazila Map, Shibpur, Narsingdi (Source: LGED, 2016)

1.4 Social Information

According to BBS (2011), there are total 65,094 households at Shibpur Upazila and average size of households is 4.64. Total number of population is 3,03,813 where the number of male is about 1,48,419 and number of female is 1,55,384. Density of this area is about 1395 per sq. km. More than half of the population is literate and the percentage has increased than 2001. It has 113 Government primary school, 31 Non-government secondary school, 5 government and non-government college, 11 Madrasa, and 1 technical and vocational institution. Among them Noted educational institutions are Lakhpur Simulia High School (1917), Shibpur Pilot High School (1918), Moharpara High School (1919), Afsar Uddin High School (1968), Kumardi Senior Madrasa (1927). There are 7 filing station, 1 fire brigade station, 3 police station etc. It also has 1554 ponds and a river flow named Arial Kha.

Chapter 2: Approach and Methodology

2.1 Study Objective (s) and Specific Objectives

The broad objective of this report was to map the socio economic condition of Shibpur Upazila, Narsingdi.

Specific objectives

The specific objectives of this report were:

- To assess the social services and infrastructures situation of Shibpur Upazila.
- To seek information about the livelihood sources, income ratio, expenditure, investments and savings of the inhabitants of Shibpur.
- To identify the basic needs of the area with intensive participatory practices and to suggest some concrete recommendations for development of Shibpur Upazila.

2.2 Scope of Work

1. Preparation of five tiers Development Plan such as Sub Regional Plan, Structure Plan, Urban Area Plan, Rural Area Plan and Action Area Plan.
2. Preparation of Land Use Plan, Traffic and Transportation Management Plan, Drainage and Environmental Plan, Disaster Management Plan, Urban and Rural Area Plan and Action Plans for the project area.

2.3 Sampling

Three criteria usually will need to be specified to determine the appropriate sample size: the level of precision, the level of confidence or risk, and the degree of variability. The determination of sample size for this project is concerned with the following issues under the assumption that the characteristic of the population for Urban and Rural belongs to different homogenous group.

- The definition of the population;
- The creation of sampling frame;
- The choice of Probability versus Non-probability sampling;
- The calculation of sample size.

The definition of the population: Households of the project area are considered as the statistical population. The rural populations are more homogeneous. For Shibpur Upazila total household number is 65094. Whereas 60816 are rural and 4278 are Urban. (BBS, 2011)

The creation of sampling frame: The standard rule for sampling frame has been followed based on SRS (Simple Random Sampling).

The choice of Probability versus Non-probability sampling: Probability sampling has been followed.

The calculation of sample size: To determine the minimum sample size the following formula has been followed: $n = \frac{z^2}{d^2} pq$ (Cochran, 1963)

Where,

$n = Sample\ size$,

$z = Statistical$ certainty $chosen$,

$p = \text{Coverage rate/estimated prevalence}$,

$q = 1 - p$ and

$d = \text{precision desired} : 0.05$

Considering 97% Confidence Interval

Let, $p = .5\ and\ z = 1.96$

$$\Rightarrow n = \frac{1.96^2}{0.03^2} \times .5 \times (1 - .5)$$

Or,n = 1067

Considering Finite Population Correction (FPC), the adjusted the sample size for the field level administration is as follows.

For Urban area of Shibpur Upazila

$$n^1 = \frac{n}{1 + (\frac{n}{N})}$$

$$\Rightarrow n^1 = \frac{384}{1 + (\frac{384}{4278})}$$

$$\Rightarrow n^1 \cong 352$$

For Rural area of Shibpur Upazila

$$n^1 = \frac{n}{1+(\frac{n}{N})} \quad \Rightarrow n^1 = \frac{384}{1+(\frac{384}{60816})}$$

$$\Rightarrow n^1 \cong 381$$

So, using 95% confidence interval and ±3% precision level total no of surveys are calculated .Distribution of sample for Shibpur Upaliza is given below:

Sl. No	Urban	Rural	Total Sample
1	352	381	733

Then, they used stratified sampling technique under probability sampling technique to collect questionnaire based primary data for socioeconomic analysis. The stratified sampling technique is further used for collecting samples from all the sub zones such as wards and unions of Shibpur Upazila. For each unions then random sampling technique is used to select the households for survey using Microsoft excel. The selected samples from total sample of households of Shibpur is illustrating by a table 2.1 below:

Table 2.1: Selected Samples for Socio-economic Survey

District	*Upazila Name*	*Paurashava/ Union Name*	*Household*	Population			
				Male	*Female*	*Total*	*Sampling HH*
Narsingdi	*Shibpur*	Ward-01	540	1182	1240	2422	44
		Ward-02	547	1267	1288	2555	45
		Ward-03	338	996	962	1958	28
		Ward-04	829	1886	1880	3766	68
		Ward-05	512	1311	1190	2501	42
		Ward-06	454	1000	1099	2099	37
		Ward-07	298	688	753	1441	25
		Ward-08	376	854	872	1726	31
		Ward-09	384	896	908	1804	32
		Ayubpur Union	6353	14726	15517	30243	40
		Baghaba Union	6054	14157	14866	29023	38
		Chak Radha	5281	11825	12838	24663	33
		Dulalpur Union	7278	15950	17270	33220	46
		Josar Union	6494	15038	15389	30427	41
		Joynagar Union	6890	14983	15557	30540	43
		Masimpur Union	5993	13517	14626	28143	38
		Putia Union	12024	27007	27496	54503	75
		Sadhar Char Union	4449	11146	116333	127479	28
		Total	*65094*	*148429*	*155384*	*303813*	*733*

2.4 Tools Development

The Survey tool was developed following the below steps. (1) Literature Review (2) Collection of Upazila Map (3) Find out sectors, indicators and variables (4) Preliminary questionnaire develop and share with Team leader as well as Project Management Office (5) Pretesting at field level (6) Questionnaire Finalization

2.4.1 Preparation of Questionnaire

In order to conduct the survey, a compact and extensive pre-coded structured questionnaire (please see Annexure-I) has been prepared for all the packages and it has been approved by the authority of Urban Development Directorate (UDD). The questionnaire has intended to capture information (see Table 2.2) according to the provided format in the TOR. Socioeconomic survey outputs represent the overall social, religious and economic condition of Shibpur Upazila.

Table 2.2: Socioeconomic Survey Format as per TOR

Item	Illustrated
Demographic Information	Age, sex, growth rate, household size, migration etc.
Family Size	Number of households, number of family members
Age, Religious Group	Age specific group, religious status
Economic Status	Primary, secondary, higher and others
Occupational Pattern	Government, private, formal, informal and others
Income Level	Lower, medium and higher (Income Range)
Ownership Pattern	Land ownership information, transfer procedures etc.
Land Value	Low land, ditch land, built-up land, buildable land etc.
Health Facilities	Type of facilities in hospital, private clinic and dispensary etc.
Recreation Facilities	Active and passive, type of facilities (Active, Passive)

2.4.2 Pre-testing

The questionnaires were pretested in urban and rural areas with participation of survey team (Survey supervisors, Enumerators) and members of Project management team. Then the survey team discussed about the field level problem with the socio-economic expert, Team leader and Project Management team for finalization of Questionnaire format.

2.4.3 Training of Enumerators and Survey Supervisors

JV of SCPL-ABL considered the experience of working in similar types of survey functions and educational qualifications for selection in the socioeconomic survey team. Considering these issues, a survey team of 28 members were selected for carrying out socioeconomic survey work at Shibpur Upazila (see Annexure-II). An arrangement has also been made to provide orientation and training to the survey team by the Team Leader (TL). After

orientation and training at the headquarters of JV of SCPL-ABL, the survey team has been sent to the field.

2.5 Survey Team Mobilization

The survey started in 12.08.2015 and the total survey is taken about 30 days from that date.

2.6 Quality Control Measures

To ensure quality of data, a number of validation checks were conducted during data collection period:

(a) The survey supervisor went back to the respondent as well as talked over mobile phone number for validate or accurate the collected data by enumerator.
(b) After data collection had been completed, 5% household was randomly chosen, and then the supervisors went to the field for further investigation. If any inconsistencies were found, then the supervisors discussed the issue with the enumerators.
(c) Project Manager from Project Management Office as well as Socio-economic expert had been checked randomly for quality of collected data.

2.7 Database Preparation and Processing

After completing the survey works in the field, a detail database has been prepared to follow the survey questionnaire. The database has prepared by using SPSS 20 software. To make the data input process easier, coding system has been used in the necessary field. Few data have been stored in MS Excel software. 3 micro computers are exclusively used for data entry. SPSS 20 software is used for all data management that has been collected from the field. In this chapter socioeconomic survey data have been presented into three forms/styles viz. tabular form, geographical and textual/report form.

2.8 Limitation of the Study

Socio-economic Questionnaire Survey is comparatively costly and time consuming. Ideally, to conduct face to face questionnaire survey, enumerators and supervisors are required. Training of enumerators and supervisors is essential. Questionnaire surveys generally cannot provide strong evidence of cause and effect. Because collected data of surveys on status and perceptions of community people of various socio economic features at the same time. It is very difficult to prove that the reputed risk factor actually causes the problem.

Other constraints to using surveys to gather data:

- The lack of time to carry out the survey format.
- While a survey provides us with quantitative and qualitative data offering insight to various socio economic features; it will not produce the kind of data needed to create a full picture of the state of socio economic profile of a certain area.
- Respondents may not feel encouraged to provide accurate, honest answers
- Respondents may not feel comfortable providing answers that present themselves in an unfavorable manner.
- Respondents may not be fully aware of their reasons for any given answer because of lack of memory on the subject.

- Surveys with closed-ended questions may have a lower validity rate than other question types.
- Data errors due to question non-responses may exist. The number of respondents who choose to respond to a survey question may be different from those who chose not to respond, thus creating bias.
- Survey question answer options could lead to unclear data because certain answer options may be interpreted differently by respondents. For example, the answer option "somewhat agree" may represent different things to different subjects, and have its own meaning to each individual respondent. 'Yes' or 'no' answer options can also be problematic. Respondents may answer "no" if the option "only once" is not available.
- Customized surveys can run the risk of containing certain types of errors

Chapter 3: Study Findings

3.1 Introduction

This chapter describes the survey findings of different socio-economic factors in both urban and rural areas of Shibpur. Here, urban areas means data gathered in 9 Wards of Shibpur Municipality/Pourashava and rural areas means data gathered from 9 Unions of Shibpur Upazila. The socio-economic factors are: age, sex, marital status, religious status, level of education, types of occupation, monthly income and expenditure of households, migration, housing status, land value, transport, utility services, medical facility, recreation facility, education facility, law and order situation, available services in Shibpur Upazila, problems of the area, traditional cultural festival of the area, people's aspiration about the development of the Upazila. The following factors are described below.

3.2 Age Sex Structure of Household Members

In the surveys, about half of the total respondents are found as male and the rest are female. When the respondents are categorized into different ages, it has been seen that, about two third of total respondents are between 18-59 age group irrespective of their sex which indicates that the Upazila might have been entered into the window of 'Demographic Bonus' in the coming years (please see Figure 3.1).

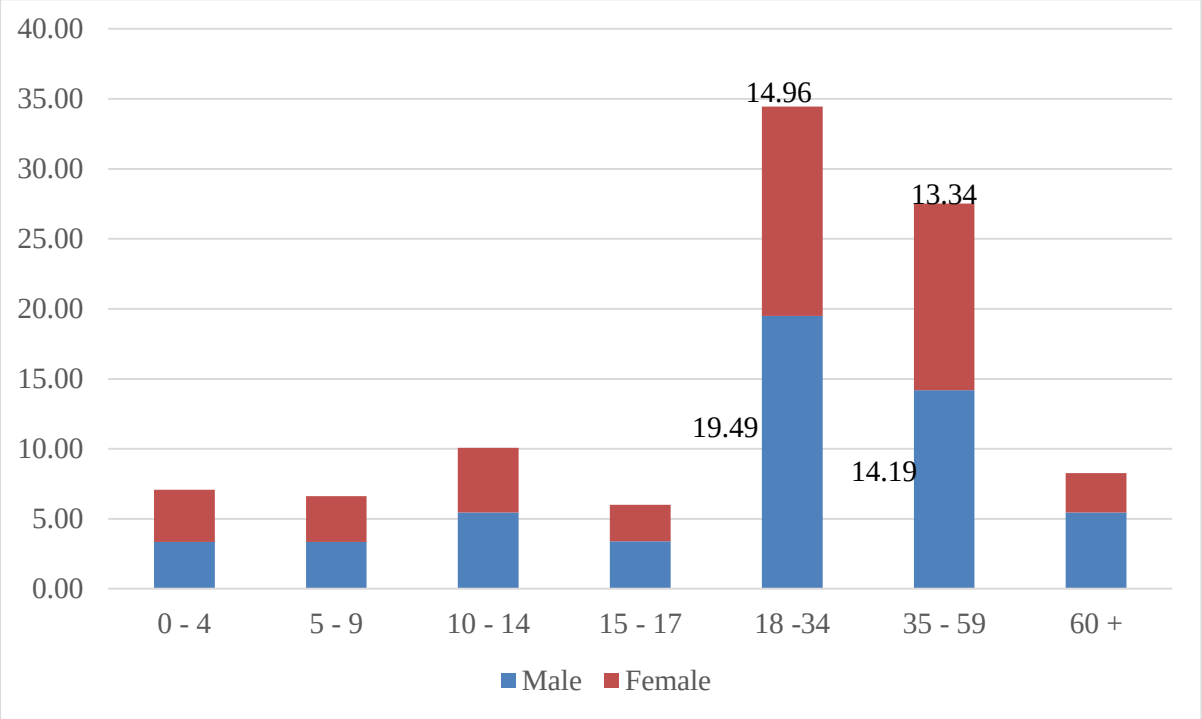

Figure 3.1: Age and Sex Structure of Households at Shibpur (Source: Field Survey, 2015)

The pyramid shows dependent and working age population by urban and rural area in Shibpur Upazila. In urban area, 29 percent population were below 18 years of age and they are depended group of people. At the working age level, age between 18 and 59 about 64 percent people are found. While in rural areas of Shibpur, the corresponding figures were almost the similar (29 % and 65 % respectively). Please see Figure 3.2 and 3.3 below:

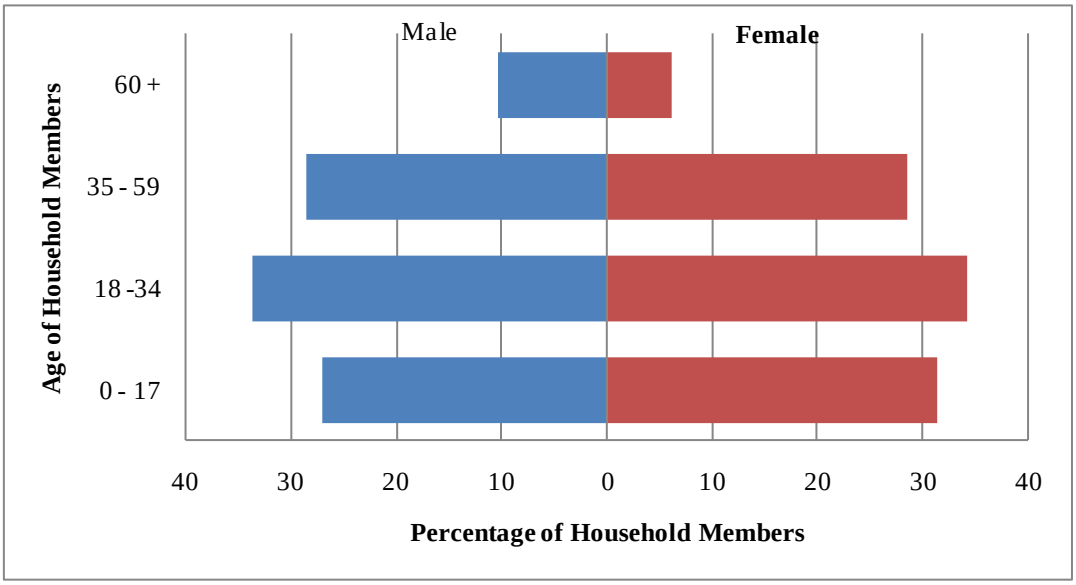

Figure 3.2: Age and Sex Pyramid of Urban Population (Source: Field Survey, 2015)

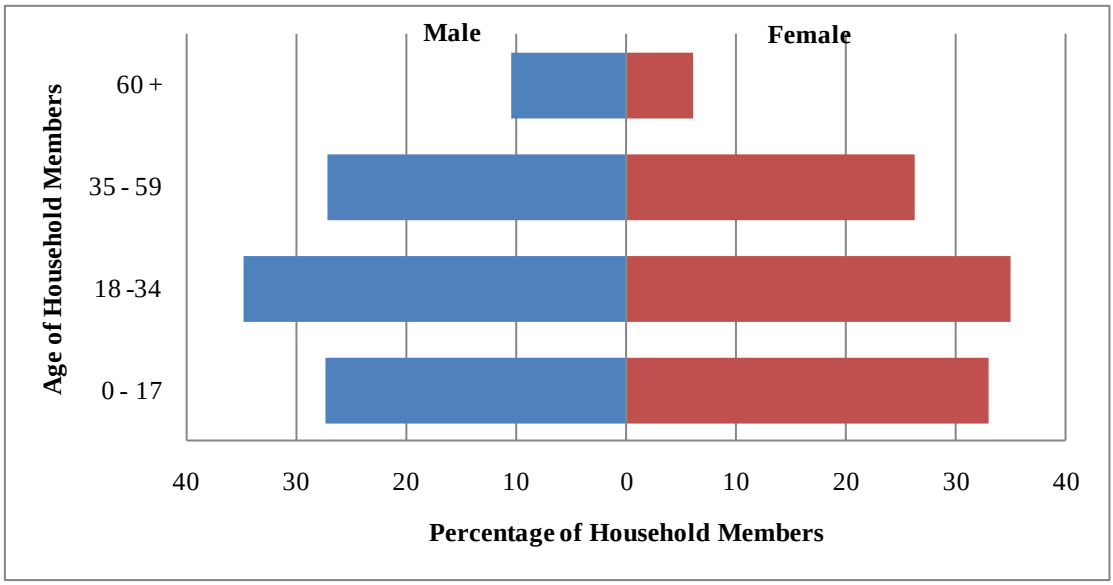

Figure 3.3: Age-sex Pyramid of Rural Population (Source: Field Survey, 2015)

Moreover, among senior citizen group male percentage is found higher than female. Again the age sex pyramid of Shibpur urban and rural area also represents almost the same condition (please see Figure 3.2& 3.3). From the above figures it could be easily anticipated that in the coming years people from age group 0-13 of both rural and urban area would be shifted into age group 14+ which would be resulted into to bring about opportunities for Shibpur upazila to enter into the window of 'Demographic Bonus'.

3.3 Sex

From Figure 3.4, it has been seen that both in urban and rural area the male percentage is slightly higher than female percentage. And the male and female ratio is about the same for both in urban and rural area.

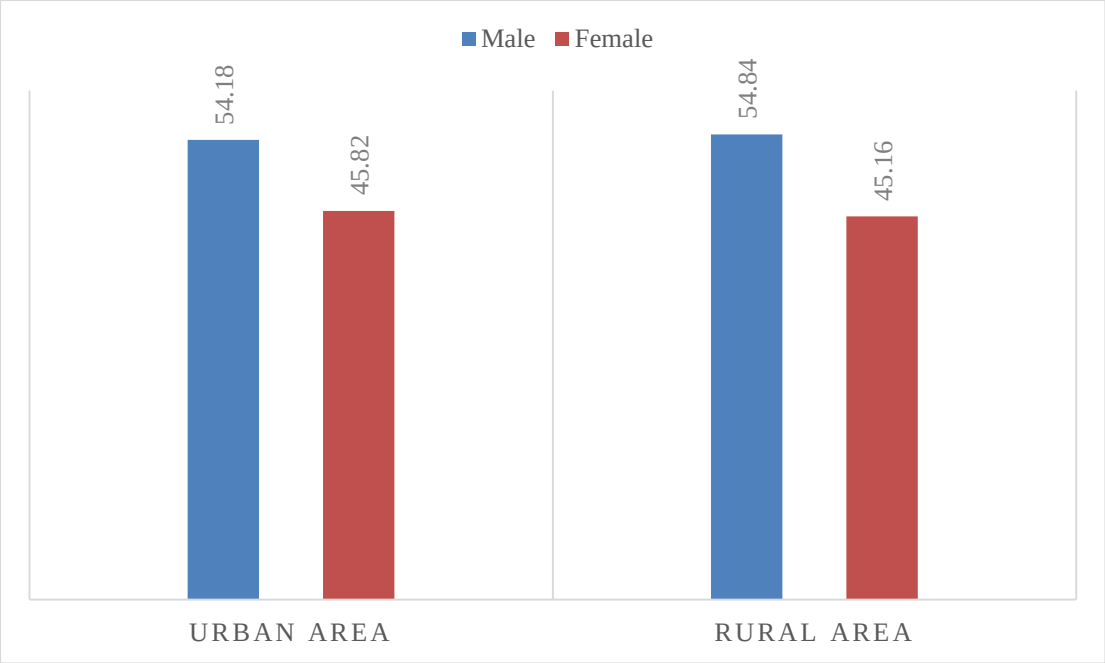

Figure 3.4: Sex of Household Members (Source: Field Survey, 2015)

3.4 Marital Status

It has been found in Shibpur Upazila most of the respondents are either single or married irrespective of rural or urban area. Among them the percentage of marital status "single" is slightly higher in rural area than urban area. Apart from these some of them also found as widow (about 2%), and the percentage remains same in both of rural and urban area (see Figure: 3.5)

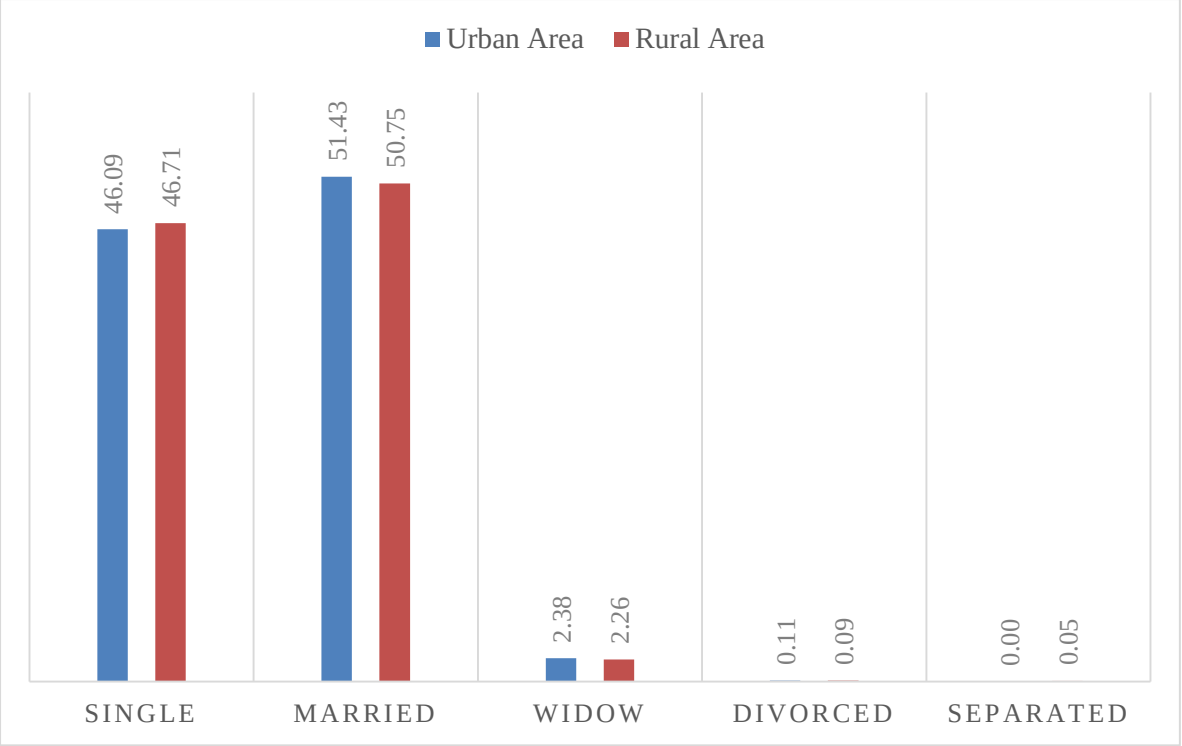

Figure 3.5: Marital Status(Source: Field Survey, 2015)

3.5 Religious Status

In Shibpur Upazila there are no Christian, Buddhist or other tribal religious people. More than 90% people of urban and rural area is found Muslim, and rest of them are Hindu. In rural area the percentage of Muslim people are found higher than the urban area (see Figure: 3.6).

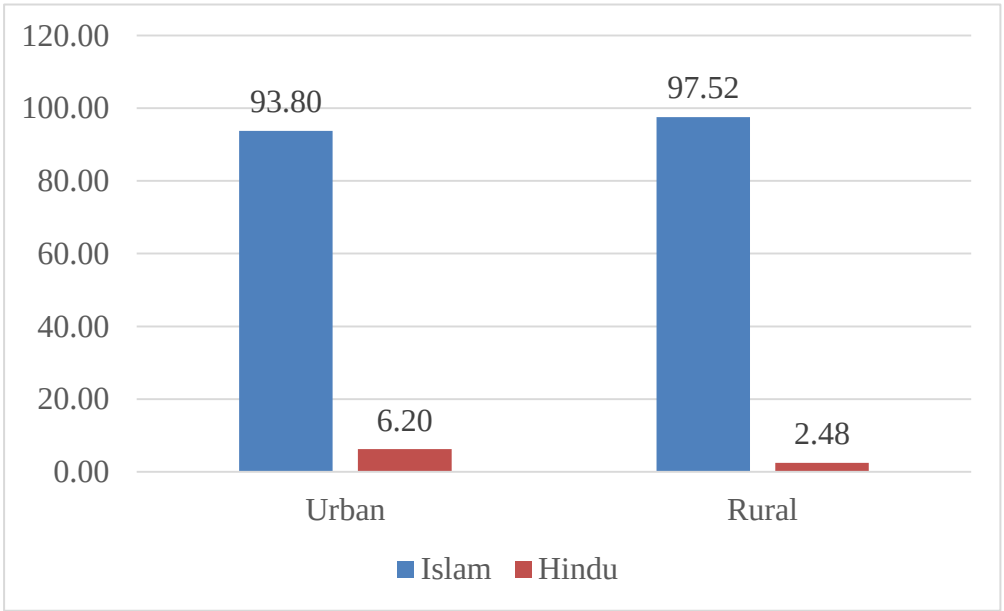

Figure 3.6: Religious Status (Source: Field Survey, 2015)

3.5 Level of Education

In Shibpur upazila, it has been found that irrespective of rural or urban area about half of the respondents are below the primary level of education. About more than one third of total respondents are found who completed their Secondary School level of education both in urban and rural area. The percentage that completed their SSC/HSC/Degree level of education is higher in urban area than rural area (please see Figure: 3.7). So it can be anticipated that people from urban area is more attached with higher education than in rural area. As about half of the total population is from below primary school level, some initiatives should be taken to increase the percentages.

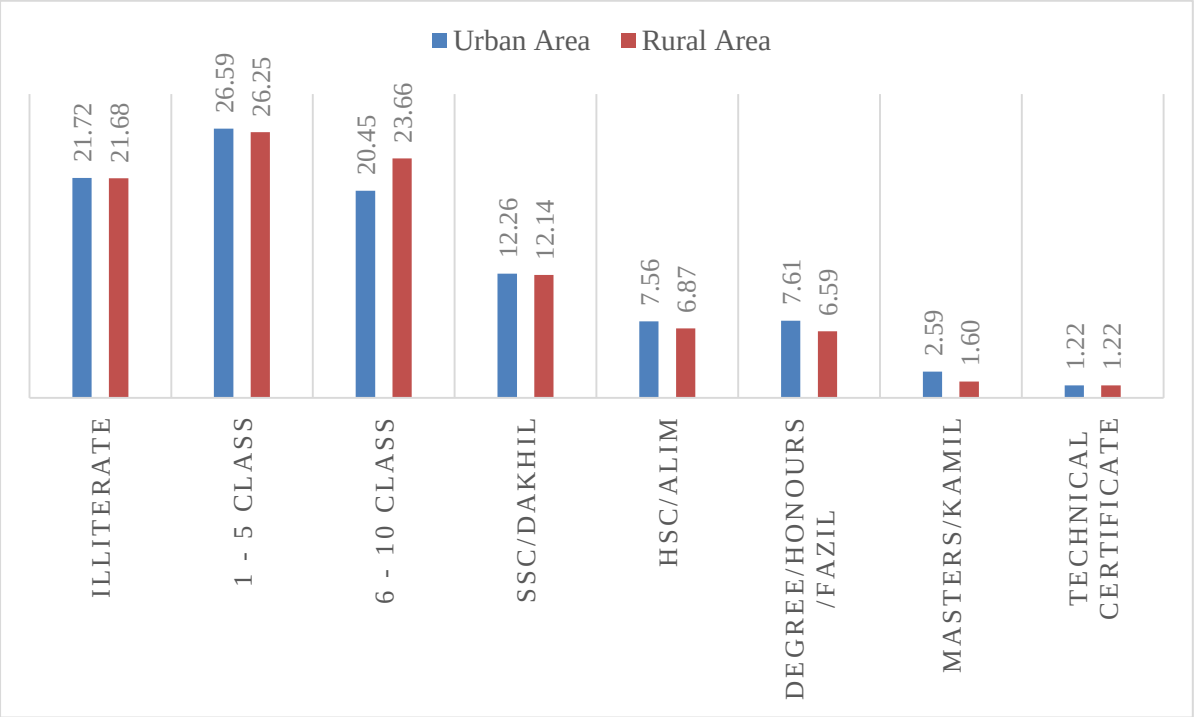

Figure 3.7: Level of Education (Source: Field Survey, 2015)

3.6 Types of Occupation

In Shibpur upazila, it has been found that in urban area most of the respondents (about 90%) are engaged in Job, Business and Labour types of occupation, the rest of them are engaged in vocational and traditional occupation. And the maximum percentage (about 40%) of respondentsare from business category in urban area whereas about the same maximum percent respondents are from labor category in rural area. Further, in rural area about one third of the total respondents are engaged in Business types of occupation. Moreover, respondents involved in vocational occupation are found about the double in rural area than urban area (please see Figure 3.8).

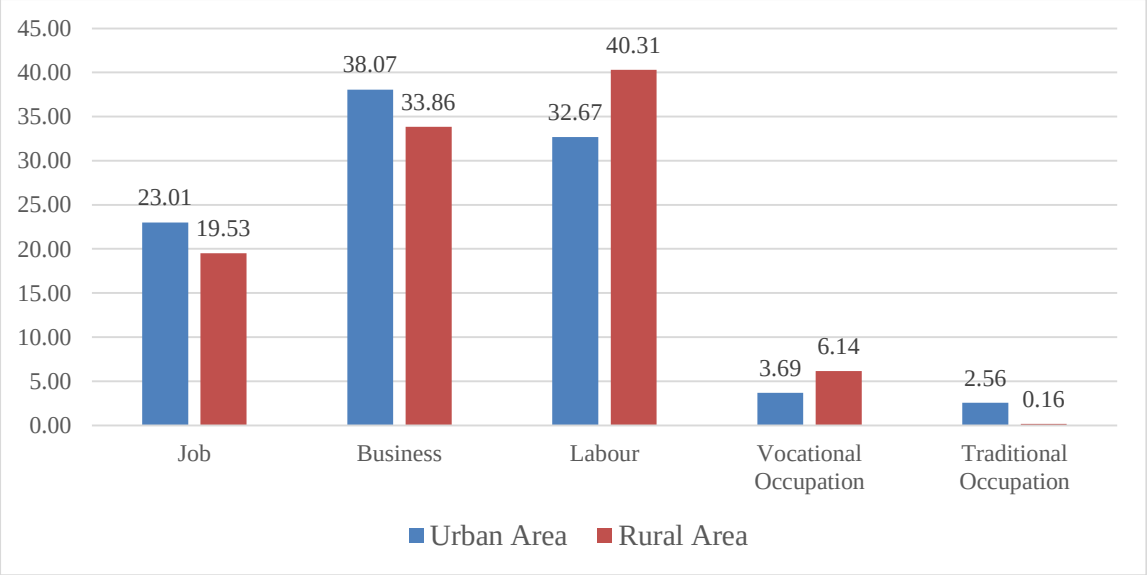

Figure 3.8: Occupation in Urban and Rural Area (Source: Field Survey, 2015)

The relations also have been studied between education level and occupation pattern in urban area. **In urban areas**, it has been found that people who are below the primary level of education mostly (about half) engaged in labor types of jobs. Some of them (about 10%) also tried to earn their living as small entrepreneurs and into Non-government jobs. Respondents who started their higher school but did not complete SSC has been found as remaining in the about same types of occupations.A significant amount of them (about one fourth) engaged in Hawker and small entrepreneurship. On the other hand, respondents who completed SSC, about half of them are Shop keeper, Small entrepreneur and Hawker. Respondents from above SSC level started to engage in Government and Non-government jobs. Respondents with technical certificate mostly got engaged in non-government jobs (please see Table 3.1).

Table 3.1:Education and Occupation Pattern in Urban Area (In Percentage)

	Level of Education								Total
	Illiterate	1 - 5 Class	6 - 10 Class	SSC/ Dakhil	HSC / Alim	Degree/Honours/Fazil	Masters /Kamil	Technical Certificate	
Government Job Holder	0	1.5	1.9	2.8	**13.6**	0	5.6	**12.5**	2.8
Non-Government Job Holder	9.2	**10**	9.3	5.6	**18.2**	**20**	**25**	**37.5**	12.1
Family Worker	0	1.5	2.8	2.8	4.5	**10**	**22.2**	0	4
NGO Worker	5.1	3.8	3.7	6.9	4.5	**10**	8.3	0	5.3
Hawker	5.1	**9.2**	**18.7**	**15.3**	6.8	8	5.6	**12.5**	10.6
Small Entrepreneur	**11.2**	**13.8**	**9.3**	**12.5**	**11.4**	8	**13.9**	**12.5**	11.6
Shopkeeper	4.1	6.9	6.5	**16.7**	6.8	**14**	8.3	0	8.3
Medium Entrepreneur	3.1	5.4	2.8	6.9	**18.2**	8	5.6	0	5.9
Large Entrepreneur	1	0	0.9	1.4	2.3	0	0	0	0.7
Agricultural Labour	2	0.8	2.8	0	0	2	0	0	1.3
Industrial Labour	4.1	0.8	0.9	2.8	2.3	6	0	0	2.2
Construction Labour	**10.2**	**9.2**	**11.2**	0	0	0	0	0	6.2
Transport Labour	2	2.3	0	1.4	2.3	2	2.8	0	1.7
Service Labour	**12.2**	3.8	5.6	0	2.3	0	0	0	4.4
Day Labour	**23.5**	**20**	**13.1**	**15.3**	6.8	8	0	**25**	15.2
Electrician	0	0	0	2.8	0	2	0	0	0.6
Mason	1	3.1	1.9	0	0	0	0	0	1.3
Rod Mechanic	0	0.8	0	0	0	0	0	0	0.2
Plumber	0	0.8	0.9	0	0	2	0	0	0.6
Woodcarver	0	0.8	1.9	0	0	0	0	0	0.6
Painter	0	0	0	1.4	0	0	0	0	0.2
Fridge or AC Mechanic	0	0.8	0.9	1.4	0	0	2.8	0	0.7
Blacksmith	1	0	0.9	2.8	0	0	0	0	0.7
Potter	2	2.3	1.9	0	0	0	0	0	1.3
Fisherman	3.1	0.8	0.9	0	0	0	0	0	0.9
Carpenter	0	1.5	0.9	1.4	0	0	0	0	0.7
	100	100	100	100	100	100	100	100	100

Source: Field Survey, 2015

On the other hand, **in rural areas**, respondents who has technical certificate two third of them are engaged in Government and non-government jobs. Rest of them worked as NGO worker and small entrepreneur. Respondents who completed Masters level of education about 40% of them are found as worked in family works. Like in urban area, the percentage of engaging in Government and Non-government jobs also increased in rural area for those who completed their education level above HSC. Respondents from below HSC level of education most of them started their small business and lead their life as small entrepreneurs. A significant amount of them also engaged in agriculture labor which is very much different than in urban area. In urban area the percentage are too small. Total 10.92 percent (rural and

urban) people of total respondents are agricultural Labor where 1.28 percent are from urban area and 19.18 percent from rural area, which represents rural area is the core working area for agricultural labors (Please see Table 3.2). The percentage of engaging in small entrepreneurship is about double in rural area than urban, which represents agriculture based rural area's economy provide more option to conduct business for small entrepreneurs. Again, those who are illiterate, about half of them are in agricultural labor or day labor.

Table 3.2: Education and Occupation Pattern in Rural Area

	Level of Education								Total
	Illiterate	1 - 5 Class	6 - 10 Class	SSC/ Dakhil	HSC/ Alim	Degree/ Honours /Fazil	Masters/ Kamil	Technical Certificate	
Gov. Job Holder	1.7	0.0	3.2	5.6	6.8	**27.7**	**16.7**	**33.3**	5.2
Non-Government Job Holder	1.7	5.3	**13.3**	**15.6**	**15.9**	**17.0**	**27.8**	**33.3**	10.5
Family Worker	.8	0.0	1.9	1.1	2.3	8.5	**38.9**	0.0	2.7
NGO Worker	.8	.7	0.0	0.0	2.3	4.3	5.6	**16.7**	1.1
Hawker	0.0	2.6	1.3	8.9	2.3	2.1	0.0	0.0	2.5
Small Entrepreneur	**12.4**	**13.2**	**24.1**	**23.3**	**25.0**	**12.8**	5.6	**16.7**	17.8
Shopkeeper	5.8	5.9	**11.4**	**11.1**	**20.5**	2.1	0.0	0.0	8.5
Medium Entrepreneur	3.3	3.9	4.4	7.8	2.3	**10.6**	5.6	0.0	4.9
Large Entrepreneur	0.0	0.0	0.0	0.0	2.3	2.1	0.0	0.0	.3
Agricultural Labour	**28.9**	**30.3**	**15.2**	**11.1**	9.1	6.4	0.0	0.0	19.2
Industrial Labour	.8	2.6	2.5	0.0	2.3	2.1	0.0	0.0	1.7
Construction Labour	6.6	9.2	1.9	5.6	2.3	0.0	0.0	0.0	4.9
Transport Labour	0.0	.7	1.9	1.1	0.0	0.0	0.0	0.0	.8
Service Labour	7.4	4.6	2.5	0.0	0.0	0.0	0.0	0.0	3.1
Day Labour	**24.8**	**10.5**	7.6	5.6	4.5	4.3	0.0	0.0	10.5
Electrician	0.0	0.0	1.3	0.0	2.3	0.0	0.0	0.0	.5
Mason	2.5	7.9	5.1	3.3	0.0	0.0	0.0	0.0	4.1
Rod Mechanic	0.0	.7	.6	0.0	0.0	0.0	0.0	0.0	.3
Woodcarver	1.7	.7	1.3	0.0	0.0	0.0	0.0	0.0	.8
Painter	0.0	1.3	.6	0.0	0.0	0.0	0.0	0.0	.5
Fisherman	.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.2
	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Field Survey, 2015

3.7 Monthly Income and Expenditure of Households

3.7.1 Income Status

In rural area, about one fourth of total respondents' income source is found as agriculture. Another one fourth of theirs' income source is poultry and business. So, about half of the rural people are engaged in poultry, business and agricultural sector, who have available agricultural lands to cultivate. On the other hand, in urban area most of the respondents are engaged in business or government or non-government jobs, as a result about 40% respondents' income source is either business or job salary. Again, the percentage of income from gardening is found significantly higher (about 6 times) than urban area. In rural area foreign remittance percentage also found as higher than in urban area (please see Figure: 3.9).

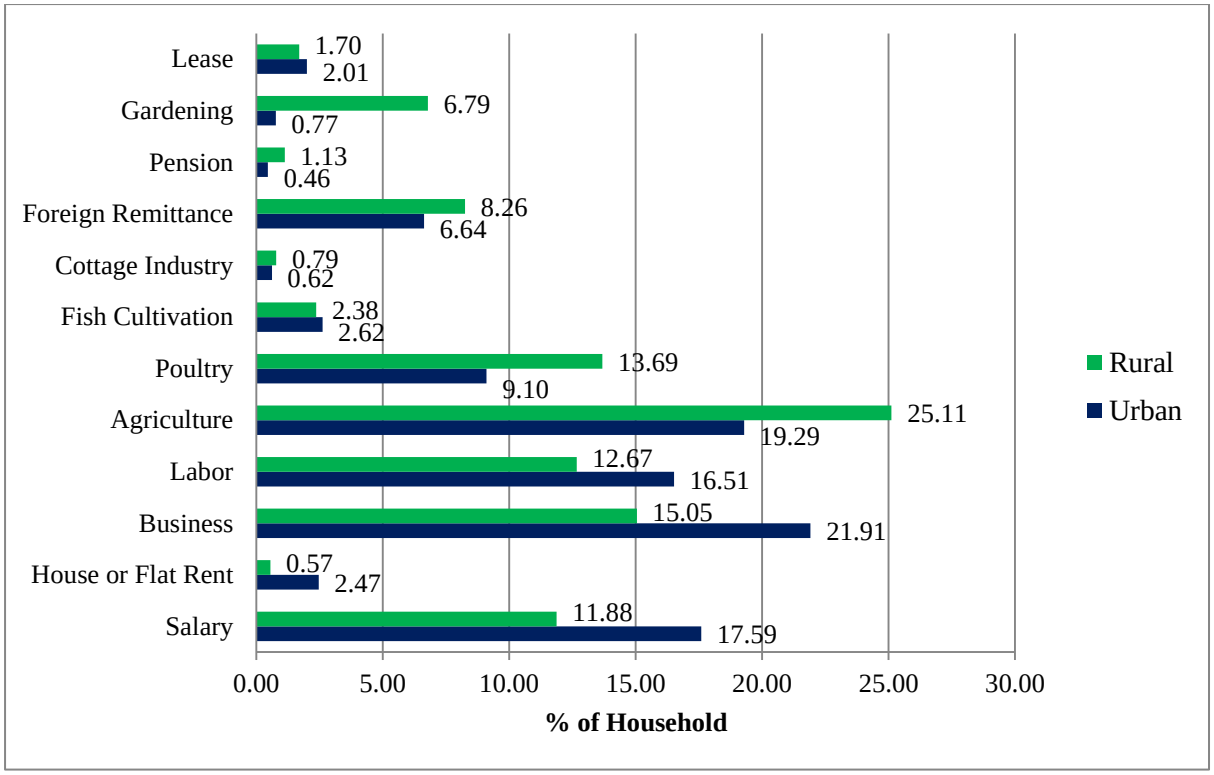

Figure 3.9: Income Source Note: Multiple Response Counted (Source: Field Survey, 2015)

Again, from the below figure it has been seen that the highest percentage of rural people's (about half) income lies between 10000-20000 range. About one fourth of rural people's income is less than 10000. On the other hand, about 40% of urban respondents' income range is between 10000-20000 and the second highest percentage (about 20%) people's income is less than 10000 (please see Figure:3.10) . Thus, it has been observed that, monthly income is about same irrespective of rural or urban area. And sometimes rural people's income is found higher than urban people.

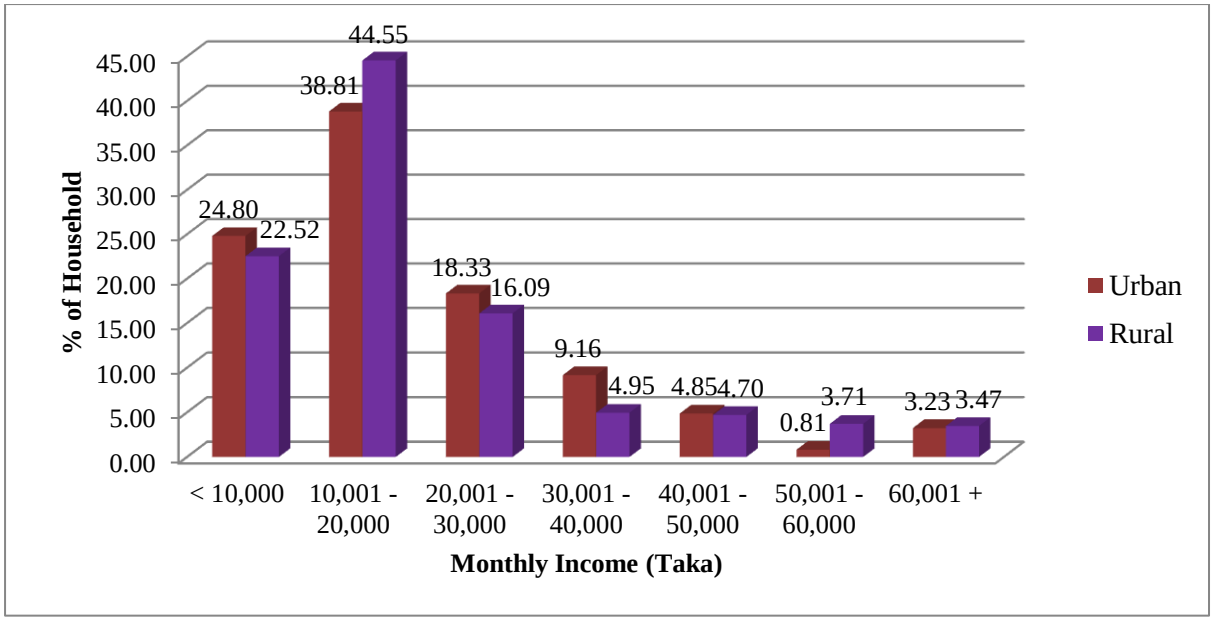

Figure 3.10: Monthly Income (Source: Field Survey, 2015)

3.7.2 Monthly Expenditure

The percentage of households, who has expenditure below BDT 10000, is found higher in urban area than rural. About one third of total urban households have the expenditure below Tk. 10000 whereas about half of the rural people have expenditure between BDT 10000-BDT 20000 which is higher than the rural percentage. Apart from that, for expenditure more than BDT 20000 urban percentage is more than the rural (please see Figure: 3.11).Most the monthly income is expended in food and education sector both in urban and rural areas.

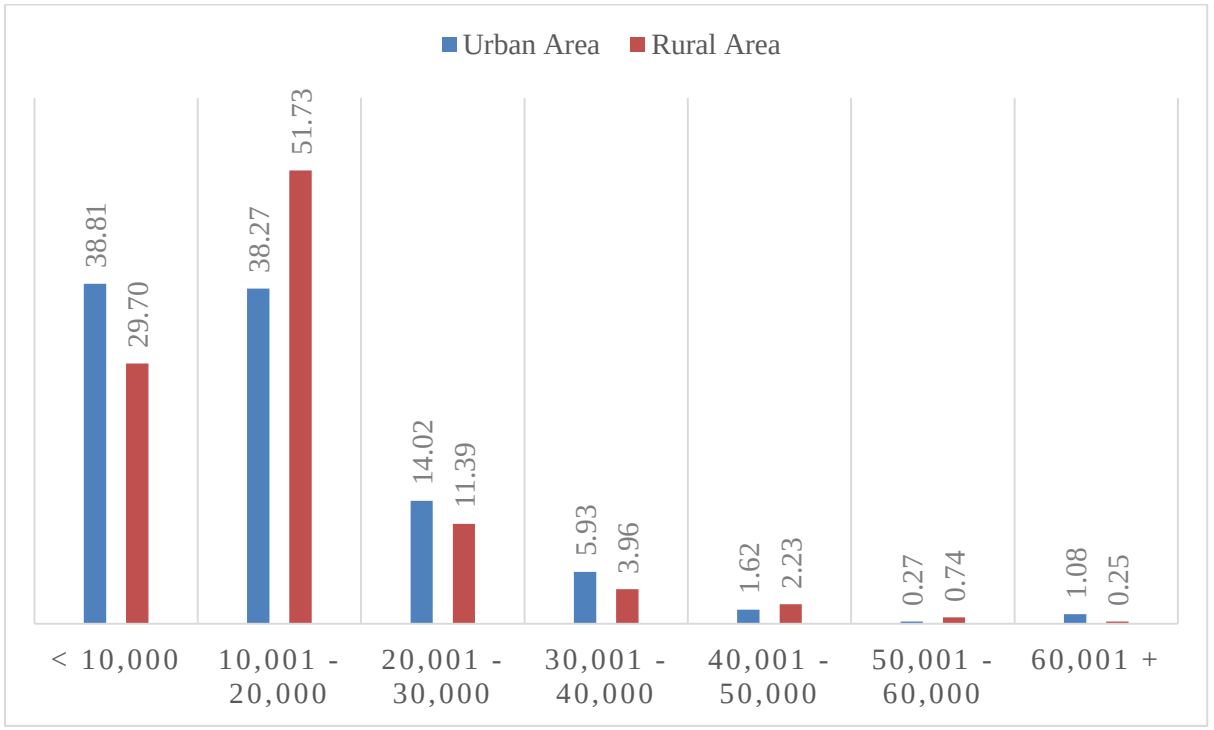

Figure 3.11: Monthly Expenditure (Source: Field Survey, 2015)

The percentage of food cost per month is a vital indicator of socioeconomic situation of household. About 26 percent households' food cost within 61 to 90 percent those are poor people. About 32 percent households food cost within 40 percent of monthly expenditure those households have more option to spend money at other sectors. Thus, the percentage of food cost at total monthly expenditure is comparatively high at rural area (please see Figure 3.11)

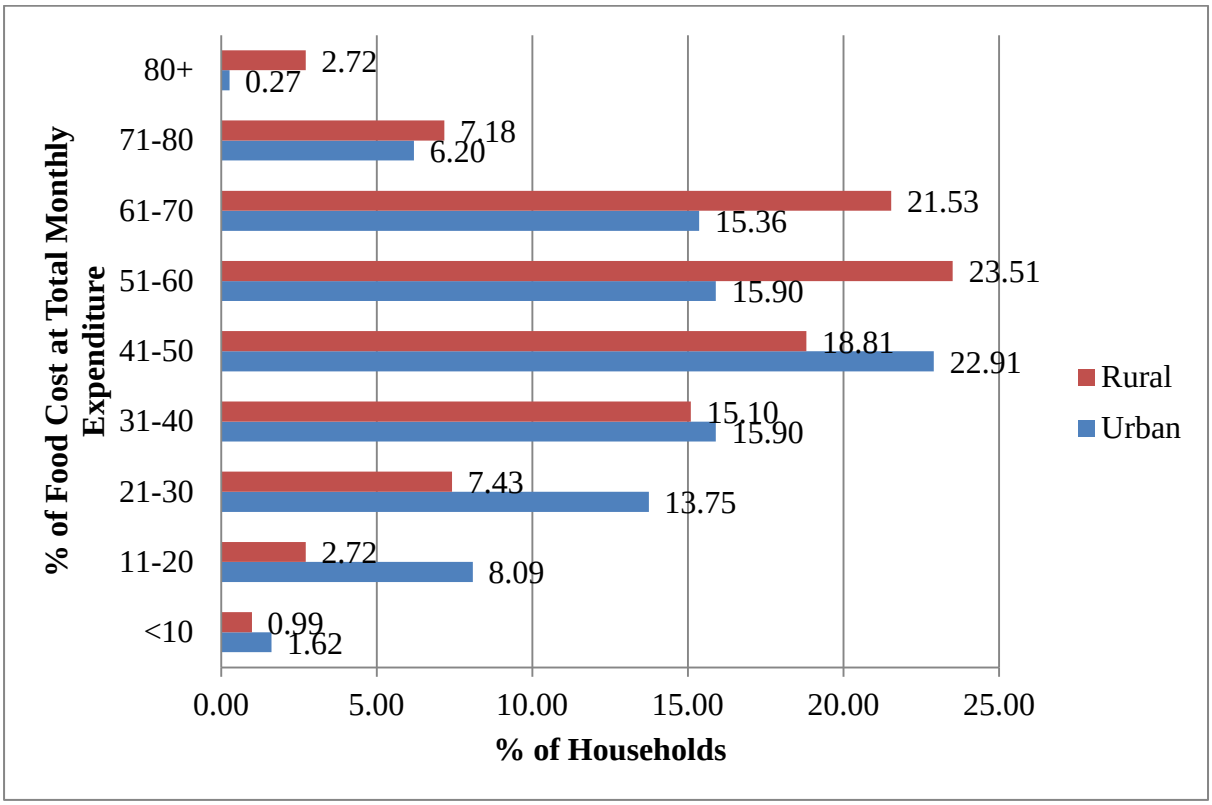

Figure 3.11: Percentage of Food Cost at Total Monthly Expenditure (Source: Field Survey, 2015)

3.8 Migration

Almost all of the households of this Upazila are non-migrant, lived in here from their birth. Only about 4% of them are migrant, among them maximum migrants came here due to eradicate poverty (please see Figure: 3.12).

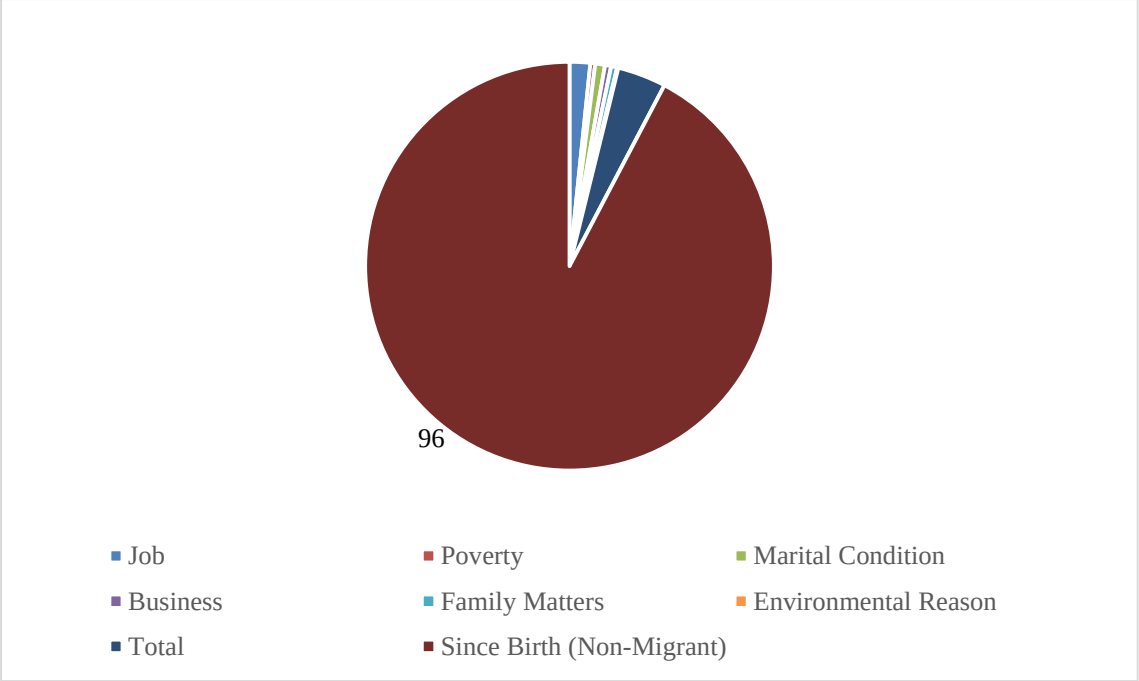

Figure3.12: Causes of Migration (in percentage)Source: Field Survey, 2015

3.9 Housing Status

3.9.1 Pattern of Household Land Ownership

In Shibpur Upazila, almost all of the households lived in their own house, and they are the owner of their household land. The families are living at the area for long time as migration rate also found very low. Thus, most of the people of Shibpur Upazila are there by their inheritance. The percentage of this types of household is slightly higher in rural area, thus in rural area most of the households are living in their own house. On the other hand, some of the respondents also lived in "Joint" owned land. These households own their household land with other members of their families. Very small percentage of people lived in rent house both in urban and rural area (please see Figure:3.13).

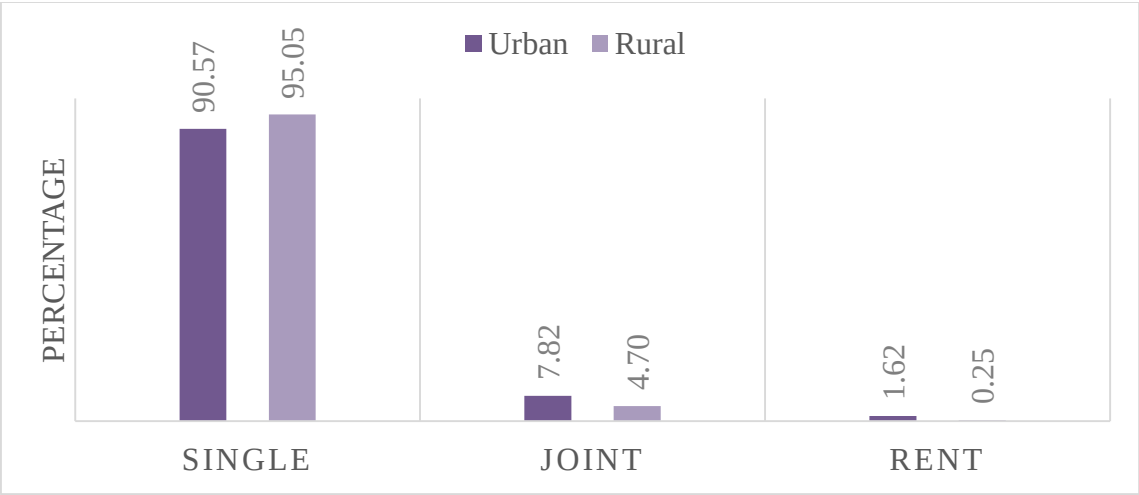

Figure 3.13: Pattern of Household Land Ownership (Source: Field Survey, 2015)

3.9.2 Types of House Structure

About half of the households of both urban and rural area those are middle income households of Shibpur lived in semi-pucca house and the percentage is almost the same and highest than other categories. Besides, in urban area about one fourth lived in Pucca house structure which represents relatively high economic status and the percentage is lower in rural area. On the other hand, in rural area about one third of total households lived in katcha house, and in urban area the percentage is lesser than urban (please see Figure: 3.14). Thus, it represents the fact that housing condition in urban and rural area are not about the same.

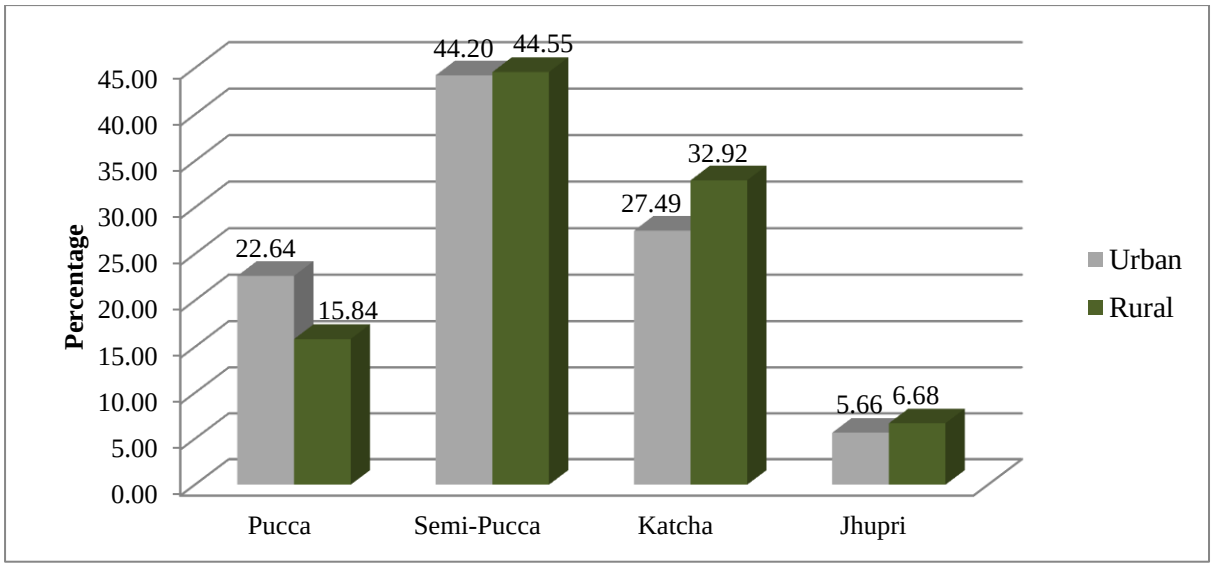

Figure 3.14: Type of Household Structure(Source: Field Survey, 2015)

3.9.3 Source of Land Ownership and Duration of Living

Both in urban and rural area most of the households owned their land by inheritance. Thus, they are living in the same house since 21 or more years. And the percentage is lower in urban area than rural area. In urban area land owned by purchasing are the second highest as the urban facility attracted people to purchase land at Shibpur and live with modern facilities (please see Figure: 3.15).

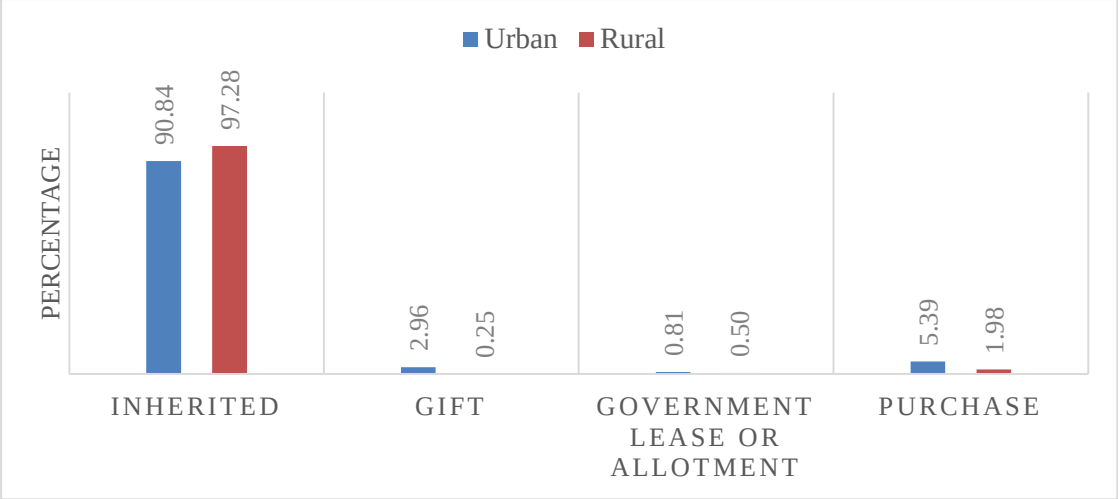

Figure3.15: Source of Household Land Ownership (Source: Field Survey, 2015)

From Figure 3.16, it is evident that, about more than two third of total respondents of both urban and rural area living in the same house 21 or more years as they got it by inheritance. The percentage is lower in urban area as in urban area a significant number of people lived there by purchasing the land and they are newly started living households as a result the ratio of living in the same households 16-20 years is about the same for both in rural and urban areas. In urban area some of new households build their own house recently because of the attraction of urban facilities.

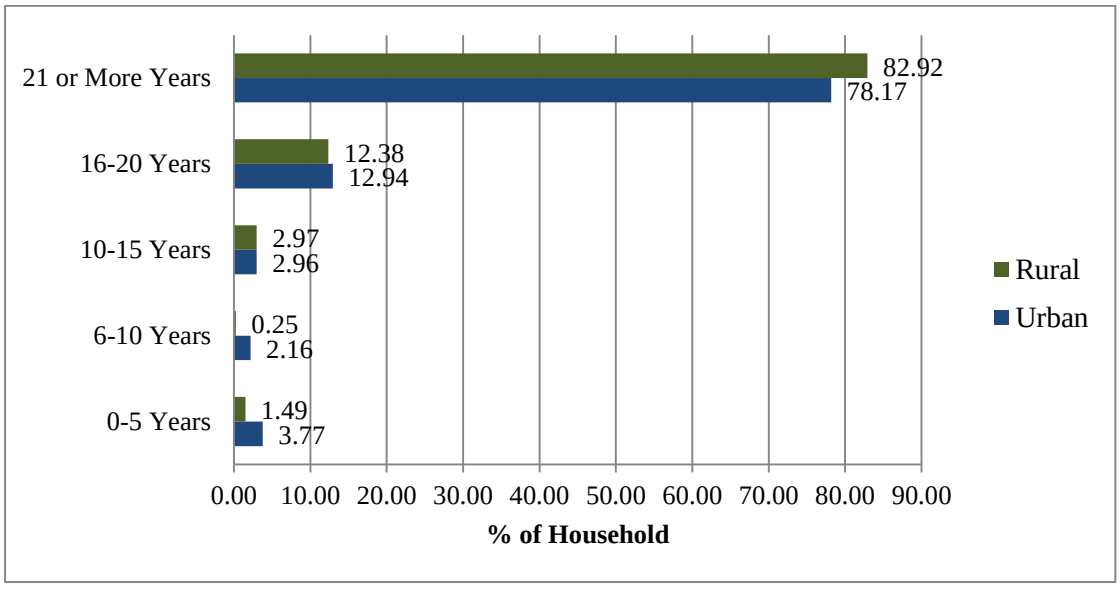

Figure 3.16: Duration of Living (Source: Field Survey, 2015)

3.10 Land Value

Land price highly varied with locations. It has been found that in rural area about to third of the land's price is below BDT 1 lakh, where as in urban area about one third of land's price is more than BDT 5 lakhs. As land price varies with location in urban area also about one fourth urban land's price varies from BDT 2to 5 lakhs. But only 10% land of rural area's land are in the same price range (please see Figure:3.17). Thus the urban facilities have highly influence on land value.

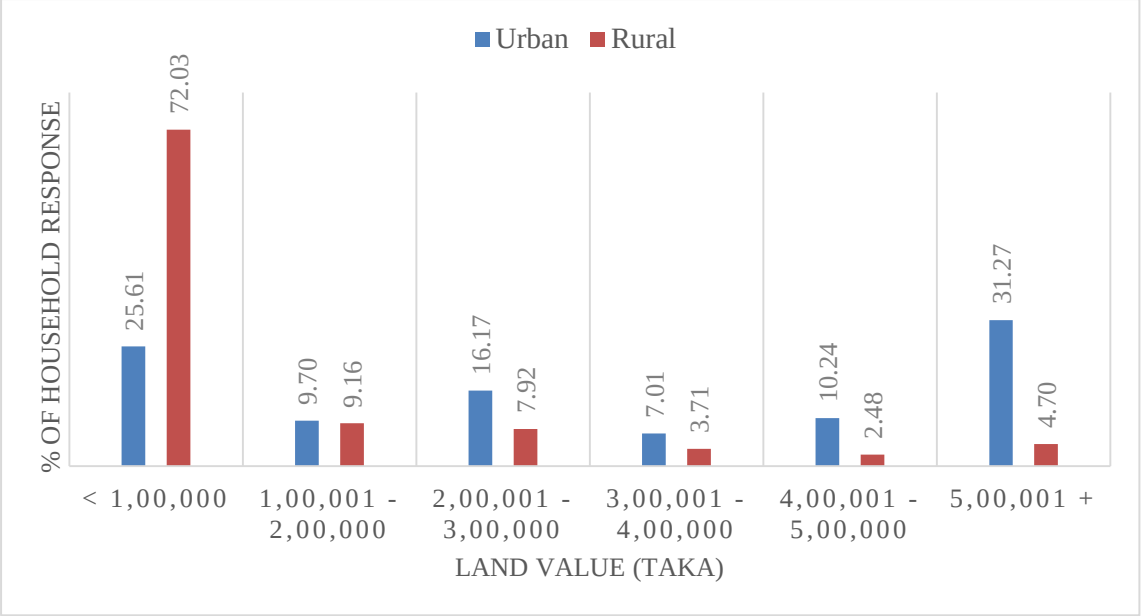

Figure 3.17: Price of Present Household Land in 2015(Source: Field Survey, 2015)

3.11 Transport

3.11.1 Mode of Communication

As there are very limited number of waterways are available almost all of the households' main mode of communication is road. It also represents that road condition in Shibpur Upazila is good. A small percentage of total households also traveled by train for long distance travel as they think it is more safe mode of communication than others (please see Figure:3.18).

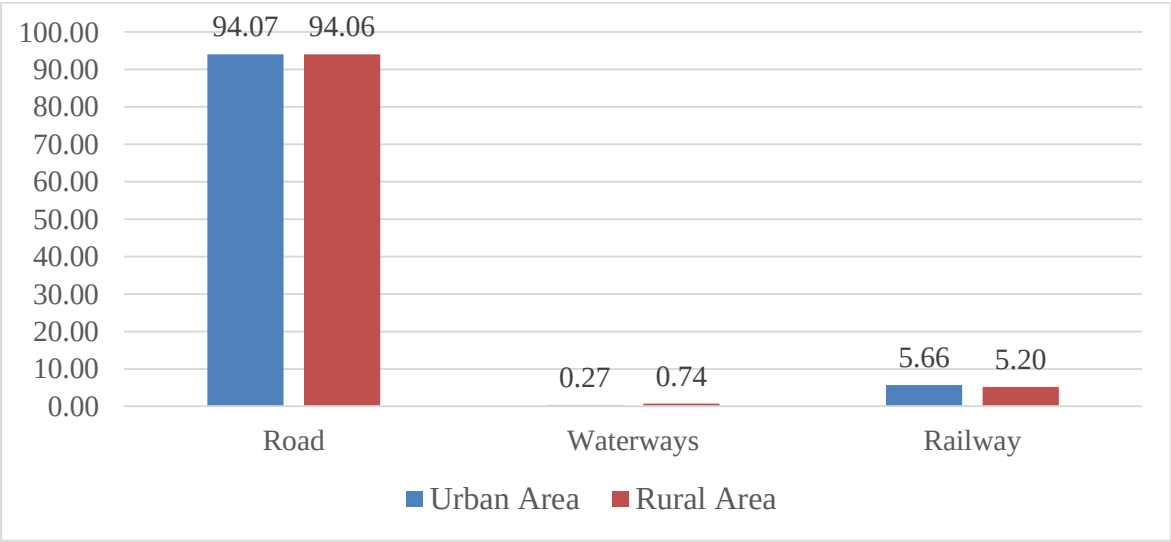

Figure 3.18: Mode of Communication (Source: Field Survey, 2015)

3.11.2 Types of Road

In urban area about three fourth of total road is bituminous road. Concrete made roads are the second highest in urban area which represents that in urban area road condition of Shibpur Upazila is satisfactory. Besides, in rural area, the percentage of bituminous made or concrete made road percentage is almost same which represents that road condition in both of urban

and rural area is almost the same. In rural area a significant percentage of roads are katcha that represents the fact that some steps could be taken for the development of these road (please see Figure: 3.19).

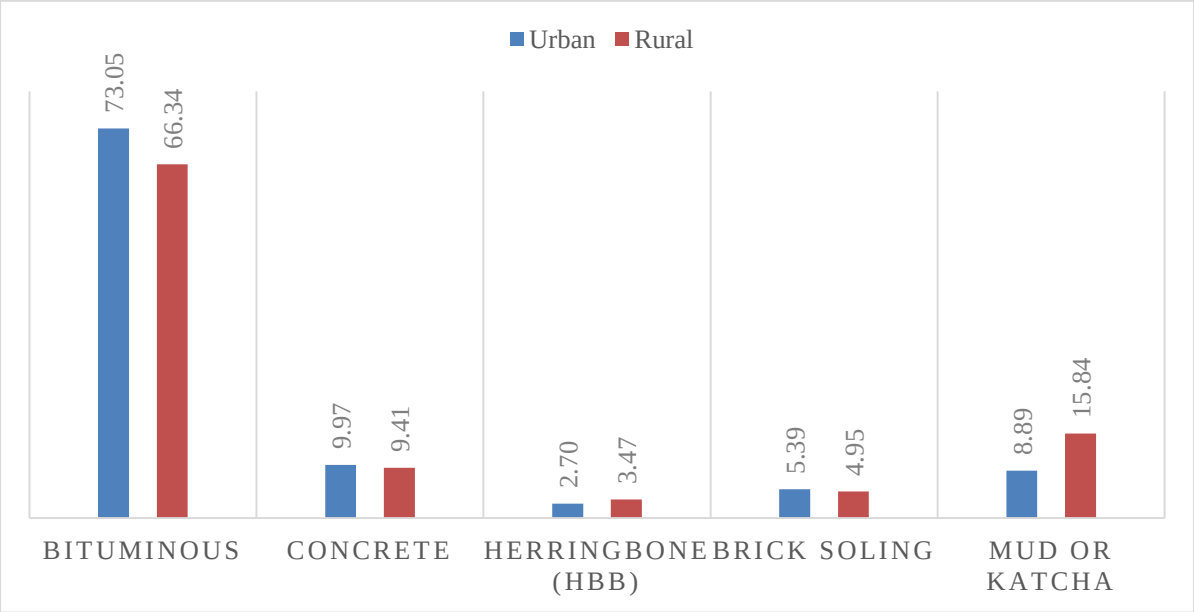

Figure 3.19: Types of Road(Source: Field Survey, 2015)

3.11.3 Mode of Access to Main Road

It has been found that about two third of total households in urban area got access to main road through footpath, whereas in rural area about the percentage is about half of the total respondents. This is because in urban area, there are sufficient establishments has been made as footpath than in rural area. In rural area most of the households went to main road by *Halot* or field boundary (please see Figure: 3.20).

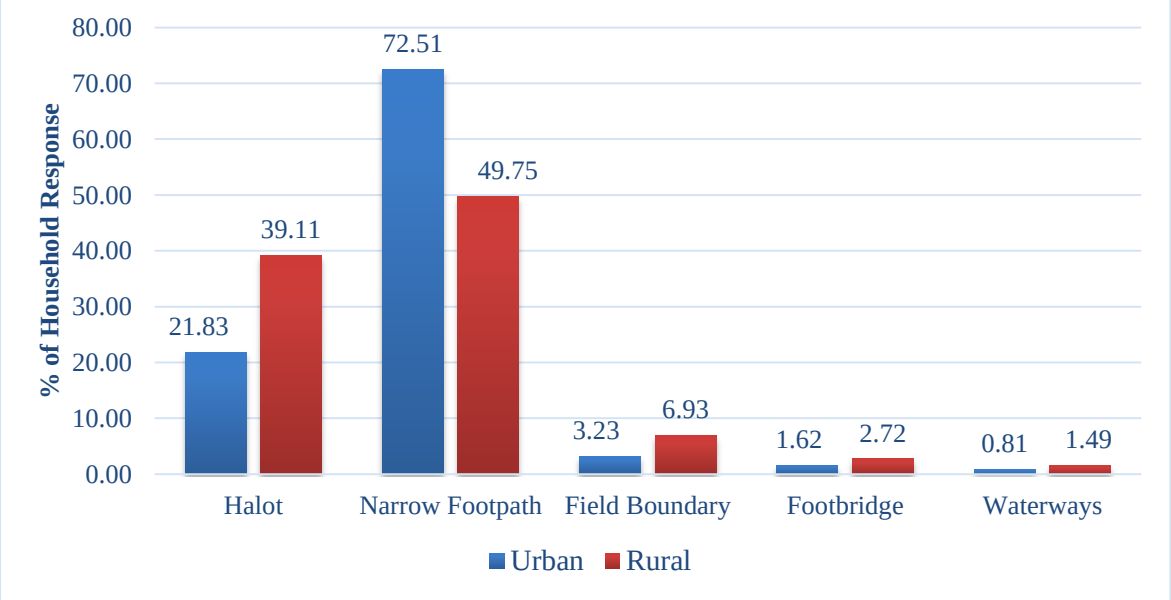

Figure 3.20: Mode of Access to Main Road (Source: Field Survey, 2015)

3.11.4 Condition of Road

In urban area, about one third or total road's condition is good, on the other hand, more than about half of total roads have been reported as deteriorated. This represents the situation that there is not enough maintenance for urban road though about two third of total urban road is made by bituminous. On the other hand, the percentage of deteriorated road is lower in rural area than urban area, but there are about four times higher destroyed roads in rural area which needsquick maintenance before totally destroyed condition. The percentage of seasonal waterlogged road in rural area is about three times higher for than urban area. Besides, the percentage of good roads is also not much significant in rural areas than urban area. In a nutshell, it can be easily understood that enough maintenance of road is not present in both of rural and urban area. But the condition in rural area is worse than urban area (please see Figure:3.21).

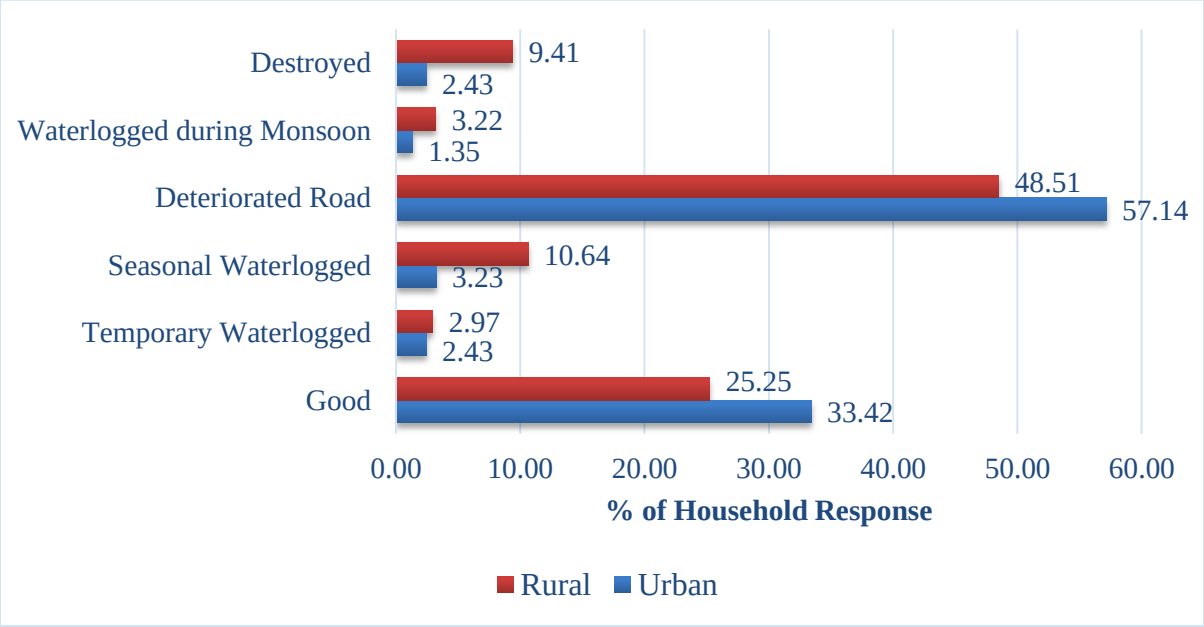

Figure 3.21: Condition of Road (Source: Field Survey, 2015)

3.11.5 Maintenance of Road

As from the previous section discussion, it has been proved that enough road maintenance has not been carried out in both of urban and rural area, the below Figure:3.22 again proved that.There is almost never annual maintenance has been carried out for both of urban and rural area. For about half of the cases irregular maintenance has been occurred. In urban area for about one fourth of the cases roads are being maintained periodically 2-3 years. But the percentage is almost half in rural area than in urban area. In rural area almost about one fourth of the cases roads are being again made by after extremely damaged. Thus, it can be said that effective regular maintenance should be carried out in both of urban and rural area by the responsible authorities

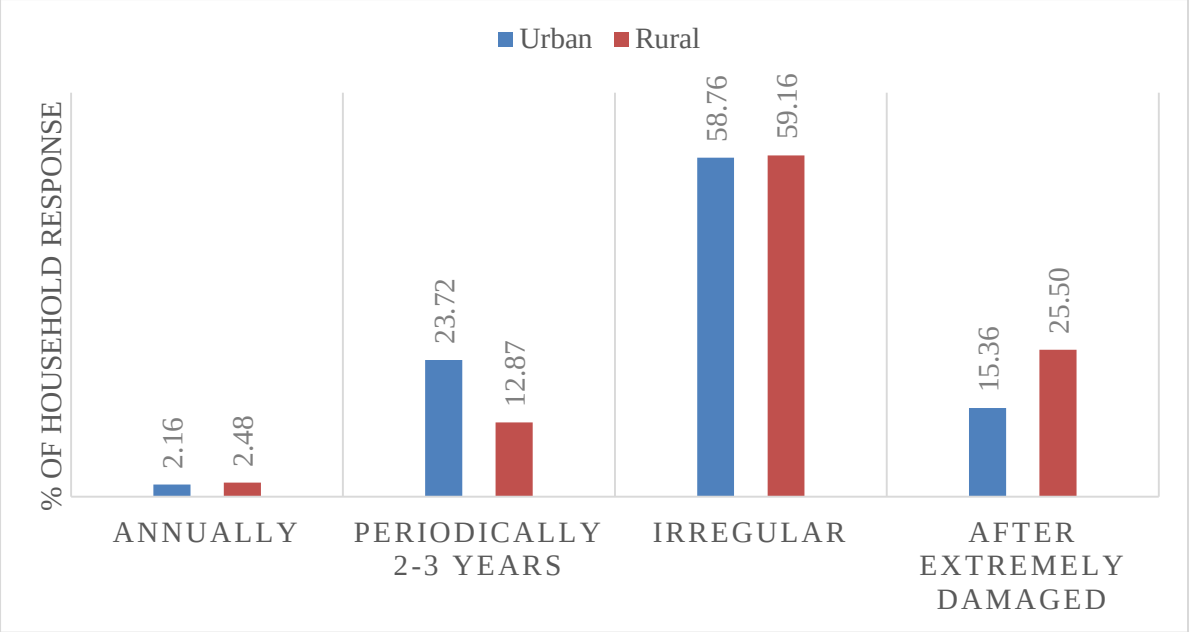

Figure 3.22: Maintenance of Road (Source: Field Survey, 2015)

3.12 Utility Service

3.12.1 Energy

a. Source of Energy for Cooking Purpose

In Shibpur Upazila, about three fourth of total households use *lakri/vusi* as source of energy for cooking purpose. It represents that most of the rural households' source of energy pattern for cooking purpose is from informal sources (please see Figure: 3.23). Thus for cooking purpose most of the households of Shibpur upazila follow the traditional pattern.

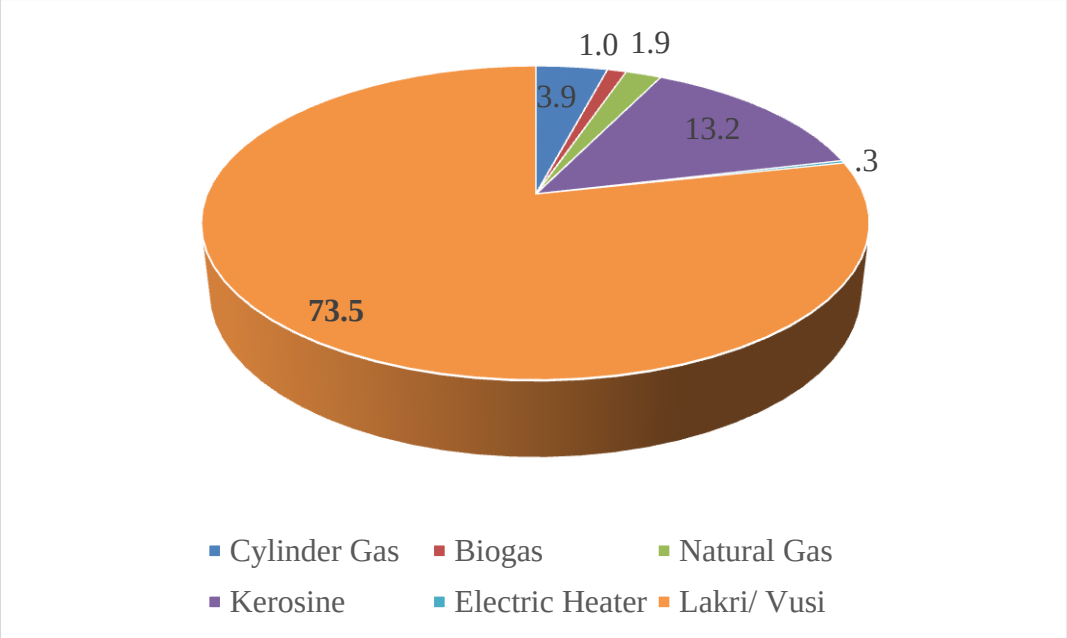

Figure 3.23: Source of Energy for Cooking Purpose (Source: Field Survey, 2015)

b. Source of Lighting

Both in urban and rural area about 90% households source of lighting is electricity. The percentage is slightly lower for rural area as in rural area electricity provider Bangladesh Rural Electrification Board (BREB) faced high demand but lesser supply (please see Figure: 3.24). Moreover, electricity connection costs more in rural area than urban area as households in rural area are scattered. In rural area,those who are not getting electricity supply usealternative lighting source like kerosene light as light source, thus the percentage is about double than in urban area. Solar power needs high installment cost as the percentage of using solar power is quite low in both of urban and rural area (please see Figure: 3.24).

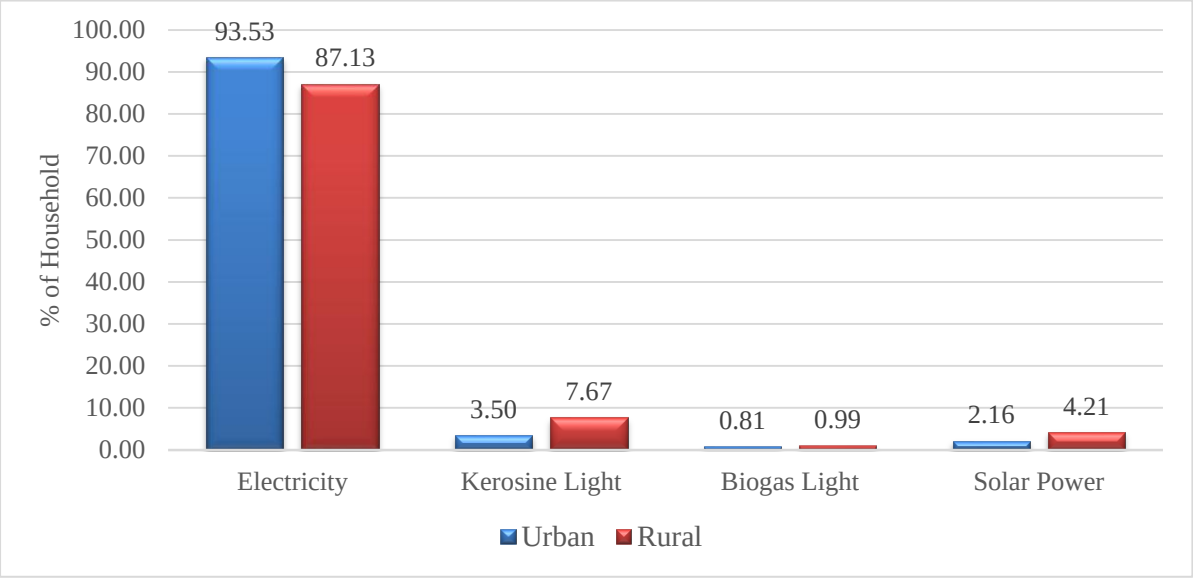

Figure 3.24: Source of Lighting (Source: Field Survey, 2015)

c. Electricity Supply Status

Because of high load shedding and high pressure in peak period with insufficient electricity, supply both in urban and rural area very small percentage households has said that they enjoy uninterrupted electricity supply. Otherwise about half of the total respondents said that electricity is irregular in their areas. About half of the total respondents said that routine based load shedding occurred in their area. In rural area, a certain percentage of households (about 7%) still do not have or experience electricity facility in their households. And the scenario is almost same irrespective of rural or urban areas in case of irregular or routine based load0shedding (please see Figure: 3.25).

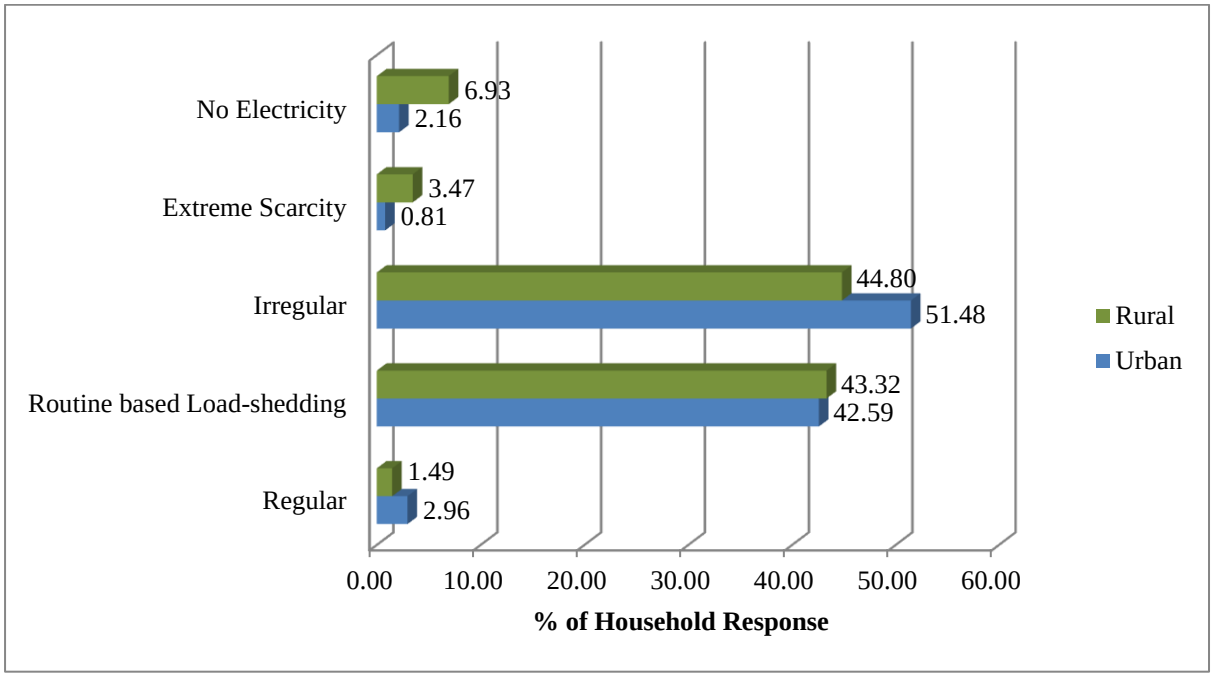

Figure 3.25: Electricity Supply Status (Source: Field Survey, 2015)

3.12.2 Drinking Water

a. Source of Drinking Water

In Shibpur Upazila, almost all of the households (about 90%) use their own tube-well for source of drinking water. As most of them lived in their own house, the percentage of having own tube-well is quite higher both in urban and rural areas. Though in urban areas a significant number of households (about 10%) use pipe line services for drinking water, generally those are the new households living in urban area (please see Figure: 3.26).

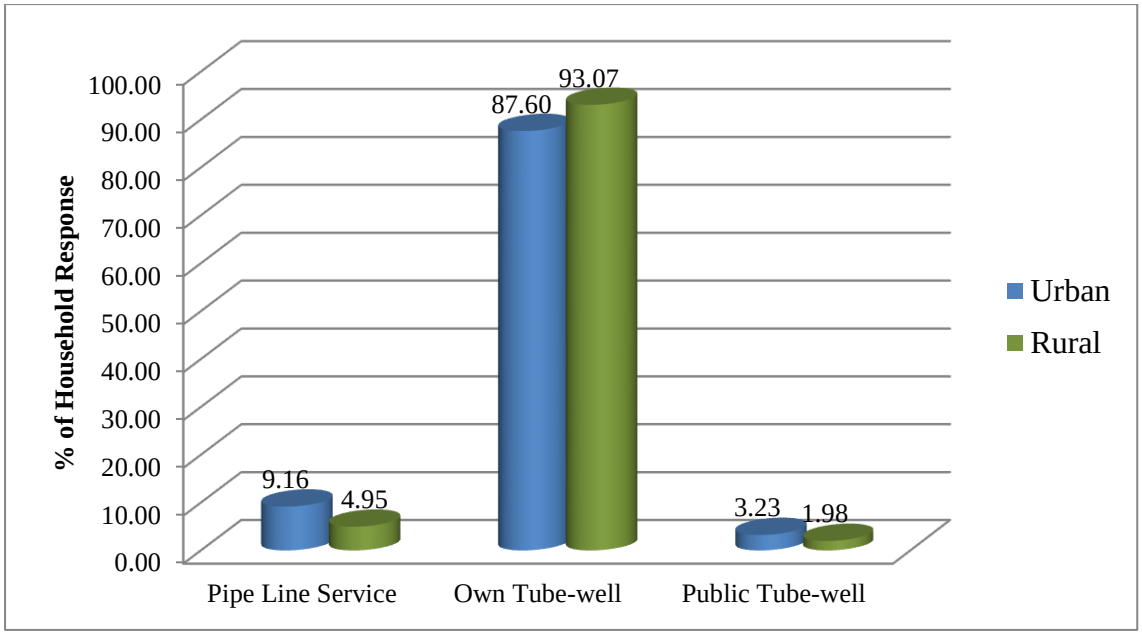

Figure 3.26: Source of Drinking Water (Source: Field Survey, 2015)

b. Drinking Water Quality

Overall drinking water quality at both urban and rural areas at Shibpur is satisfactory. About 80% of total households said that they are satisfied or highly satisfied with the quality of drinking water. On the other hand, in urban area some of the households also said that they are not satisfied with the drinking water quality. Most of them have no own tube-well and they have to use water from adjacent ponds or other sources of water(please see Figure: 3.27).

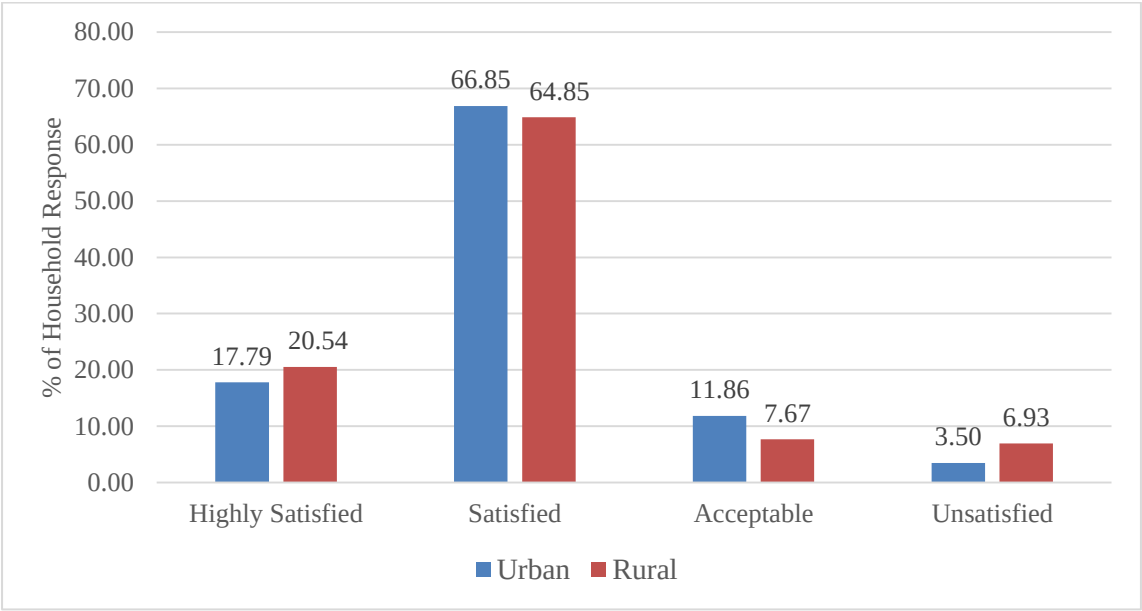

Figure3.27: Drinking Water Quality(Source: Field Survey, 2015)

c. Distance of Water Source

Moreover, almost all of the households collect water from 0.5 km of water source. Among them, about 90% of total households are within .25 km radius of water source. So the basic

right of having enough potable water within walking reach is being maintained here (please see Figure: 3.28).

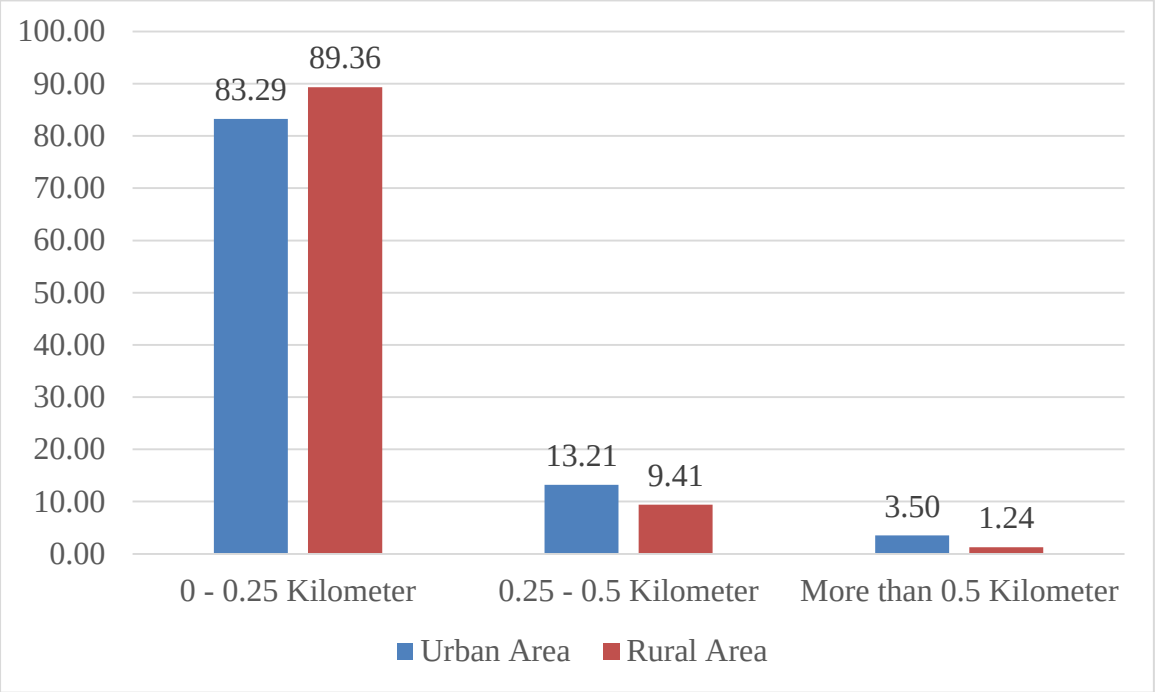

Figure 3.28: Distance of Water Source(Source: Field Survey, 2015)

3.12.3 Sanitation

Percentage of using pit latrine is satisfactory in both of urban and rural area. About almost all of the households use commode or pit latrine. Only a small percentage of households do not maintain healthy sanitation facilities and use open toilet. The percentage of using open toilet is higher in rural area than urban are, thus awareness building program can be carried out in rural area about using healthy sanitation systems (please see Figure: 3.29).

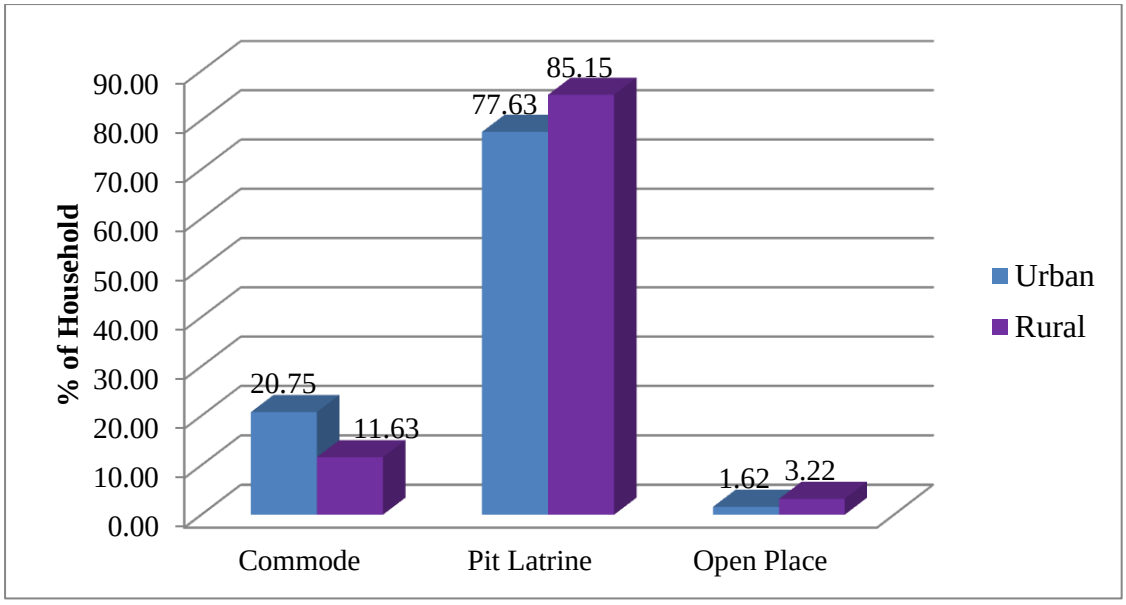

Figure 3.29: Sanitation System (Source: Field Survey, 2015)

About more than half of the households used absorb well sanitations system both in urban and rural area. About one third of total respondents also used septic tank sanitation system though the system's installation cost is comparatively high. The percentage of using different systems is almost the same for both of urban and rural area thus there are no significant differences in using sanitation system in between urban and rural areas (please see Figure: 3.30).

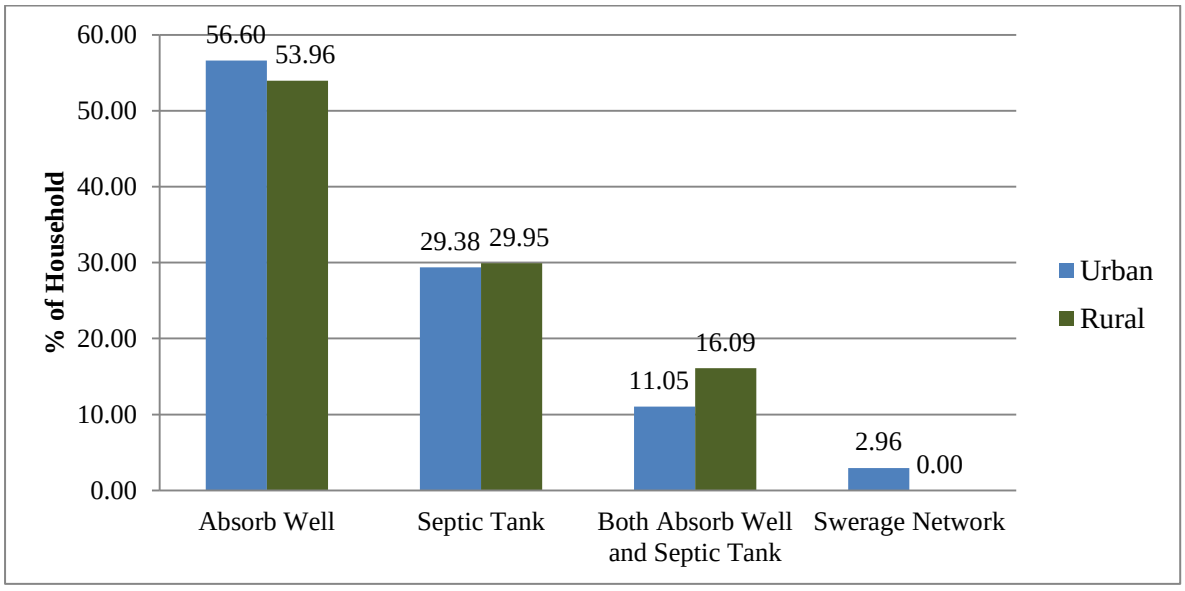

Figure 3.30: Type of Sanitation Management System (Source: Field Survey, 2015)

3.12.4 Waste Management

a. Waste Management System

From table 3.3, it is found that, in Shibpur Upazila, most of the households manage their waste through their own management. Among them, more than half of them use lowland besides their house. About one third of them also use hole within their yard for

wastemanagement. Only small percentage (about 3%) of them use canal or river or small water-body or beside the road which is not environment friendly. The small percentage can also be lessened down by creating awareness about waste management system.

Table 3.3: Distribution of Waste Management System

Waste Management	Number	Percent
Door to Door Collection	43	5.5
Own Management	732	94.5
Dustbin	45	5.8
Hole Within Yard	257	33.2
Lowland Beside House	435	56.1
Canal or River or Small Water-body	23	3.0
Beside Road	15	1.9
Total	775	100.0

Source: Field Survey, 2015

b. Distance to Waste Disposal Place

Again the distance from waste disposal place to households is within 50m for almost all of the households (please see Figure: 3.31). So, it can be seen as advantages for the households as they can put away their waste easily. But the less distance also keeps them in vulnerable position as several diseases can easily be spread out from the waste disposal place.

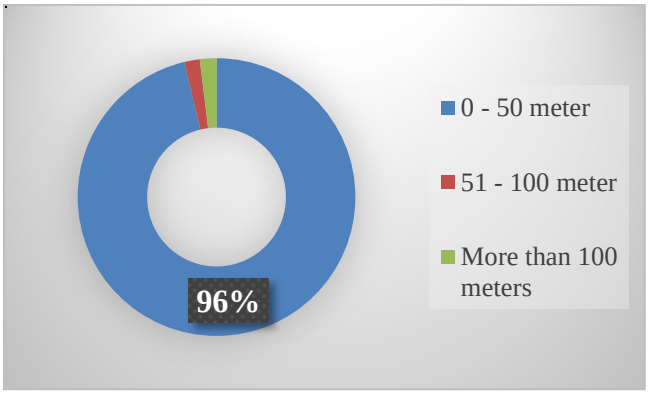

Figure 3.31: Distance to Waste Disposal Place (Source: Field Survey, 2015)

3.13 Medical Facility

From Table 3.4, it is found that, in Shibpur Upazila, most common disease is fever in both urban and rural area. The percentage is higher in rural area than urban. Moreover, the second highly common disease is flux/cough both in urban and rural area. And the percentage of

affecting with this disease is higher in urban area than rural area. Thus the environmental condition is better in rural area than urban area which results into more disease affected people are found in urban area. Water borne diseases like diarrhea, dysentery, skin diseases etc. also are more common in urban area.

Table 3.4: Type of Sickness

Type of Sickness in Last 6 Months	Urban Area		Rural Area		Total	
	No.	%	No.	%	No.	%
Fever	196	52.83	250	61.88	446	57.55
Flux/Cough	82	22.10	75	18.56	157	20.26
Diarrhea/Dysentery	36	9.70	10	2.48	46	5.94
Jaundice	5	1.35	12	2.97	17	2.19
Polio	2	0.54	2	0.50	4	0.52
Worms Disease	1	0.27	9	2.23	10	1.29
Sexual Disease	0	0.00	6	1.49	6	0.77
Bone-loss Disease	4	1.08	12	2.97	16	2.06
Diabetes	16	4.31	3	0.74	19	2.45
Skin Disease/Itching	4	1.08	2	0.50	6	0.77
Gynecological Disease	7	1.89	8	1.98	15	1.94
Gastric	13	3.50	2	0.50	15	1.94
Ulcers	1	0.27	9	2.23	10	1.29
Piles	4	1.08	4	0.99	8	1.03
Total	371	100.00	404	100.00	775	100.00

Source: Field Survey, 2015

In urban area, according to Figure 3.32, it is found that about two third of total urban households said that the general health service is found at nearest health service centers and Upazila Health Complex is providing good operation facilities for both urban and rural people. The percentage is low in rural area, thus about half of the total households are deprived of having general health service in the nearest health service centers. The percentage of getting quality health service in nearest health service centers is better in urban area in comparison to rural area. The mother and child health care service is almost close in urban and rural area. But the alarming situation is that most of the households' nearest health service center is not able to provide enough medical service facilities for mother and child health.

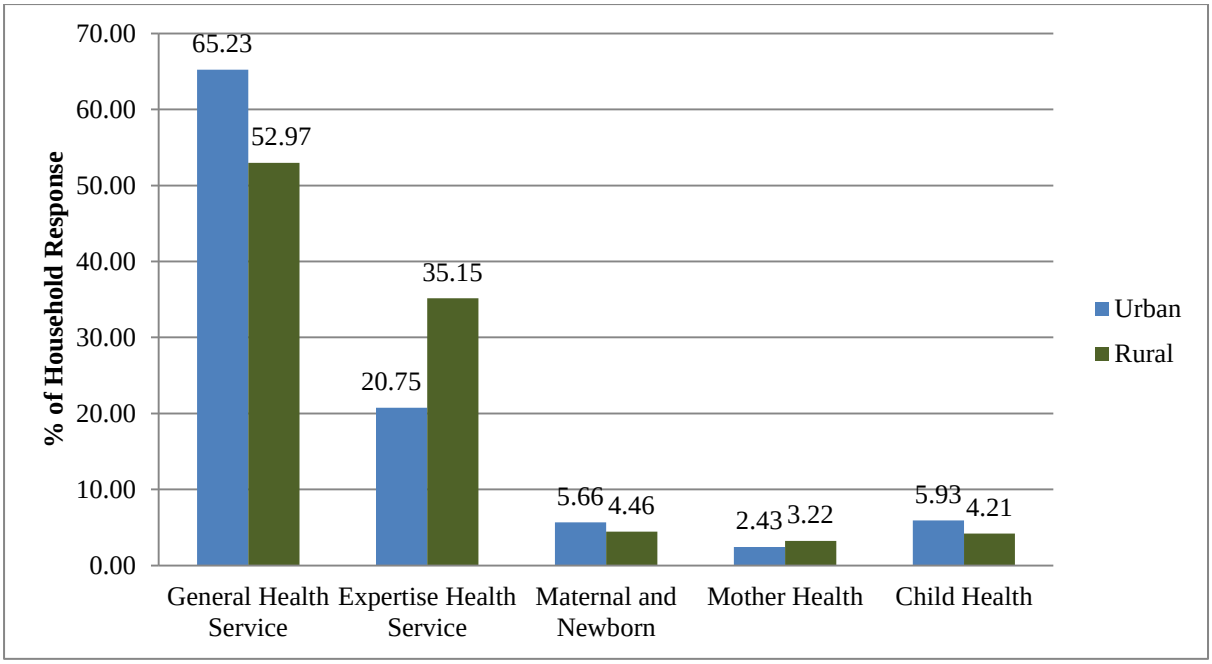

Figure 3.32: Type of Treatment Facility (Source: Field Survey, 2015)

On the other hand, despite of such shortcomings discussed in earlier section about more than two third of total household in both of urban and rural area anticipated that, they are satisfied with the treatment quality provided by the health service centers. Rural people generally are highly satisfied with their services as the percentage for "Highly Satisfied" and "Acceptable" is higher in rural area. Which represents the fact that though the medical centers could not have enough expertise for maternal and child health, but they are providing a satisfactory service for general health issues (please see Figure: 3.33).

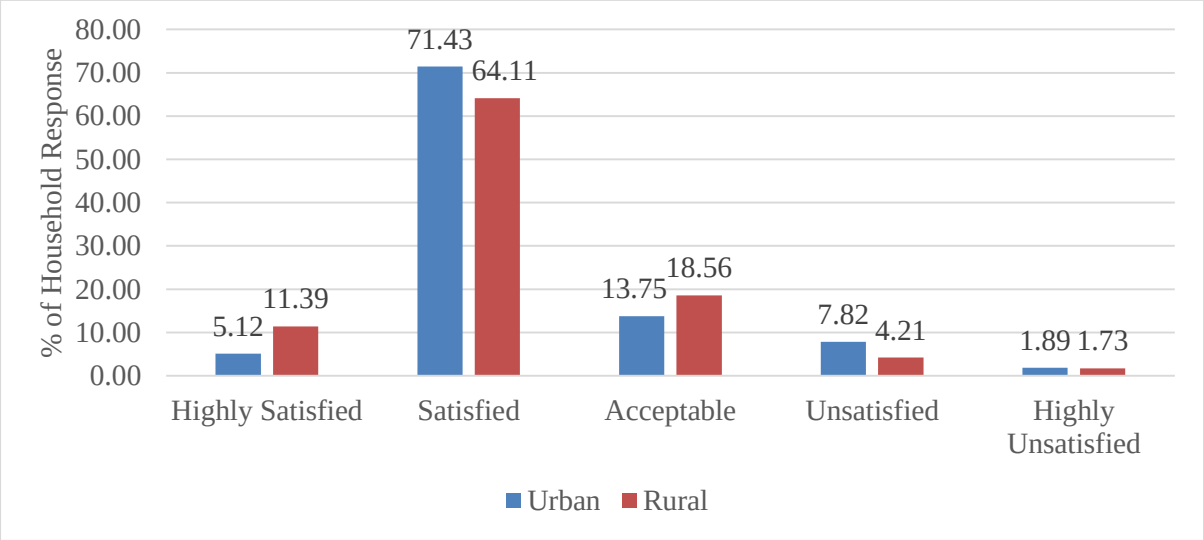

Figure 3.33: Quality of Treatment Facility(Source: Field Survey, 2015)

Apart from these positive situations of treatment facilities of Shibpur Upazila, the most important drawbacks of this upazila is lacking of community clinic in both rural and urban area. And the percentage is higher in urban area ((please see Figure: 3.34). Moreover, there is

also lack of enough free medical center services. Thus steps for establishing new community clinic and government clinic should be taken by proper authorities. Moreover, there are also lack of necessary medicines, for which immediate measurements should be taken.

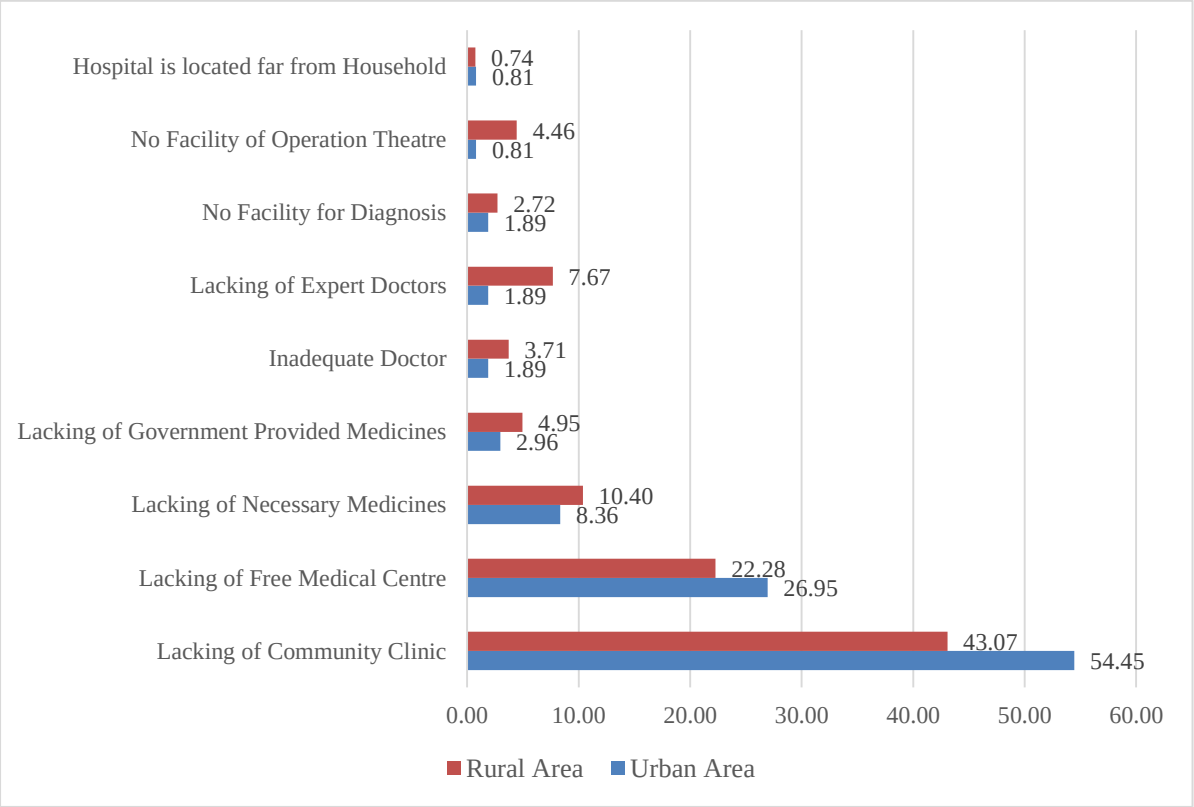

Figure 3.34: Drawbacks of Treatment Facility (Source: Field Survey, 2015)

3.14 Educational Facility

In Shibpur Upazila, it has been found that there is not enough qualified teacher. The dearth of this problem is about the same for both in urban and rural area. Moreover, the number of studentagainst teachert is too high, which deteriorates the quality of education. In addition, lacking of laboratory and library also hinders the quality education of Shibpur Upazila (please see Figure: 3.35).

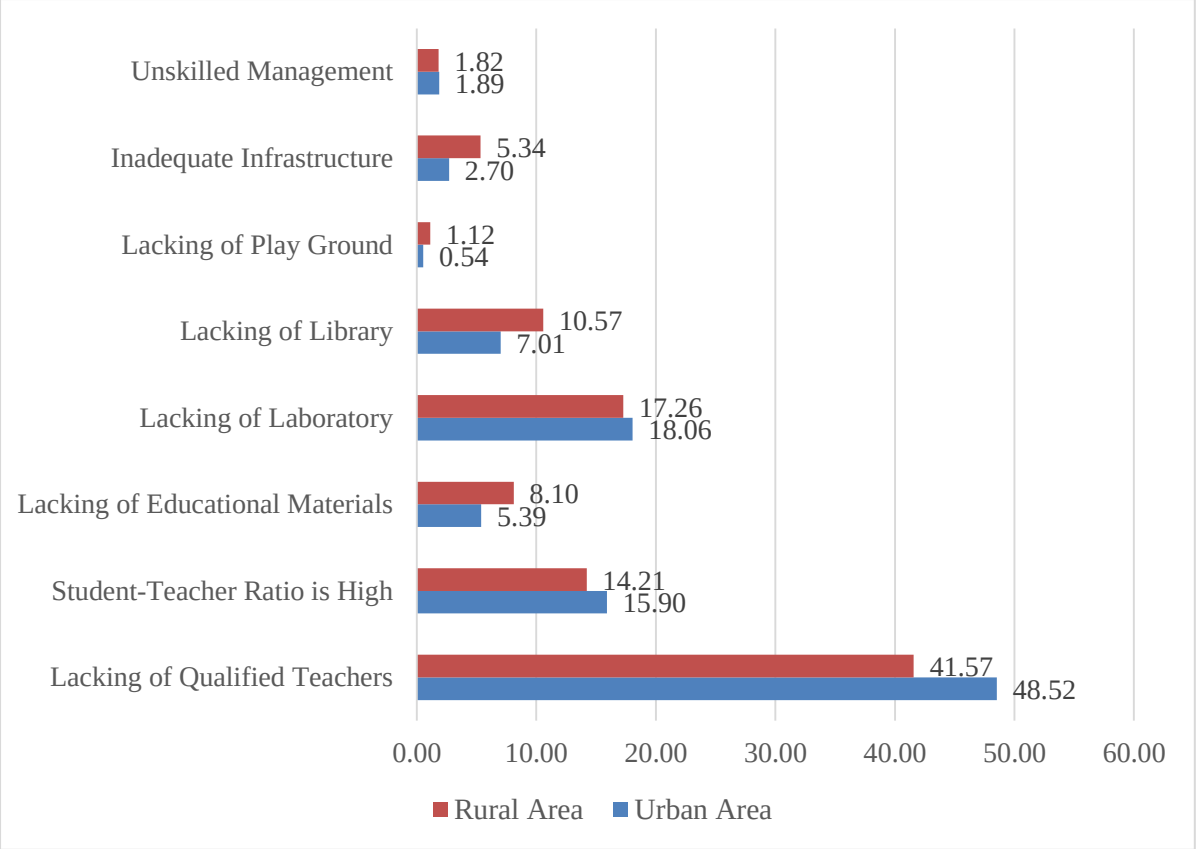

Figure 3.35: Problems of Educational Service (Source: Field Survey, 2015)

3.15 Recreational Facility

In Shibpur upazila about two third of total households' source of outdoor recreation is sports/playing in the field both in urban and rural area. A significant number of households also watch the sports as their recreation. In rural area fishing is another important source of recreation for some of the households (please see Figure: 3.36).

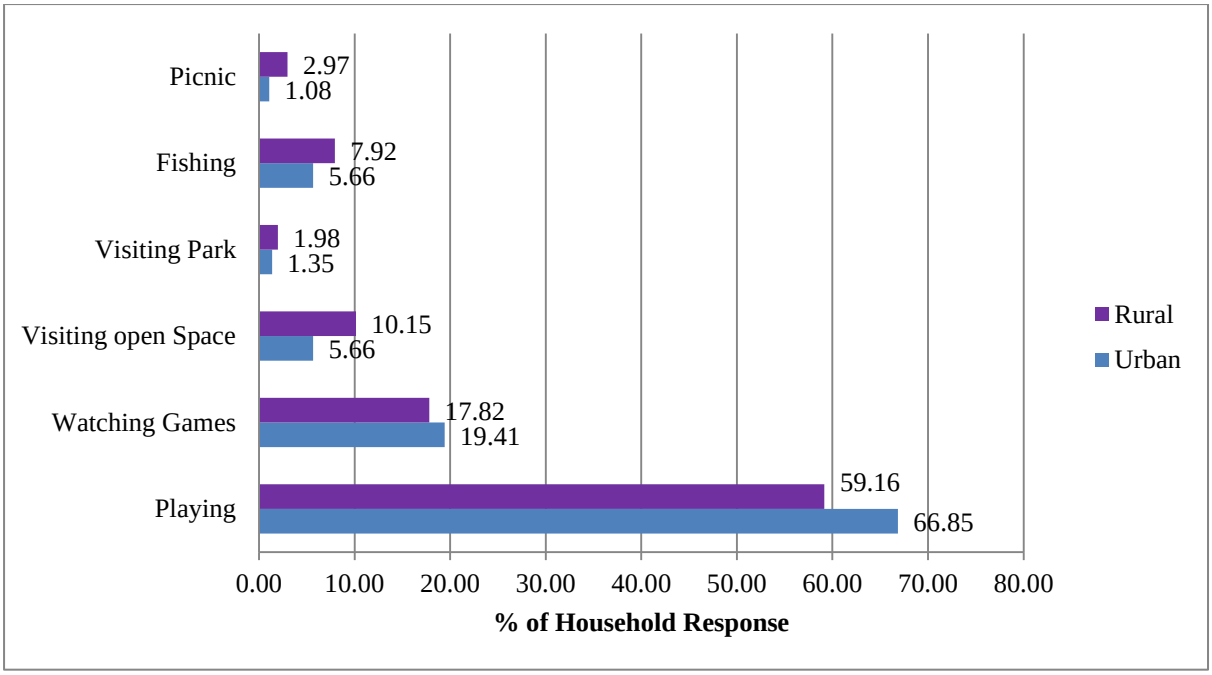

Figure 3.36: Out-Door Recreation (Source: Field Survey, 2015)

It is evident from Figure 3.37 that about half of total households in both of urban and rural area anticipated that there are not enough recreational facilities in their area. It occurred in the urban area most than rural area. On the other hand, economic insolvency is one of the important reasons for hindering outdoor reaction for some of the households of rural area, whereas in urban area lack of proper recreational environment and management of recreational areas are the prime drawbacks of recreational facilities.

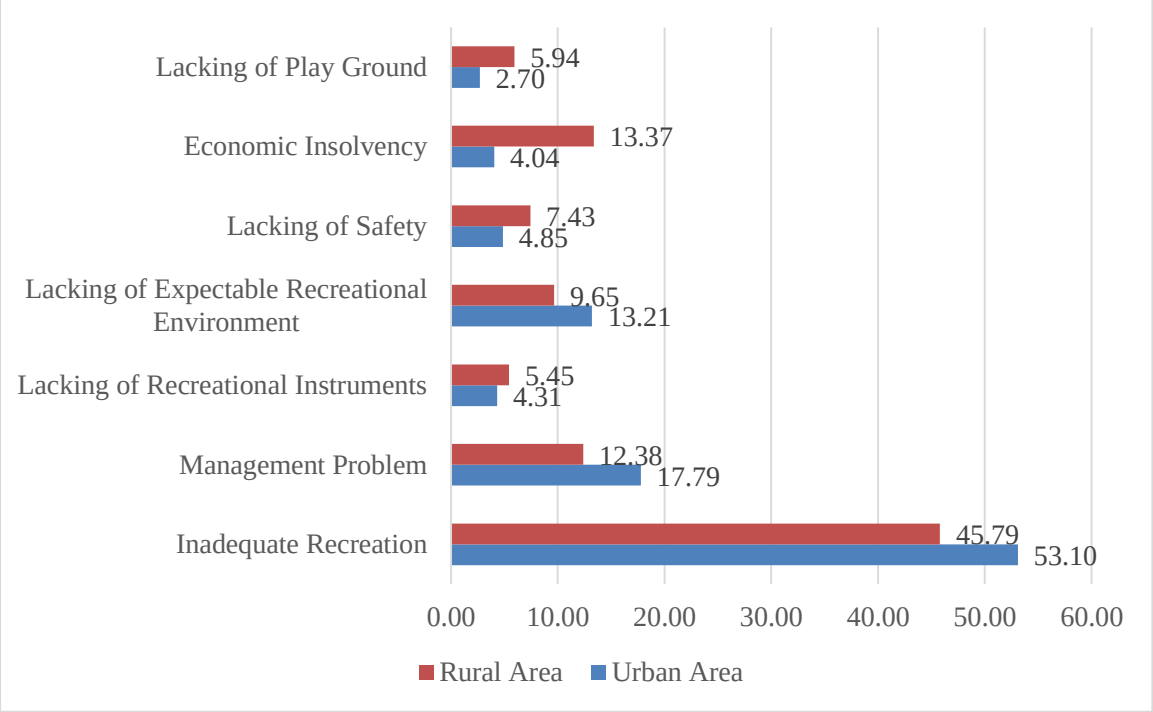

Figure 3.37: Drawbacks of Recreation Facilities (Source: Field Survey, 2015)

3.16 Law and Order Situation

Sneaking is the most common crime in Shibpur Upazila both in rural and urban area. In urban area the percentage is higher than rural area as the community bonding is much better in rural areas. On the other hand, heinous crimes like burgling, robbery, extortion, land or resource grabbing occurred in rural area more frequently than urban area (please see Figure: 3.38). It represents the fact that security condition in urban area is better from some perspectives than the rural area.

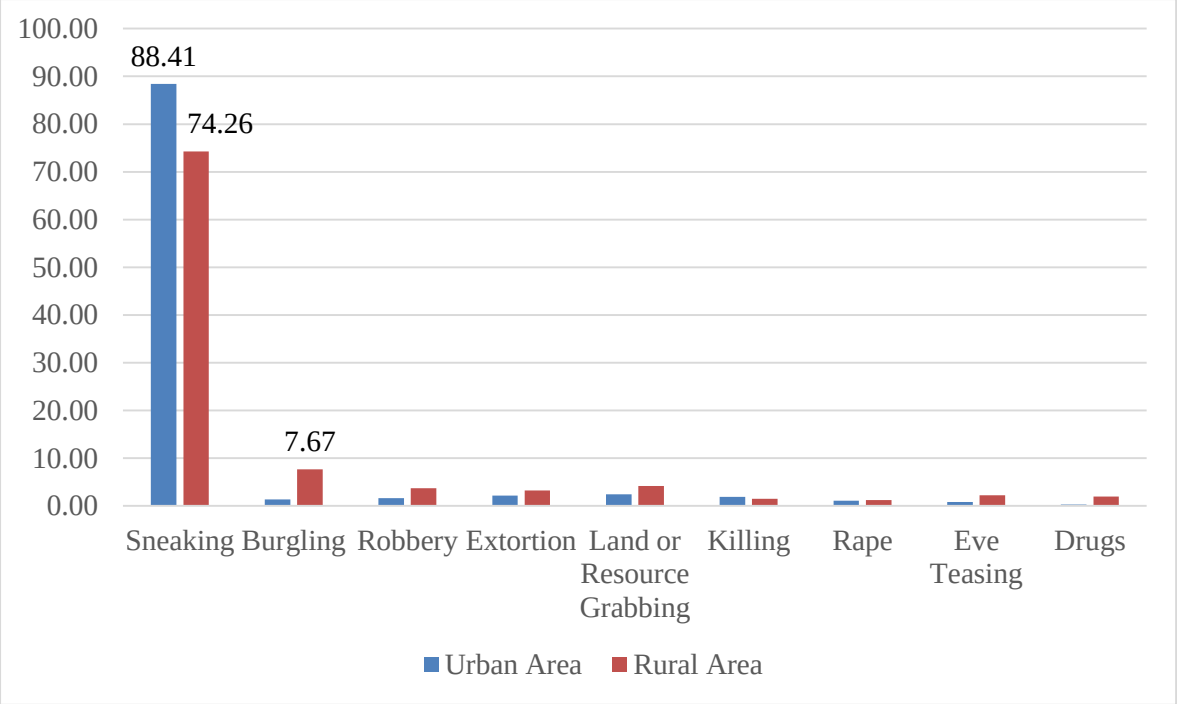

Figure 3.38: Types of Crimes (Source: Field Survey, 2015)

3.17 Available Services in Shibpur Upazila

The consultant analyzed retail market, post office, fire service and playground condition as vital services of Shibpur where the location, distance from the household and service quality has been studied.

3.17.1 Distance and Service Quality of Retail Market

More than half of the households has retail market within 1-2 km and more than two third of total households has it within 3 km. Thus, the service of retail markets could easily be taken by most of the households as the distance is not too far. Also, both in urban area about two third of total households said that they are highly satisfied with the service of it. The ratio is about the same for both in urban and rural area for all of the categories like (highly satisfied, satisfied, unsatisfied etc.). Thus, the service is about the same for in urban and rural area (please see Figure: 3.39 & 3.40).

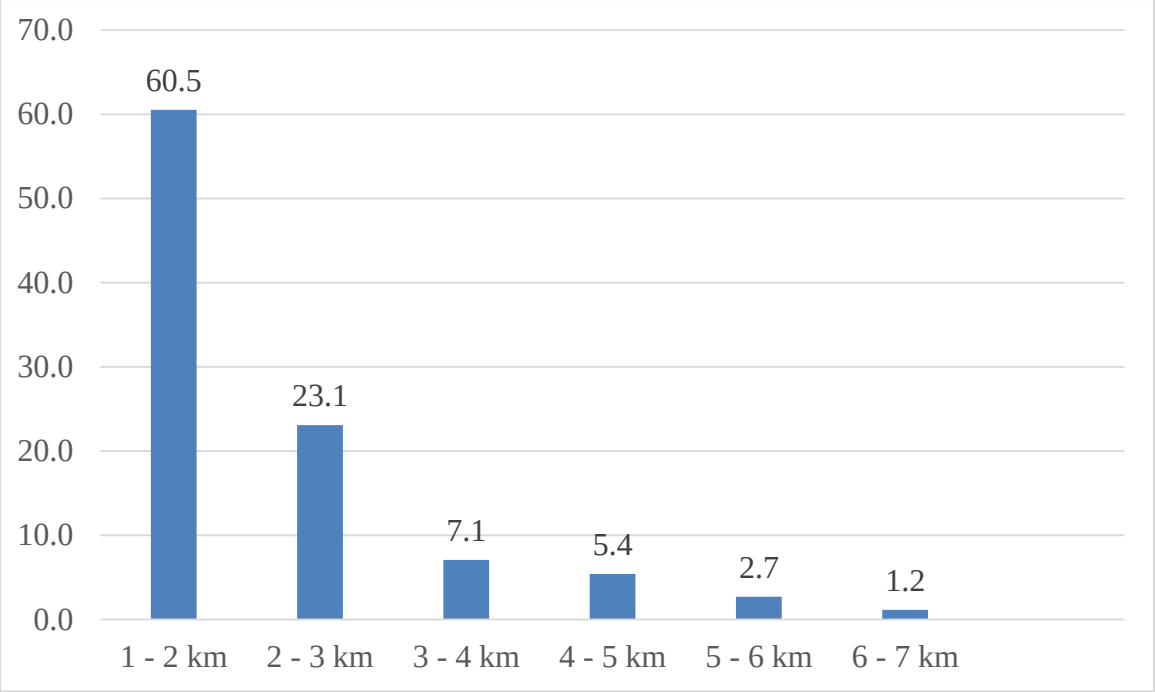

Figure3.39: Location and Distance of Retail Market (Source: Field Survey, 2015)

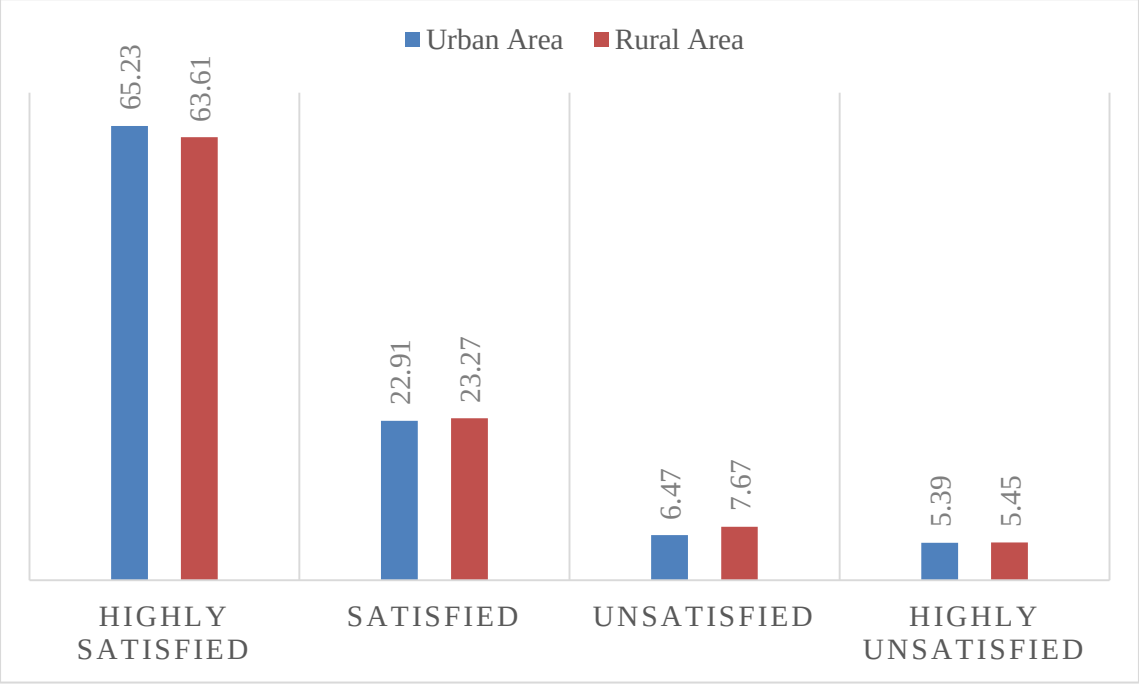

Figure 3.40: Service Quality of Retail Market(Source: Field Survey, 2015)

3.17.2 Distance and Service Quality of Post Office

Again, there are 17 post offices in Shibpur Upazila. Most of them are within 3km radius for about 90% household. More than half of total households have their post office within 2 km. Thus, the location is convenient for most of the households (please see Figure: 3.41).

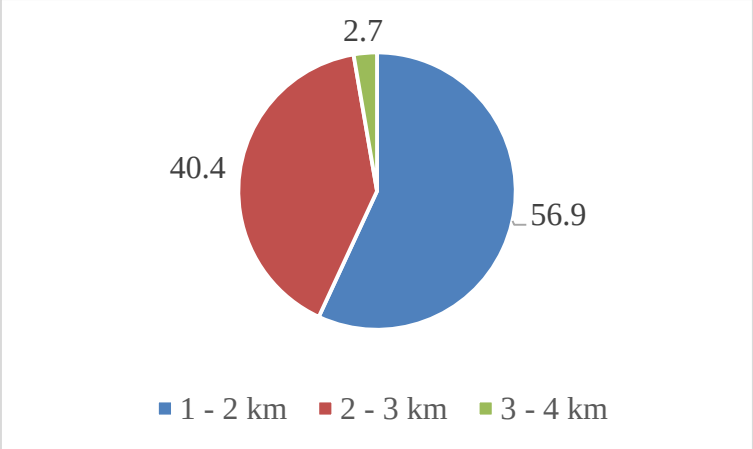

Figure3.41: Location and Distance of Post Office (Source: Field Survey, 2015)

In urban area, more than two third of total households are satisfied about the service quality of post office, but in rural areas the percentage is significantly low compared to the urban area (please see Figure: 3.42). So, the service facilities highly varied with the regions. In rural area, the percentage,those who are unsatisfied with the service of post office or even did not know about it as they did not get any service from post office, is significantly higher than in urban area. Thus, appropriate steps should be taken to improve the service facilities in rural area.

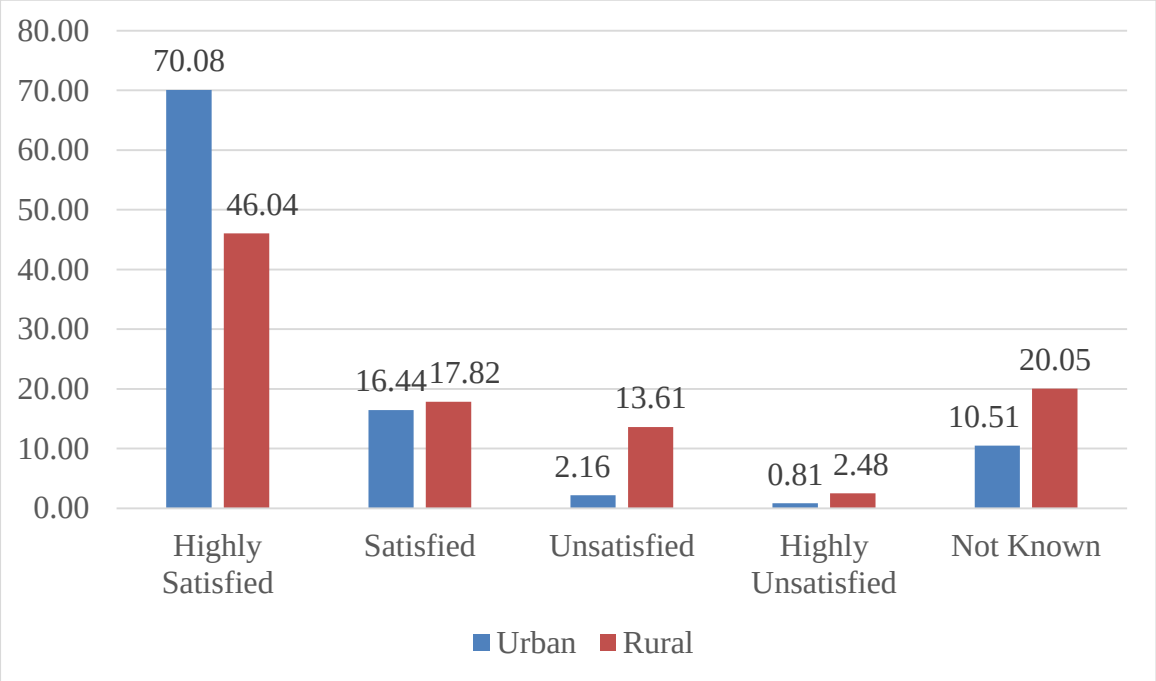

Figure 3.42: Service Quality of Post Office(Source: Field Survey, 2015)

3.17.3 Distance and Service Quality of Fire Service Station

There is a fire service station in Shibpur Upazila (BBS, 2011). It is located at Shibpur-Monohordi-Kishorgonj road at Shibpur. Distance of fire station is also convenient for almost all of the households (please see Figure: 3.43). They are located within 3km radius for about

all of the total households. Among them, for about two third of them has fire stations within 2 km radius of their households.

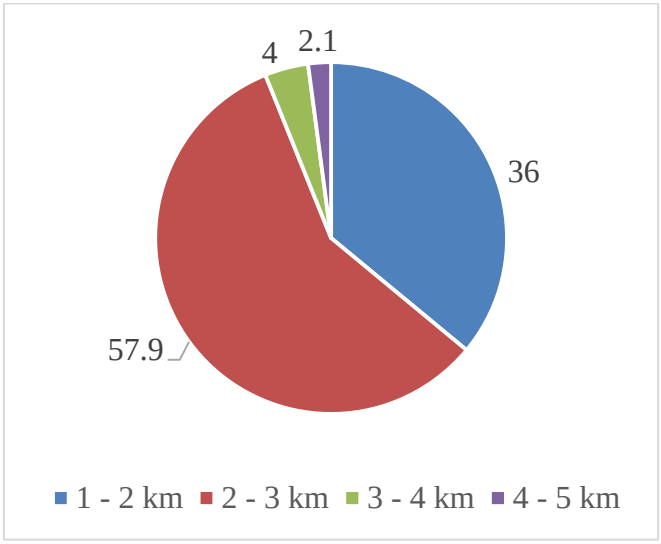

Table 3.43: Location and Distance of Fire Service(Source: Field Survey, 2015)

And in urban area, more than about two third of total households said that they are highly satisfied with the service of fire station (please see Figure: 3.44). On the other hand, in rural area the percentage is quite low as most of them said that they are not satisfied or did not even know about the service of fire station. This is because there is only one fire station and they give priority to the urban people than rural.

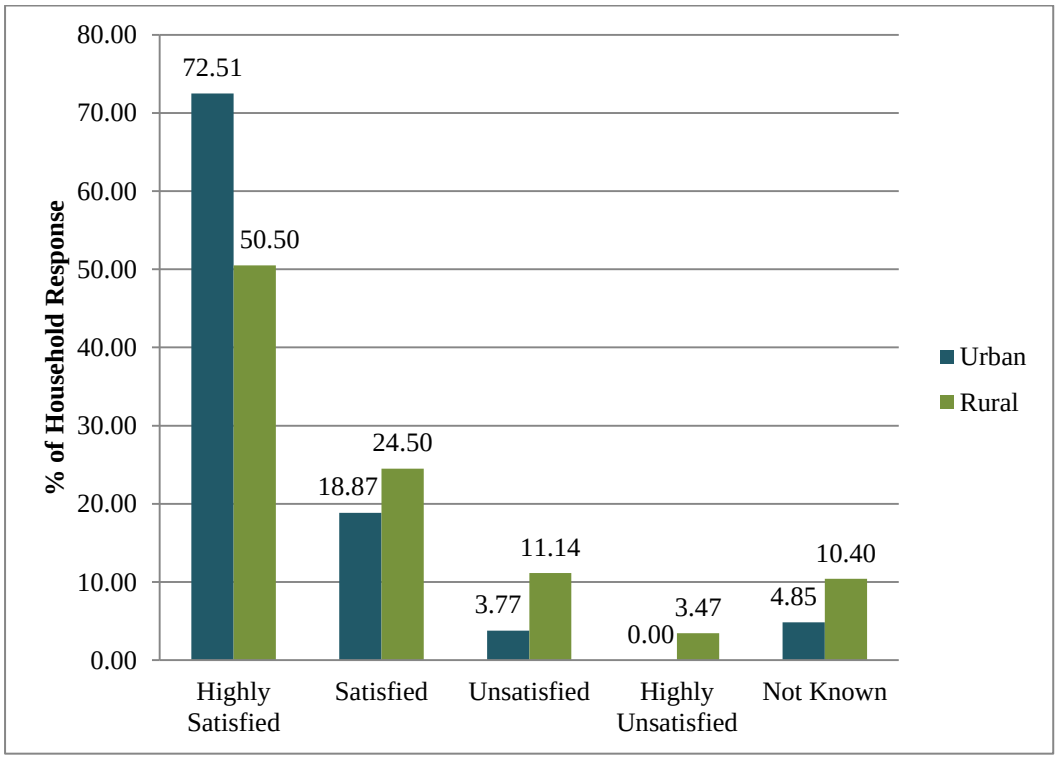

Figure 3.44: Service Quality of Fire Service(Source: Field Survey, 2015)

3.17.4 Distance and Service Quality of Playground

From table 3.5, it is found that, in Shibpur Upazila, for most of the households (about more than two third,) playground is within 2 km of their households. Thus it explains the reason why playing sports and watching playing sports are the most common recreational facilities in both urban and rural areas.

Table 3.5: Distance of Playground from Household

Distance	Number	Percent
1 - 2 km	543	70.1
2 - 3 km	232	29.9
Total	775	100.0

Source: Field Survey, 2015

And almost all of the respondents are satisfied or highly satisfied with their playground. So, it can be said that in Shibpur Upazila there are sufficient number of playgrounds for the households and they are well maintained (please see Figure: 3.45).

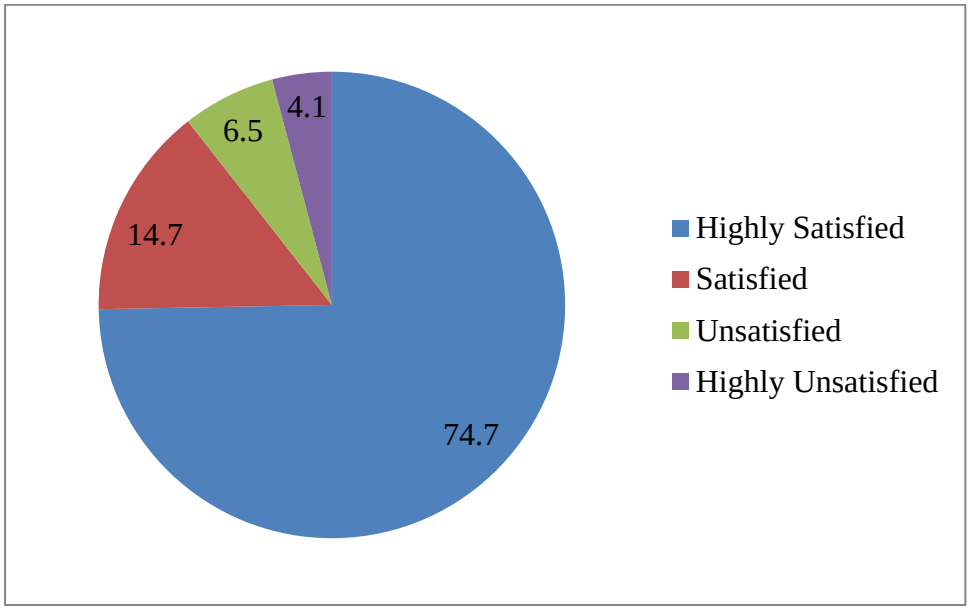

Figure 3.45: Service Quality of Play Ground (Source: Field Survey, 2015)

3.18 Problems of the Area

As discussed in the earlier section of this chapter, load shedding is the top problem in both of urban and rural area, which is generated from imbalance situation of demand and supply of electricity. The percentage of having road related problems and water logging problem is almost the same for both areas. The alarming finding is, in rural area one of the top problem is domestic violence on female which needs to be addressed. Thus the authority should give enough importance to these prioritized problems (see Figure: 3.46).

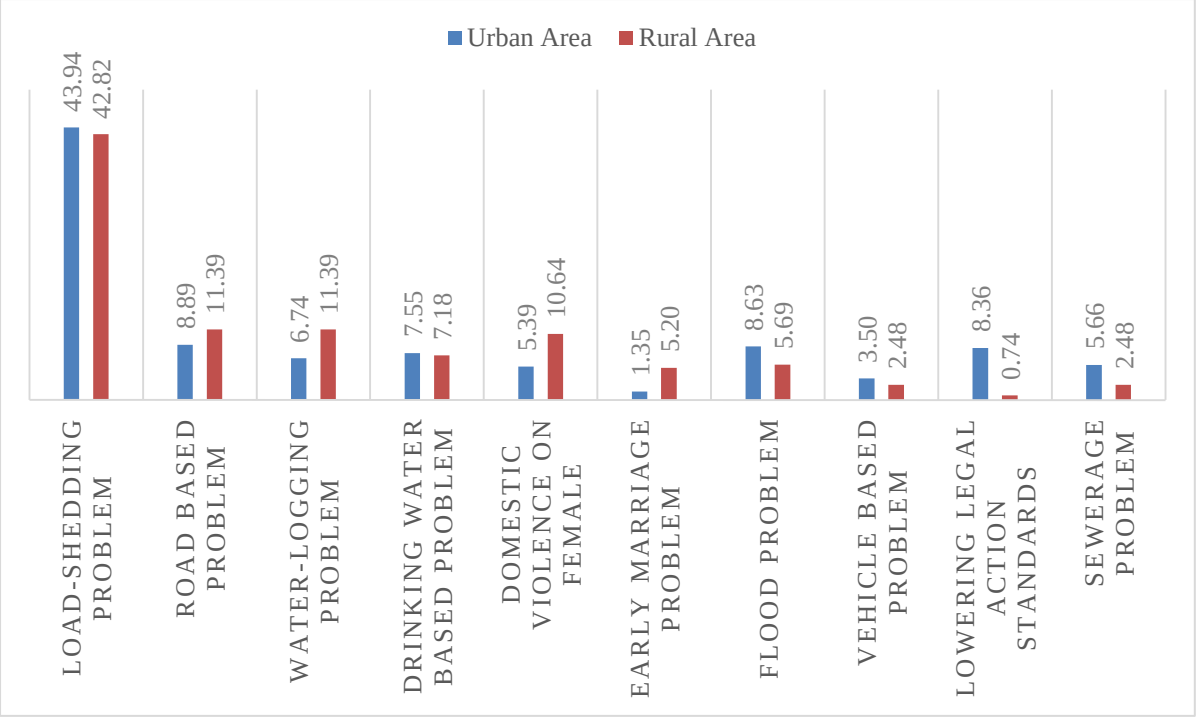

Figure3.46: Problems of the Area(Source: Field Survey, 2015)

3.19 Traditional Cultural Festival of the Area

The traditional cultural festivals data of the area collected from multiple ranks method. From Figure: 3.47, it is found that In Shibpur Upazila, about 40% of total respondents celebrate "International Mother Language Day" as their first choice of traditional culture festival. About one fourth of total respondents also described "literature and cultural competitions" as most important traditional cultural festival activities.

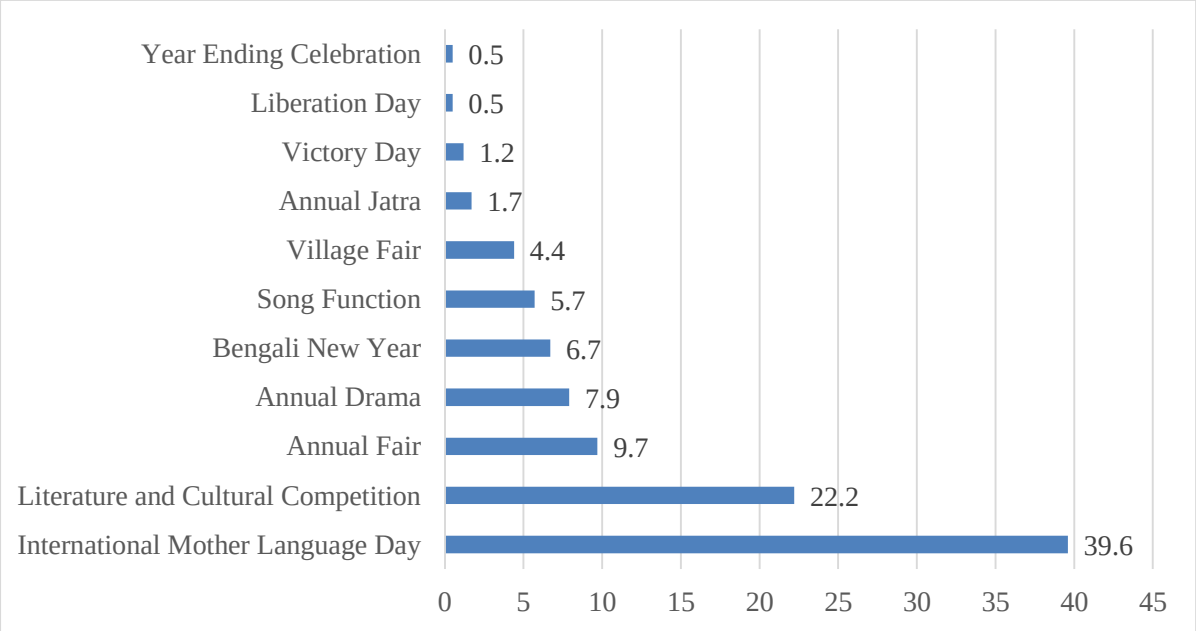

Figure3.47: Traditional Cultural Festival of the Area (Source: Field Survey, 2015)

3.20 People's Aspiration about the Development of the Upazila

The people's aspiration about the development of the area has also been collected from the respondents through multiple rank method. It plays a vital role to represent the importance of different people's aspiration about the development of the area. It has been found that about half of the total respondents wanted to improve their community service and electricity supply first of all. About more than one third of total respondent also wanted the improvement of road, drainage and increasing the number of educational institutions. On the other hand, setting up new industries is the second last ranking among them (please see Figure: 3.48).

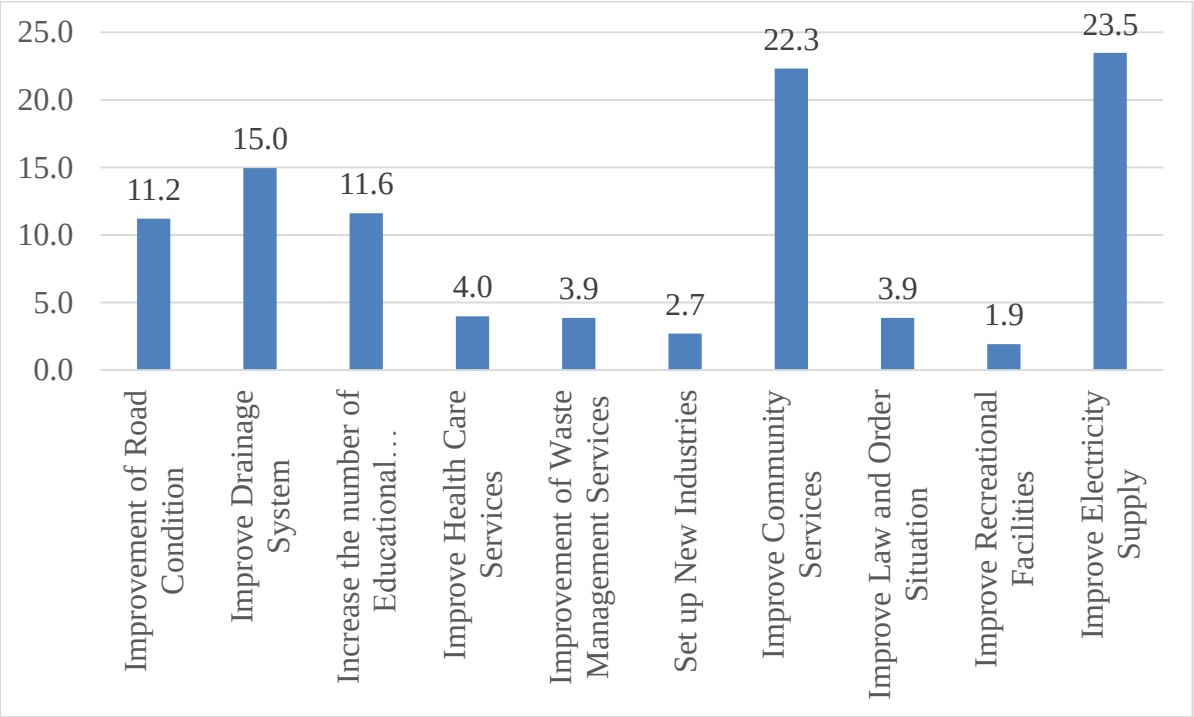

Figure3.48: Prioritization of Development Works (Source: Field Survey, 2015)

Chapter 4: Conclusion and Policy Framework

Shibpur Upazila is on the edge of entering in "Demographic Bonus" window within the coming years as the percentage of working people is high and will increase in the near future. So, there is immense need to build skilled and educated youth generation. But it has been found that the level of education of this area is not satisfactory. Moreover, there is not enough vocational and youth training centers. One of the main reasons behind it is the very high student-teacher ratio and lacking of qualified teachers. So, concerned authorities should pay attention to the issues of the Upazila. Moreover, the Upazila's main mode of communication is by road, and the condition of road is decent but because of lack of regular maintenance both rural and urban roads are deteriorating day by day. So, road authorities should take some necessary steps regarding it. In addition, electricity supply condition in this area is one of the main problems expressed by the most of the households especially in rural area, so Bangladesh Rural Electrification Board (BREB) should take some necessary steps. It should be bear in mind that development goes hand in hand with development of roads and electrification. Moreover, concerned authority should consider taking some steps regarding improvement of maternal and child health. Apart from these, this Upazila is in good condition regarding drinking water, recreational facilities, sanitation, law and order situation, retail markets etc.

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Annexure-I

গৃহায়ন ও গনপূর্ত মন্ত্রনালয়
নগর উন্নয়ন অধিদপ্তর (ইউ ডি ডি)
প্রিপারেশন অব ডেভেলপমেন্ট প্লান ফর ফোরটিন উপজেলাস -প্যাকেজ-০২ এর আওতায় শিবপুর ও রায়পুরা উপজেলা এবং ঈশ্বরগঞ্জ উপজেলার উন্নয়ন পরিকল্পনা প্রণয়ন কার্যক্রম
পরামর্শক প্রতিষ্ঠান : যৌথভাবে শেল্‌টেক কনসালটেন্ট প্রাঃ লিঃ ও আর্ক বাংলাদেশ লিঃ
আর্থ সামাজিক জরিপ প্রশ্নমালা-২০১৫

প্রশ্নমালা নংঃ ..... জরিপের তারিখঃ ..... সময়ঃ .....

সাক্ষাৎকার গ্রহণকারীর নামঃ ..... সাক্ষাৎকার গ্রহণকারীর স্বাক্ষর ঃ .....

অধ্যায়-১ঃ খানার তথ্যঃ

১.১ অবস্থানঃ

ওয়ার্ড নংঃ ..... মহল্লা/ঃ ..... রোড নংঃ ..... হোল্ডিং নংঃ .....

মৌজাঃ ..... ঃ

অধ্যায়-২ঃ তথ্যপ্রদানকারীর পারিবারিক তথ্যঃ

২.১ তথ্যপ্রদানকারীর নাম ঃ ..... ২.২ তথ্যপ্রদানকারীর মোবাইল নম্বরঃ .....

২.৩ খানা/পরিবার প্রধানের নাম ঃ

.....1.....2.....

২.৪ খানা প্রধানের পৈত্রিক বাড়ী এই এলাকায় কিনা? (ইউনিয়ন/ওয়ার্ডে)ঃ হ্যাঁ না; ২.৫ 'না' হলে কোথায়ঃ .....

২.৬ কত বছর যাবৎ খানা প্রধান এখানে বসবাস করেনঃ .....

২.৭ এখানে চলে আসার কারণ (কোড)ঃ ☐ ☐ ☐ ☐ ২.৭.১ অন্যান্য ঃ .....

কোড ২.৭ ঃ এখানে চলে আসার কারণ

১. চাকরি/কর্মস্থল	*২. বেকারত্ব*	*৩. দারিদ্র*	*৪. বৈবাহিক কারণ*	*৫. উচ্চ শিক্ষা*
৬. সামাজিক অস্থিরতা	*৭. ব্যবসা*	*৮. পারিবারিক কারণ*	*৯. পরিবেশগত কারণ*	*১০. অন্যান্য (উল্লেখ করুন)*

২.৮ বসতবাড়ির ধরণ (কোড):

কোড ২.৮ঃ বসতবাড়ির ধরণ

১.পাকা	২. আধা-পাকা	৩. কাঁচা(টিন)	৪. ঝুপড়ি	৫. অন্যান্য:

২. ৯ মালিকানার ধরন (কোড)ঃ ..... ২.৯.১ অন্যান্যঃ ..... কোড ২.৯: মালিকানার ধরন

১. একক	২. যৌথ	৩. সরকারি	৪. ভাড়া (মালিকানাহীন)

২.১০ মালিকানার উৎস (কোড)ঃ ..... ২.১০.১ অন্যান্যঃ ..... কোড ২.১০: মালিকানার উৎস

১.উত্তরাধিকার	২. দান	৩. সরকারি লিজ/বরাদ্দ	৪. ক্রয়

২.১১ বসবাসের মেয়াদকাল (কোড)ঃ ..... কোড ২.১১: বসবাসের মেয়াদকাল

১. ০-৫	২. ৬-১০	৩. ১১-১৫	৪. ১৬-২০	৫) ২০ এর অধিক

২.১২ নিজস্ব জমির পরিমান (একরে)ঃ..... ২.১২.১ বসত বাড়ীর জমির পরিমান (একরে)ঃ..... ২.১২.২ কৃষি জমির পরিমান (একরে)ঃ.....

২.১২.৩ অন্যান্য(বাগান,পুকুর) জমির পরিমান (একরে)ঃ.....

২.১৩ ভূমিহীন হলে কি ভাবে থাকে?ঃ.....

২.১৪ নিচে উল্লিখিত বছরগুলোতে বর্তমান বসবাসস্থানের জমির দাম প্রতি শতকে কেমন ছিল?

২০০৭ [২.১৪.১]	২০০৯ [২.১৪.২]	২০১১ [২.১৪.৩]	২০১৩ [২.১৪.৪]	২০১৫ [২.১৪.৫]

২.১৫ খানার সদস্যদের জনমিতিক তথ্যঃ

সদস্য নং	*খানা প্রধানের সাথে সম্পর্ক (কোড)*	*বয়স (বছর)*	*লিঙ্গ (কোড)*	*বৈবাহিক অবস্থা (কোড)*	*শিক্ষা (কোড)*	*বৃত্তি / পেশা (কোড)*
	২.১৫.*.১	২.১৫.*.২	২.১৫.*.৩	২.১৫.*.৪	২.১৫.*.৫	২.১৫.*.৬
১						
২						
৩						
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৮						
৯						
১০						

নোটঃ তথ্যপ্রদানকারীর সদস্য নম্বর ও খানা প্রধান চিহ্নিত করুন

কোড ২.১৫.*.১ ঃ খানা প্রধানের সাথে সম্পর্ক

১. *খানা প্রধান*	২. *স্ত্রী/ স্বামী*	৩. *পুত্র/কন্যা*	৪. *পিতা/মাতা*	৫. *ভাই/বোন*
৬. *ভাতিজা/ভাতিজি*	৭. *ভাগ্নে/ভাগ্নি*	৮. *নাতি/নাত্নি*	৯. *পুত্রবধূ/জামাতা*	১০. *অন্যান্য*

কোড ২.১৪.*.৩ ঃ লিঙ্গ

১. পুরুষ	২. *মহিলা*	৩. *হিজড়া*

কোড ২.১৫.*.৪ ঃ বৈবাহিক অবস্থা

১. *অবিবাহিত*	২. *বিবাহিত*	৩. *বিধবা/বিপত্নিক*	৪. *তালাক প্রাপ্ত*	৫. *পৃথক*	৬. *পরিত্যক্ত*	৭.*অন্যান্য*

কোড ২.১৫.*.৫ ঃ শিক্ষা

১. *নিরক্ষর*	২. *প্রাথমিক*	৩. *নিম্ন-মাধ্যমিক*	৪. *মাধ্যমিক/দাখিল*	৫. *এইচ.এস.সি/আলিম*
৬. *ডিগ্রি/অনার্স/ফাজিল*	৭.*মাষ্টার্স /কামিল/**	৮.*টেকনিক্যাল সার্টিফিকেট*	৯. *অন্যান্য*	

*(উল্লেখ করুনঃ প্রকৌশলী/ডাক্তার/কৃষিবিদ/এডভোকেট/নগর পরিকল্পনাবিদ, প্রভৃতি)

কোড ২.১৫.*.৬ ঃ বৃত্তি /পেশা

১. *ছাত্র*	২.*গৃহিণী*	৩.*কর্মজীবী*	৪. *অবসর প্রাপ্ত*	৫. *বেকার*	৬. *অন্যান্য*

অধ্যায়-৩ঃ পেশা ও আয়-ব্যায় সম্পর্কিত তথ্য

পেশা ও উপার্জনের তথ্য (শুধুমাত্র কোড এ বৃত্তির মান ৩ এর জন্য প্রযোজ্য)

সদস্য নং	প্রধান পেশা					সহায়ক পেশা - ১ঃ নিয়মিত					সহায়ক পেশা - ২ঃ ঋতুভিত্তিক				
	পেশা		উপার্জন		কর্মস্থলের দুরত্ব	পেশা		উপার্জন		কর্মস্থলের দুরত্ব	পেশা		উপার্জন		কর্মস্থলের দুরত্ব
	কোড	নাম	ধরন	পরিমাণ		কোড	নাম	ধরন	পরিমাণ		কোড	নাম	ধরন	পরিমাণ	
	৩.১*.১	৩.১*.২	৩.১*.৩	৩.১*.৪	৩.১*.৫	৩.১*.৬	৩.১*.৭	৩.১*.৮	৩.১*.৯	৩.১*.১০	৩.১*.১১	৩.১*.১২	৩.১*.১৩	৩.১*.১৪	৩.১*.১৫

কোড ৩.১*.১, ৩.১*.৬, ৩.১.*.১১ ঃ পেশা

১. চাকরি	*২.৫. বৃহৎ ব্যবসায়ী*	*৫.কারিগরি পেশা*	*৬. ঐতিহ্যগত পেশা*
১.১. সরকারি/স্বায়ত্বশাসিত সংস্থায়	*৩. শ্রমিক*	*৫.১. বিদ্যুৎ মিস্ত্রি*	*৬.১. কামার*
১.২. বেসরকারি অফিসের কর্মী	*৩.১. কৃষি কাজে নিয়োজিত*	*৫.২. রাজ মিস্ত্রি*	*৬.২. কুমার*
১.৩. পরিবার পর্যায়ে নিয়োজিত কর্মী	*৩.২. শিল্প কারখানায় নিয়োজিত*	*৫.৩. রড মিস্ত্রি*	*৬.৩. জেলে*
২. ব্যবসা	*৩.৩. নির্মাণ কাজে নিয়োজিত*	*৫.৪. স্যানিটারি মিস্ত্রি*	*৬.৪. তাঁতি*
২.১. ফেরিওয়ালা	*৩.৪. পরিবহন কাজে নিয়োজিত*	*৫.৫. কাঠমিস্ত্রি*	*৬.৫. ঘরামি*
২.২. ক্ষুদ্র ব্যবসায়ী	*৩.৫. সেবাখাত শ্রমিক*	*৫.৬. রং মিস্ত্রি*	*৬.৬. বাঁশের দ্রব্যাদি প্রস্তুতকারী*
২.৩. দোকান ব্যবসায়ী	*৩.৬. দিন মজুর*	*৫.৭. ফ্রিজ/এসি মিস্ত্রি*	*৬.৭. বেত মিস্ত্রি*
২.৪. মাঝারি ব্যবসায়ী	*৪. পেশাজীবী*	*৫.৮. ইলেকট্রনিক যন্ত্রপাতি*	*৬.৮. গাছি*

কোড ৩.১*.৩, ৩.১*.৮, ৩.১*.১৩ ঃ উপার্জনের ধরন

১. মাসিক বেতন	*২. দৈনিক মজুরী*	*৩. কাজ অনুযায়ী মূল্য*	*৪. নিজস্ব প্রতিষ্ঠানে কর্মরত*	*৫. বিনা বেতনে কর্মরত*	*৬. অন্যান্য*

কোড ৩.১*.৪, ৩.১*.৯, ৩.১*.১৪ ঃ উপার্জনের পরিমান

১. ৫০০০ এর কম	*২. ৫০০০-১০০০০*	*৩. ১০০০১-১৫০০০*	*৪. ১৫০০১-২০০০০*	*৫. ২০০০১-২৫০০০*	*৬. ২৫০০১-৩০০০০*	*৭. ৩০০০০ এর বেশি*

কোড ৩.১*.৫, ৩.১*.১০, ৩.১*.১৫ ঃ কর্মস্থলের দুরত্ব

১. আবাসস্থল	*২. ০.৫ কি.মি এর কম*	*৩. ০.৫ কি.মি-১ কি.মি*	*৪. ১ কি.মি-২ কি.মি*	*৫. ২ কি.মি-৫ কি.মি*	*৬. ৫ কি.মি.র অধিক*

৩.২.১১ পারিবারিক আয়ের তথ্যঃ

☐ ☐ ☐ ☐

৩.২.১ আয়ের উৎস (কোড)ঃ , , , ৩.২.১ অন্যান্য ঃ .....

কোড ৩.২.১ ঃ আয়ের উৎস

১. বেতন	২. বাড়ি /ফ্ল্যাট ভাড়া	৩. ব্যবসা	৪. মজুরী	৫. কৃষি	৬. হাঁস, মুরগী, গরু, ছাগল পালন	
৭. মৎস্য চাষ	৮. কুটির শিল্প	৯. রেমিট্যান্স (বৈদেশিক আয়)	১০. অবসর ভাতা	১১. বাগান	১২. লিজ	১৩. অন্যান্য

৩.২.২ মাসিক আয়ঃ

উৎস	৩.২.২.১	৩.২.২.২	৩.২.২.৩	৩.২.২.৪	৩.২.২.৫	৩.২.২.৬	৩.২.২.৭	৩.২.২.৮	৩.২.২.৯	৩.২.২.১০	৩.২.২.১১	৩.২.২.১২	৩.২.২.১৩	মোট
মাসিক আয়														

৩.৩ পারিবারিক ব্যয়ের তথ্যঃ

৩.৩.১ ব্যয়ের খাত (কোড)ঃ ☐ , ☐ , ☐ , ☐ , ☐ , ☐ , জ☐ ৩.৩.২ অন্যান্য ঃ .....

কোড ৩.৩.১ ঃ ব্যয়ের খাত

১. নিজস্ব বাড়ি রক্ষণাবেক্ষণ		২. বাড়ি ভাড়া (সার্ভিস চার্জসহ)		৩. ইউটিলিটি	৪. সংবাদপত্র , সাহায্যকারীর বেতন ইত্যাদি		৫. খাদ্য
৬. যাতায়াত	৭. পরিচ্ছদ	৮. শিক্ষা	৯. স্বাস্থ্য	১০. উৎসব	১১. বিনোদন	১২. কিস্তি পরিশোধ	১৩. অন্যান্য

ধর্মীয় অনুষ্ঠানঃ যেমন ঈদ, পূজা, বড় দিন. বৌদ্ধ পূর্ণিমা ইত্যাদি

৩.৩.২ মাসিক ব্যয়ঃ

খাত	৩.৩.২.১	৩.৩.২.২	৩.৩.২.৩	৩.৩.২.৪	৩.৩.২.৫	৩.৩.২.৬	৩.৩.২.৭	৩.৩.২.৮	৩.৩.২.৯	৩.৩.২.১০	৩.৩.২.১১	৩.৩.২.১২	৩.৩.২.১৩	মোট
মাসিক ব্যায়														

☐ ☐

৩.৩.৩ বিনিয়োগ করেন কিনা? হ্যা না ৩.৩.৩.১ উত্তর হ্যা হলে বিনিয়োগের পরিমান(টাকায়)ঃ

৩.৩.৪ সঞ্চয় করেন কিনা? ? ☐ হ্যা ☐ না ৩.৩.৪.১ উত্তর হ্যা হলে সঞ্চয়ের পরিমান বৎসরে(টাকায়)ঃ

অধ্যায় ৪: প্রাকৃতিক দুর্যোগ বিষয়ক প্রশ্নাবলী

☐ ☐ ☐ ☐ ☐ ☐

৪.১ প্রাকৃতিক দুর্যোগের নাম (কোড): , , , , ,

৪.১.১ অন্যান্য:.....

কোড: ৪.১: প্রাকৃতিক দুর্যোগের নাম

১.বন্যা	২. খরা	৩. অতিবৃষ্টি	৪. অনাবৃষ্টি	৫. মঙ্গা	৬. ঘূর্ণিঝড়	৭. টর্নেডো	৮.	৯. অন্যান্য

৪.১.২ প্রাকৃতিক দুর্যোগের ধরণঃ

দুর্যোগ	৪.১.২.১	৪.১.২.২	৪.১.২.৩	৪.১.২.৪	৪.১.২.৫	৪.১.২.৬	৪.১.২.৭	৪.১.২.৮	মোট
কত দিন পর পর									

হয়									

৪.২ সর্বশেষ দুর্যোগের বছর (সাল):

৪.৩ দুর্যোগে কোন ক্ষয়ক্ষতি হয়েছে কি না? ☐ **হ্যাঁ** ☐ **না**

৪.৩.১ উত্তর হ্যাঁ হলে ক্ষয়ক্ষতির পরিমাণ (টাকায়):

অধ্যায়-৫ঃ অবকাঠামোগত সুবিধাদি

৫.১ যাতায়াত সুবিধাদির তথ্যঃ

৫.১.১ বাসস্থানের নিকটতম যাতায়াত মাধ্যমঃ 1. সড়কপথ 2. জলপথ 3. রেলপথ

৫.১.১.১ উত্তর সড়কপথ হলে, রাস্তার ধরন (কোড)ঃ .....

১. বিটুমিনাস	*২. ঢালাই*	*৩. হেরিংবোন*	*৪. ব্রিকসোলিং*	*৫. কাঁচা*

৫.১.১.২ রাস্তার নামঃ .....

৫.১.১.৩ উত্তর জলপথ হলে, পথের ধরন (কোড)ঃ ..... কোড ৫.১.১.৩ ঃ জলপথের ধরন

১. বছরব্যপি নাব্য নদী/খাল	*২. ঋতুভিত্তিক নাব্য নদী/খাল*	*৩. বদ্ধজলাশয়/বিল*

৫.১.১.৪ জলপথের নামঃ .....

৫.১.২ বাসস্থান হতে নিকটতম পথে যাতায়াতের সংযোগ (কোড)ঃ ..... কোড ৫.১.২ ঃ যাতায়াতের সংযোগ

১. সরাসরি	*২. হালট*	*৩. সরু হাটাপথ*	*৪. ক্ষেতের আইল*	*৫. সাঁকো*	*৬. নৌ-পথ*

৫.১.৩ রাস্তার অবস্থা (কোড)ঃ ..... কোড ৫.১.৩ ঃ রাস্তার অবস্থা

১. ভালো	*২. সাময়িক জলমগ্ন*	*৩. ঋতুভিত্তিক জলমগ্ন*	*৪.ভাঙ্গাচোরা*	*৫. বৃষ্টি-গর্তবহুল*	*৬. ধ্বসবহুল*

৫.১.৪ মেরামতের সময়কাল (কোড)ঃ ..... কোড ৫.১.৪ ঃ মেরামতের সময়কাল

১. প্রতিবছর	*২. দুই তিন বছর পর পর*	*৩. অনিয়মিত*	*৪. চরম দূরবস্থায় পৌছালে*

অত্যাবশ্যকীয় ইউটিলিটি সার্ভিস সমূহের তথ্যঃ

৫.২ উহবৎম্ব/শক্তির উৎস/তথ্যঃ

৫.২.১ জ্বালানির উৎস (কোড)ঃ ..... ৫.২.১.১ অন্যান্যঃ ..... কোড ৫.২.১ ঃ জ্বালানির উৎস

১. সিলিন্ডার গ্যাস	২. বায়োগ্যাস	৩. কেরোসিন	৪. বৈদ্যুতিক হিটার	৫. লাকড়ি/ভূষি	৬. গোবর	৭. অন্যান্য

৫.২.২ আলোর উৎস (কোড)ঃ ..... ৫.২.২.১ অন্যান্যঃ ..... কোড ৫.২.২ ঃ আলোর উৎস

১. বিদ্যুৎ	২. কেরোসিন বাতি	৩. মোমবাতি	৪. জেনারেটর	৫. বায়োগ্যাস বাতি	৬. সৌরশক্তি	৭. অন্যান্য

৫.২.৩ উত্তর বিদ্যুৎ হলে, বিদ্যুৎ প্রাপ্যতা (কোড)ঃ ..... ৫.২.৩.১ অন্যান্য ..... কোড ৫.২.৩ ঃ বিদ্যুৎ প্রাপ্যতা

১. নিরবচ্ছিন্ন	২. রুটিন লোডশেডিং	৩. অনিয়মিত	৪. চরম অপ্রাপ্যতা

৫.৩ খাবার পানির তথ্যঃ

৫.৩.১ খাবার পানির উৎস (কোড)ঃ ..... ৫.৩.১.১ অন্যান্য ..... কোড ৫.৩.১ ঃ খাবার পানির উৎস

১. পাইপ লাইন সরবরাহ	২. নিজস্ব চাপকল	৩. গণ চাপকল	৪. গণ কল ব্যবস্থা	৫. কুয়া	৬. খোলা জলাশয়

৫.৩.২ খাবার পানির মান (কোড)ঃ ..... কোড ৫.৩.২ ঃ খাবার পানির মান

১. অত্যন্ত সন্তোষজনক	২. সন্তোষজনক	৩.গ্রহণযোগ্য	৪. অসন্তোষজনক

৫.৩.৩ উত্তর অসন্তোষজনক হলে (কোড)ঃ ..... কোড ৫.৩.৩ ঃ অসন্তোষের কারণ

১. আর্সেনিক	২. আয়রন/লৌহ	৩ দুর্গন্ধ	৪. জীবাণু/ প্রাণী	৫. জৈব যৌগ	৬. রাসায়নিক দ্রব্য	৭.অদ্রবনীয় দ্রব্য

৫.৩.৪ পানির উৎসের দূরত্ব (কোড)ঃ ..... কোড ৫.৩.৪ ঃ পানির উৎসের দূরত্ব

১. ০-০.২৫ কি.মি	২. ০.২৫-০.৫ কি.মি	৩. ০.৫ কি.মি এর অধিক

৫.৪ পয়নিষ্কাশন তথ্যঃ

৫.৪.১ পয়নিষ্কাশন ব্যবস্থা (কোড)ঃ ..... কোড ৫.৪.১ ঃ পয়নিষ্কাশন ব্যবস্থা

১. জলাবদ্ধ পায়খানা	২. পিট ল্যাট্রিন	৩. খোলা জায়গা

৫.৪.২ পয়বর্জ্য শোধনঃ [1.] শোধিত [2.] অশোধিত

৫.৪.৩ উত্তর শোধিত হলে, শোধন ব্যবস্থার ধরন (কোড)ঃ ..... অন্যান্যঃ ..... কোড ৫.৪.৩ ঃ শোধন ব্যবস্থার ধরন

১. শোষণ কূপ	২. সেপটিক ট্যাংক	৩. সেপটিক ট্যাংক ও শোষণ কূপ	৪. স্যুয়ারেজ নেটওয়ার্ক	৫. অন্যান্য

৫.৪.৪ উত্তর অশোধিত হলে,

ধরন (কোড)ঃ [1.] অন্যান্যঃ [2.] কোড ৫.৪.৪ ঃ ধরন

১.চাক কুয়া	২. কাঁচা কুয়া	৩. উন্মুক্তস্থল	৪. উন্মুক্ত জলাশয়	৫. অন্যান্য

৫.৫ আবর্জনা ব্যবস্থাপনা তথ্যঃ

৫.৫.১ আবর্জনা অপসারণ ব্যবস্থাঃ বাড়ি থেকে সংগ্রহ নিজস্ব ব্যবস্থাপনা

৫.৫.২ নিজস্ব ব্যবস্থাপনা হলে, ময়লা ফেলার স্থান (কোড)ঃ ..... ৫.৫.৩ অন্যান্যঃ ..... কোড ৫.৫.২ ঃ ময়লা ফেলার স্থান

১. নির্দিষ্ট ডাষ্টবিন	*২. বাড়ির সীমানায় মাটির গর্ত*	*৩. বাড়ির আশে পাশের নীচু জমি*	*৪. খাল/নদী/ডোবা*	*৫. রাস্তার ধার*	*৬. অন্যান্য*

৫.৫.৪ বাড়ি থেকে সংগৃহীত হলে, আবর্জনা সংগ্রহের সময়সূচী (কোড)ঃ ..... ৬.৫.৫ অন্যান্যঃ ..... কোড ৫.৫.৪ ঃ সংগ্রহের সময়

১. প্রতি দিন	*২. প্রতি ২ দিন পর পর*	*৩. অনিয়মিত*	*৪. অন্যান্য*

৫.৫.৬ আবর্জনা ফেলার স্থানের দূরত্ব (কোড) ঃ ..... কোড ৫.৫.৬ ঃ আবর্জনা ফেলার স্থানের দূরত্ব

১. নিজ বাড়ির সীমানায়	*২. ০-৫০ মিঃ*	*৩. ৫১-১০০ মিঃ*	*৫. ১০০ মিঃ এর উপরে*

অধ্যায়-৬ঃ সামাজিক সুবিধাদি

স্বাস্থ্য বিষয়ক তথ্যঃ

৬.১ গত ৬ মাসে আপনার পরিবারের কেউ অসুস্থ হয়েছিল কি? 1. হ্যাঁ 2. না 3. অবগত নন

৬.২ 'হ্যাঁ' হলে,

সদস্য (ওউ)	অসুস্থতা (কোড)	চিকিৎসা নিয়েছিলেন কি? হ্যাঁ = ১; না = ২	হ্যাঁ হলে কোথায় গিয়েছিলেন (কোড)	না হলে কেন যাননি (কোড)
৬.২.*.১	৬.২.*.২	৬.২.*.৩	৬.২.*.৪	৬.২.*.৫

কোড ৬.২.*.২ ঃ অসুস্থতা

১. জ্বর	*২. সর্দি/কাশি*	*৩. ডাইরিয়া/আমাশয়*	*৪. জন্ডিস*	*৫. টাইফয়েড*	*৬. নিউমোনিয়া*	
৭. হাম	*৮. পোলিও*	*৯. ম্যালেরিয়া*	*১০. জল বসন্ত*	*১১. ডেঙ্গু জ্বর*	*১২. হৃদরোগ*	

১৩. ধনুস্টংকার	*১৪. কৃমিরোগ*	*১৫. বাত জ্বর*	*১৬. হাপানী/শ্বাস কষ্ট*	*১৭. যৌন রোগ*	*১৮. গলগন্ড*
১৯. হাড় ক্ষয় রোগ	*২০. ডায়াবেটিস*	*২১. চর্মরোগ/ চুলকানি/পাঁচড়া*	*২২. স্ত্রীরোগ*	*২৩. জলাতঙ্ক*	*২৪. অন্যান্য*

কোড ৬.২.*.৪ ঃ চিকিৎসার জন্য কোথায় যান

১. ডিগ্রিধারী ডাক্তার	*২. প্রাইভেট ক্লিনিক*	*৩. সরকারি হাসপাতাল*	*৪. কমিউনিটি ক্লিনিক*	*৫. উপজেলা স্বাস্থ্য কেন্দ্র*
৬. গ্রাম্য চিকিৎসক	*৭. হোমিও ডাক্তার*	*৮. হেকিম/কবিরাজ*	*৯. দাতব্য চিকিৎসালয়*	*১০. ওঝা/ ফকির*
১১. রাস্তার দেশীয় ঔষধ বিক্রেতা	*১২. অন্যান্য (উল্লেখ করুন)ঃ*			

কোড ৬.২.*.৫ ঃ চিকিৎসা কেন্দ্রে না যাওয়ার কারণ

১. অর্থনৈতিক অসামর্থ	*২. প্রয়োজনবোধ করেননি*	*৩. ঔষধালয় থেকে ঔষধ কিনে খেয়েছেন*	*৪. চিকিৎসা কেন্দ্রের দূরত্ব বেশি*	*৫. অন্যান্য*

৬.৩ চিকিৎসালয়ের তথ্য (বিস্তারিত হাসপাতাল থেকে)

ধরন (কোড)	অবস্থান	দূরত্ব	সেবাসমূহ (কোড)	সেবার মান (কোড)	স্থান সংকুলান (কোড)
৬.৩.*.১	৬.৩.*.২	৬.৩.*.৩	৬.৩.*.৪	৬.৩.*.৫	৬.৩.*.৬

কোড ৬.৩.*.১ ঃ চিকিৎসালয়ের ধরন

১. সরকারি হাসপাতাল	*২. প্রাইভেট ক্লিনিক*	*৩. ডাক্তারের চেম্বার*	*৪. দাতব্য চিকিৎসালয়*	*৫. কমিউনিটি ক্লিনিক*	*৬. কবিরাজ ঘর*	*৭. অন্যান্য*

কোড ৬.৩.*.৪ ঃ চিকিৎসালয়ের সেবাসমূহ

১. সাধারণ চিকিৎসা	*২. বিশেষজ্ঞ চিকিৎসা (উ.ক)*	*৩. প্রসূতি ও নবজাতক*	*৪. মাতৃ স্বাস্থ্য*	*৫. শিশু স্বাস্থ্য*	*৬. অন্যান্য*

কোড ৬.৩.*.৫ ঃ সেবার মান

১. অত্যন্ত সন্তোষজনক	২. সন্তোষজনক	৩.গ্রহণযোগ্য	৪. অসন্তোষজনক	৫. হতাশাজনক

কোড ৬.৩.*.৬ ঃ স্থান সংকুলান

১. পর্যাপ্ত	২. কার্যোপযোগী	৩. অপ্রতুল	৪. অত্যন্ত অপ্রতুল

☐ ☐ ☐ ☐ ☐ ☐

৬.৪ চিকিৎসা প্রাপ্তির সমস্যাসমূহ (কোড)ঃ , , , , ,

কোড ৬.৪ ঃ চিকিৎসা প্রাপ্তির

১.কমিউনিটি ক্লিনিক এর অভাব	*২. ফ্রি চিকিৎসা কেন্দ্র নাই*	*৩.প্রয়োজনীয় ঔষধ পত্রের অভাব*	*৪. সরকারি ঔষধ পাওয়া যায় না*	*৫. ডাক্তার অপ্রতুল*
৬. বিশেষজ্ঞ ডাক্তারের অভাব	*৭. রোগ নির্ণয়ের সুবিধা নাই*	*৮. অপারেশন কক্ষ নাই*	*৯. হাসপাতাল দূরে*	*১০. চিকিৎসা বিষয়ক অজ্ঞানতা*
১১. অন্যান্য (উল্লেখ করুন)ঃ				

৬.৫ চিকিৎসালয়ের অবকাঠামোর ধরন (কোড) ঃ

কোড ৬.৫ ঃ অবকাঠামোর ধরন

১. পাকা	*২. সেমি-পাকা*	*৩. টিনের ছাদ/ টিনের বেড়া*	*৪. টিনের চাল বাঁশ/খড়ি/মাটির বেড়া*	*৪. ছন/বেড়ার চাল খড়ি/বাঁশ/ছনের বেড়া*

৬.৬ চিকিৎসালয়ের অবকাঠামোর অবস্থা (কোড) ঃ

কোড ৬.৬ ঃ অবকাঠামোর অবস্থা

১. চমৎকার	*২. ভালো*	*৩. পুরাতন*	*৪. ধবংসম্মুখ*

শিক্ষা বিষয়ক তথ্যঃ

৬.৭ পরিবারের সদস্যদের শিক্ষা ব্যবস্থাঃ

সদস্য (ওউ)	**শ্রেণী**	**শিক্ষা প্রতিষ্ঠান**		**বাসস্থান থেকে দূরত্ব**	**যাওয়ার মাধ্যম (কোড)**
		সরকারি (কোড)	**বেসরকারি (কোড)**		
	৬.৭.*.১	৬.৭.*.২	৬.৭.*.৩	৬.৭.*.৪	৬.৭.*.৫

কোড ৬.৭.*.২, ৬.৭.*.৩ ঃ শিক্ষা প্রতিষ্ঠান

১. কিন্ডার গার্টেন	*২. প্রাইমারি স্কুল*	*৩. হাই স্কুল/দাখিল মাদ্রাসা*	*৪. কলেজ/আলিম*	*৫. বিশ্ববিদ্যালয় কলেজ*
৬. ডিগ্রি/ফাজিল মাদ্রাসা	*৭. বিশ্ববিদ্যালয়/*	*৮.কারিগরি শিক্ষা প্রতিষ্ঠান*		*৯. প্রশিক্ষণ কেন্দ্র*

কোড ৬.৭.*.৫ ঃ যাওয়ার মাধ্যম

১. পায়ে হাটা	*২. সাইকেল*	*৩. রিক্সা*	*৪. ভ্যান*	*৫. ভটভটি*
৬. ইজিবাইক	*৭. অটো রিক্সা*	*৮. টেম্পু/হিউম্যান হলার*	*৯. বাস*	*১০. অন্যান্য*

☐ ☐ ☐ ☐ ☐ ☐ ☐

৬.৮ শিক্ষা প্রতিষ্ঠানের সমস্যা (কোড)ঃ , , , , , ,

কোড ৬.৮ ঃ শিক্ষা প্রতিষ্ঠানের সমস্যা

১. দক্ষ শিক্ষকের অভাব	*২. উচ্চ ছাত্র শিক্ষক অনুপাত*	*৩. শিক্ষা উপকরণের অভাব*	*৪. বিজ্ঞানাগার নেই*
৫. লাইব্রেরি নাই	*৬. খেলার মাঠ নেই*	*৭. অপর্যাপ্ত অবকাঠামো*	*৮. জরাজীর্ণ- অবকাঠামো*

৯. আসবাবপত্রের অভাব	*১০. অদক্ষ পরিচালনা*	*১১. অন্যান্য (উল্লেখ করুন)ঃ* .....

৬.৯ প্রাথমিক বিদ্যালয় গমনের উপযোগী বয়সের ছেলেমেয়ের বিদ্যালয় না যাওয়ার কারণ (কোড)ঃ ☐ , ☐ , ☐

কোড ৬.৯ ঃ বিদ্যালয় না যাওয়ার কারণ

১. আর্থিক অসচ্ছলতা	*২. পরিবারের জন্যে রোজগার*	*৩. শিক্ষায় পরিবারের অনীহা*	*৪. অন্যান্যঃ* .....

৬.১০ প্রাথমিক/মাধ্যমিক ছাত্র-ছাত্রীদের ঝরে পড়ার কারণ (কোড) ☐ , ☐ , ☐

কোড ৬.১০ ঃ ঝরে পড়ার কারণ

১. আর্থিক অসচ্ছলতা	*২. পরিবারের জন্যে রোজগার*	*৩. পড়তে অনীহা*	*৪. বাল্য বিবাহ*	*৫. অন্যান্যঃ* .....

অধ্যায়-৭ঃ সেবা ও এলাকার সমস্যাসমূহ

৭.১ বিনোদনের তথ্যঃ

৭.১.১ ঘরোয়া বিনোদনের উপকরণ কী (কোড)ঃ ☐ , ☐ , ☐ , ☐ , ☐ ৭.১.১.১অন্যান্য (উল্লেখ করুন)ঃ .....

কোড ৭.১.১ ঃ ঘরোয়া বিনোদনের উপকরণ

১. রেডিও	*২.ক্যাসেট/ সিডি প্লেয়ার*	*৩. টেলিভিশন*	*৪. ঘরোয়া খেলার উপকরণ*	*৫. বই*	*৬. অন্যান্য*

৭.১.২ ঘরোয়া বিনোদনের জন্য কি করেন (কোড)ঃ ☐ , ☐ , ☐ , ☐ , ☐ ৭.১.২.১ অন্যান্য (উল্লেখ করুন)ঃ .....

কোড ৭.১.২ ঃ ঘরোয়া বিনোদন

১. টেলিভিশন/রেডিও এর অনুষ্ঠান উপভোগ করেন	*২. ঘরোয়া খেলা*	*৩. বই পড়া*	*৪. গান শোনা*	*৫. অন্যান্য*

৭.১.৩ বহির্বিনোদনের জন্য কি করেন (কোড)ঃ ☐ , ☐ , ☐ , ☐ , ☐ , ☐ ৭.১.৩.১ অন্যান্য (উল্লেখ করুন)ঃ .....

কোড ৭.১.৩ ঃ বহির্বিনোদন

১. খেলাধুলা	*২. খেলা উপভোগ*	*৩. খোলা জায়গায় ভ্রমণ*	*৪. ক্লাব*	*৫. পার্ক*	*৬. চিড়িয়াখানা*
৭. যাদুঘর	*৮. পর্যটন স্থান*	*৯. মাছ ধরা*	*১০. বনভোজন*	*১১. সিনেমা*	*১২. অন্যান্য*

৭.১.৪ বর্হিবিনোদনের সমস্যাসমূহ (কোড)ঃ ☐ , ☐ , ☐ , ☐ , ☐ , ☐ ৭.১.৪.১ অন্যান্য (উল্লেখ করুন)ঃ .....

কোড ৭.১.৪ ঃ বর্হিবিনোদনের সমস্যাসমূহ

১.অপ্রতুল চিত্ত বিনোদন ব্যবস্থা	*২. রক্ষণাবেক্ষণ সমস্যা*	*৩. বিনোদন সরঞ্জামের অভাব*	*৪. কাঙ্খিত বিনোদন পরিবেশের অভাব*
৫.নিরাপত্তার অভাব	*৬.অর্থনৈতিক অসামর্থ*	*৭. অন্যান্য*	

৭.১.৫ খেলার মাঠ ও পার্ক এলাকায় কোন সমস্যা আছে কী? 1. হ্যাঁ 2. না

৭.১.৬ সমস্যা থাকলে সেগুলো কি কি ?

কোডঃ ৭.১.৬ ঃ খেলার মাঠের সমস্যা

১. মাঠের পরিবেশ ভাল না	*২. ময়লা আবর্জনা মাঠে জমা থাকে*	*৩. মাঠের আংশিক পুকুরে পরিণত হয়েছে*
৪. মাস্তানদের দখলে	*৫. চাঁদাবাজদের উপদ্রব*	*৬. মাঠ/পার্ক রক্ষণাবেক্ষণ করা হয় না*
৭. প্রভাবশালীরা গরু চড়ায়	*৮. আংশিক বেদখল হয়ে গেছে*	*৯. অন্যান্য*

৭.২ প্রয়োজনীয় সেবাসমূহের তথ্যঃ

অন্যান্য প্রয়োজনীয় সেবাসমূহের দূরত্ব (বাড়ি থেকে) ও মান ঃ

ক্রম নং	সেবা সমূহ	দূরত্ব (কি.মি)	সেবার মান (কোড)
		৭.২.*.১	৭.২.*.২
৭.২.১	কাঁচা বাজার		
৭.২.২	বিপণি কেন্দ্র		
৭.২.৩	উপাসনালয় (মসজিদ/ মন্দির/গীর্জা)		
৭.২.৪	পাঠাগার		
৭.২.৫	কমিউনিটি সেন্টার		
৭.২.৬	স্বাস্থসেবা কেন্দ্র		
৭.২.৭	পোস্ট অফিস		
৭.২.৮	ফায়ার সার্ভিস		
৭.২.৯	পুলিশ ফাঁড়ি/পুলিশ বক্স		
৭.২.১০	বাস/ টেম্পো স্ট্যান্ড		
৭.২.১১	পাবলিক টয়লেট		
৭.২.১২	ঈদগাহ		
৭.২.১৩	কবরস্থান/ শ্মশান		
৭.২.১৪	মোবাইল/ফোন/ফ্যাক্স/ই-মেইলের দোকান		
৭.২.১৫	মিলনায়তন		
৭.২.১৬	সিনেমা হল		
৭.২.১৭	ব্যায়ামাগার		
৭.২.১৮	যুব সংগঠন /		
৭.২.১৯	মহিলাদের ক্লাব		
৭.২.২০	যাদুঘর		

৭.২.২১	খেলার মাঠ		
৭.২.২২	অন্যান্য (উল্লেখ করুন)		

কোড ৭.২.*.২ ঃ সেবার মান

১. সন্তোষজনক	২. মোটামুটি	৩. সন্তোষজনক নয়	৪. হতাশাজনক	৫. জানা নাই

৭.৩ বিদ্যমান আইন-শৃঙ্খলা ও অপ-প্রথার তথ্য ঃ

৭.৩.১ প্রবনতা ক্রমান্বয়ে এলাকার আইন-শৃঙ্খলার হুমকিসমূহ (কোড)ঃ ☐, ☐, ☐, ☐, ☐, ☐ অন্যান্য (উল্লেখ করুন)ঃ .....

কোড ৭.৩.১ ঃ আইন-শৃঙ্খলার হুমকিসমূহ

১. ছিচকে চুরি	*২. সিধেল চুরি*	*৩. ডাকাতি*	*৪. ছিনতাই*	*৫. চাঁদাবাজি*	*৬. জমি/সম্পদ দখল*	*৭. দাঙ্গা*	*৮. খুন*
৯. গুম	*১০. ধর্ষণ*	*১১. অপহরণ*	*১২. মুক্তিপণ দাবী*	*১৩. এসিড সন্ত্রাস*	*১৪. আত্মহত্যা*	*১৫. অন্যান্য*	

৭.৩.২ এলাকায় প্রচলিত অপ-প্রথাসমূহ (কোড)ঃ ☐, ☐, ☐, ☐, ☐, ☐ অন্যান্য (উল্লেখ করুন)ঃ .....

কোড ৭.৩.২ ঃ অপ-প্রথাসমূহ

১. বাল্য বিবাহ	*২.পুত্রের আশায় পুনঃ বিবাহ*	*৩. যৌতুক*	*৪. নারী নির্যাতন*	*৫. ঝাড়ফুঁক/ তাবিজ দিয়ে চিকিৎসা*
৬. পুরুষ ডাক্তার দিয়ে মেয়েদের চিকিৎসা না করানো		*৭. মেয়েদের চাকরিতে বাঁধা দেয়া*		*৮. অন্যান্য*

৭.৩.৩ আইন-শৃঙ্খলা রক্ষাকারী বাহিনীর ভূমিকা (কোড) ঃ ..... কোড ৭.৩.৩ ঃ আইন-শৃঙ্খলা রক্ষাকারী বাহিনীর ভূমিকা

১. অত্যন্ত সন্তোষজনক	২. সন্তোষজনক	৩.গ্রহণযোগ্য	৪. অসন্তোষজনক	৫. হতাশাজনক	৬. জানা নাই

৭.৩.৪ এলাকার সমস্যাসমূহ গুরুত্বের ক্রম অনুসারে সাজান

সমস্যা	ক্রম	সমস্যা	ক্রম	সমস্যা	ক্রম
লোডশেডিং		যানবাহন সম্পর্কিত		বর্জ্য নিষ্কাশনের জায়গার অভাব	
রাস্তাঘাট সম্পর্কিত		আইন শৃঙ্খলার অবনতি		বিদ্যুৎ সমস্যা (লো-ভোল্টেজ, বিদ্যুৎ নাই)	
জলাবদ্ধতা		পয়ঃনিষ্কাশন		ভাল শিক্ষা প্রতিষ্ঠানের অভাব	
খাবার পানি সংক্রান্ত		বাজার অনেক দূরে		কর্ম-সংস্থান সমস্যা	
নারী নির্যাতন		দুঃস্থ মাতৃপ্রধান পরিবারের আধিক্য		ধর্মীয় গোঁড়ামী	
বাল্য বিবাহ		বহু বিবাহ			
				অন্যান্য (উল্লেখ করুন)	

অধ্যায়-৮ঃ বিভিন্ন গুরুত্বপূর্ণ সরকারি প্রতিষ্ঠানের সেবার মান

৮.১ ইউনিয়ন পরিষদ/পৌরসভার সেবাসমূহের মান

ক্রম নং	সেবা সমূহ	সেবার মান (কোড)	ক্রম নং	সেবা সমূহ	সেবার মান (কোড)
৮.১.১	পানি সরবারহ		৮.১.১১	পার্ক, খেলার মাঠ, কমিউনিটি স্থাপনা রক্ষাণাবেক্ষণ	
৮.১.২	স্যানিটেশন		৮.১.১২	হোল্ডিং নাম্বার/ নাম	
৮.১.৩	কঠিন আবর্জনা অপসারন		৮.১.১২	ভূমির সীমানা নির্ধারণ	
৮.১.৪	সড়ক বাতি		৮.১.১৪	গালিস	
৮.১.৫	ড্রেন ও রাস্তা পরিস্কার		৮.১.১৫	পারিবারিক আদালত	
৮.১.৬	ইমারতের নক্সা অনুমোদন		৮.১.১৬	পশু জবাইয়ের স্থান পরিদর্শন ও মাংশের গুণগতমান নিশ্চিতকরণ	
৮.১.৭	নাগরিকত্ব সনদ প্রদান		৮.১.১৭	মশক নিধন	
৮.১.৮	জন্ম সনদ প্রদান		৮.১.১৮	কুকুর নিধন	
৮.১.৯	মৃত্যু সনদ প্রদান		৮.১.১৯	ইপিআই (টিকা) কার্যক্রম	
৮.১.১০	উত্তরাধিকার সনদ প্রদান		৮.১.২০	গণসচেতনা বৃদ্ধিমূলক কর্মকান্ড	

কোড ৮.১ ঃ সেবার মান

১. অত্যন্ত সন্তোষজনক	২. সন্তোষজনক	*৩.গ্রহণযোগ্য*	*৪.* অসন্তোষজনক	*৫. হতাশাজনক*	*৬. জানা নাই*

অধ্যায়-৯ঃ ধর্মীয় ও সাংস্কৃতিক কর্মকান্ড

৯.১ ধর্মীয় সাংস্কৃতিক কর্মকান্ডের তথ্য ঃ

৯.১.১ এলাকার সাংস্কৃতিক অনুষ্ঠানগুলি কী ? (কোড)ঃ ☐, ☐, ☐, ☐, ☐, ☐ ৯.১.১.১অন্যান্য (উল্লেখ করুন) ঃ .....

কোড ৯.১.১ ঃ এলাকার সাংস্কৃতিক অনুষ্ঠান

১. সাহিত্য ও সাংস্কৃতিক প্রতিযোগিতা	*২. বাৎসরিক নাটক*	*৩.গানের অনুষ্ঠান*	*৪. বাৎসরিক যাত্রা/পালাগান*	*৫. বাৎসরিক মেলা*
৬. আন্তর্জাতিক মাতৃভাষা দিবস	*৭. স্বাধীনতা দিবস*	*৮. বিজয় দিবস*	*৯. অন্যান্য*	

৯.২ এলাকার ঐতিহ্যবাহী উৎসবগুলি কী ? (কোড)ঃ ☐, ☐, ☐, ☐, ☐, ☐ ৯.২.১ অন্যান্য (উল্লেখ করুন)ঃ .....

কোড ৯.২ ঃ এলাকার ঐতিহ্যবাহী উৎসব

১. বাংলা নববর্ষ	*২. চৈত্র সংক্রান্তি*	*৩.নবান্ন*	*৪.* বসন্ত বরণ	*৫. বর্ষা বরণ*	*৬. গ্রাম্য মেলা*	*৭. স্বাধীনতা দিবস*
৮. একুশে ফেব্রুয়ারী	*৯.পহেলা বৈশাখ*	*১০. অন্যান্য*				

অধ্যায়-১০ঃ খানা সদস্যদের প্রতিদিনের ভ্রমণ সংক্রান্ত তথ্য

১০. ১ পরিবারের সদস্যদের ভ্রমণ সংক্রান্ত তথ্যঃ

সদস্য নং (ওউ)	ভ্রমণ নং	ভ্রমণের উৎস (স্থান)	ভ্রমণের গন্তব্য (স্থান)	ভ্রমণের দূরত্ব	উদ্দিষ্ট স্থান (কোড)	ভ্রমণের সময়		বাহন (কোড)	সমস্যা (কোড)
						শুরু	শেষ		
	১০.১.*.১	১০.১.*.২	১০.১.*.৩	১০.১.*.৪	১০.১.*.৫	১০.১.*.৬	১০.১.*.৭	১০.১.*.৮	১০.১.*.৯

কোড ১০.১..৫ ঃ উদ্দিষ্ট স্থান*

১. কর্মস্থল	*২. শিক্ষা প্রতিষ্ঠান*	*৩. কাঁচা বাজার*	*৪. দোকান/বিপণি বিতান*
৫. আনন্দ ভ্রমণ/বিনোদন/খেলাধুলা	*৬. আত্মীয় গৃহ*	*৭. অন্যান্য ঃ .....*	

কোড ১০.১..৮ ঃ বাহন*

১. বাহনহীন (পায়ে হাটা)	*২. সাইকেল*	*৩. রিক্সা*	*৪. ভ্যান*	*৫. ভটভটি*	*৬. ইজিবাইক*	*৭. অটো রিক্সা*
৮. টেম্পু/হিউম্যান হলার	*৯. বাস*	*১০. অন্যান্য*				

কোড ১০.১..৯ ঃ সমস্যা*

১. রাস্তা সংকীর্ণ	*২. যানজট*	*৩. বাস স্টপেজ দূরে*	*৪. বাহন সংখ্যা কম*	*৫. জরাজীর্ণ রাস্তা*
৬. গন্তব্যে যেতে বাহন পরিবর্তন	*৭. ভাড়া বেশি*	*৮. অন্যান্য ঃ .....*		

অধ্যায়-১১ঃ সম্পদ সম্পর্কিত তথ্য

১১.১ উল্লেখযোগ্য কি কি সম্পদ আছে?

কোড ৯.২ ঃ এলাকার ঐতিহ্যবাহী উৎসব

১. টেলিভিশন	*২. মোবাইল ফোন*	*৩.রেডিও*	*৪.ক্যাসেট প্লেয়ার*	*৫. ট্রাক্টর*	*৬. 'স' মিল*	*৭. রাইস মিল*
৮. অন্যান্য.....						

অধ্যায়-১২ঃ উন্নয়ন পরিকল্পনা সম্পর্কিত

১২.১ শিবপুর/রায়পুর/ঈশ্বরগঞ্জ উপজেলার উন্নয়ন পরিকল্পনা প্রণয়ন সম্পর্কে অবহিত আছেন কি? 1. হ্যাঁ 2. না

১২.২ গুরুত্ব অনুসারে প্রয়োজনীয় উন্নয়নমূলক কাজ কি কি হতে পারে?

(শুধুমাত্র দাপ্তরিক কাজের জন্য)

ডাটা এন্ট্রিকারীর নাম ও স্বাক্ষরঃ ..... তারিখ ঃ.....

তথ্য নিরীক্ষকের নাম ও স্বাক্ষরঃ ..... তারিখ ঃ.....

☐ সকল তথ্য নেয়া হয়েছে ☐ অসম্পূর্ণ

.....

সুপারভাইজারের স্বাক্ষর

তথ্য প্রদানের জন্য আপনাকে আন্তরিক ধন্যবাদ

Annexure-II

Table: List of Socioeconomic Survey Team Members

Sl	**Name**	**Designation**	**Date Start**	**Date End**
1	Tarek Khan	Supervisor	12/8/2015	12/31/2015
2	Rubaiat Islam	Supervisor	12/8/2015	12/31/2015
3	Md Jahangir	Supervisor	12/8/2015	12/31/2015
4	Kawsar Hamid	Supervisor	12/8/2015	12/31/2015
5	Md. Zahirul haque	Surveyor	12/8/2015	12/31/2015
6	Md. Babul Prodhan	Surveyor	12/8/2015	12/31/2015
7	Md. Emran	Surveyor	12/8/2015	12/31/2015
8	Tarikul Gazi	Surveyor	12/8/2015	12/31/2015
9	Shohanur Rahman	Surveyor	12/8/2015	12/31/2015
10	Badhaan Chandra	Surveyor	12/8/2015	12/31/2015
11	Md. Ebrahim Khalil	Surveyor	12/8/2015	12/31/2015
12	Tanvir Alam	Surveyor	12/8/2015	12/31/2015
13	Manik Barman	Surveyor	12/8/2015	12/31/2015
14	Harisul Haque	Surveyor	12/8/2015	12/31/2015
15	Md. Habibullah	Surveyor	12/8/2015	12/31/2015
16	Md. Touhidul Alam Tusar	Surveyor	12/8/2015	12/31/2015
17	Md. Reazuddin	Surveyor	12/8/2015	12/31/2015
18	Nadim Sarkar	Surveyor	12/8/2015	12/31/2015
19	Rocky	Surveyor	12/8/2015	12/31/2015
20	Md. Mahabub	Surveyor	12/8/2015	12/31/2015
21	Ratul Chandra	Surveyor	12/8/2015	12/31/2015
22	Md. Mohsin	Surveyor	12/8/2015	12/31/2015
23	Tahmina Akter	Surveyor	12/8/2015	12/31/2015
24	Tarikul Islam Tuhin	Surveyor	12/8/2015	12/31/2015
25	Arif Nazir	Surveyor	12/8/2015	12/31/2015
26	Md. Masud	Surveyor	12/8/2015	12/31/2015
27	Sumaia Islam	Surveyor	12/8/2015	12/31/2015
28	Mamun Khan	Surveyor	12/8/2015	12/31/2015

Annex-III

Plate: Socio-economic survey at Shibpur

Government of the People's Republic of Bangladesh
Ministry of Housing and Public Works
Urban Development Directorate (UDD)

Preparation of Development Plan for Fourteen Upazilas

Package-02

(Ishwarganj Upazila, Mymensingh; Raipura Upazila and Shibpur Upazila, Narsingdi)

DRAFT SURVEY REPORT

Socio-economic Survey
of
Shibpur Upazila, Narsingdi

August, 2016

Joint Venture
of
SCPL Sheltech Consultants Pvt. Ltd
and
ARC Bangladesh Ltd

Table of Contents

Page No.

JV of SCPL-ABL
Preparation of Development Plan for Fourteen Upazilas Project (Package-02)

Ref: SCPL-ABL/UDD/2016/ Hydrological Survey Report/Shibpur Upazila Date:

To
The Project Director
"Preparation of Development Plan for fourteen Upazilas" Project
Urban Development Directorate
82, Segunbagicha, Dhaka, 1000.

Subject: Submission of the Final Hydrological Survey Report of Shibpur Upazila, Narsingdi.

Dear Sir,
We are pleased to submit herewith the Final Hydrological Survey Report of Shibpur Upazila, Narsingdi for your kind information and further action.

Thanking you and assuring you of our best services.

Your Sincerely,

(Dr. Nurul Islam Nazem) (D S Adibul Abedin)
Team Leader, Package -2 Hydrologist, Package -2

Encl: As stated.

Copy to:
1. Project Manager, Package-2, 14 Upazila Project, UDD
2. Director, Sheltech Consultants Pvt. Limited
3. Chairman, Arc-Bangladesh limited, Dhaka

1/E/2 Paribagh (Mazar Road), Shahbagh, Dhaka-1000, Bangladesh
Phone: +880-2-9611171 Fax: +880-2-9611172
Email: scpl.mail@gmail.com

Abbreviations

ArcGIS	Spatial Date Analysis Software by ESRI
BADC	Bangladesh Agricultural Development Corporation
BM	Benchmark
BMD	Bangladesh Meteorological Department
BWDB	Bangladesh Water Development Board
DEM	Digital Elevation Model
EGL	Existing Ground Level
EPA SWMM	The United States Environmental Protection Agency (EPA) Storm Water Management Model (SWMM)
EV I	The first asymptotic distribution of extreme values
GCP	Ground Control Point
GPS	Global Positioning System
HEC-HMS	The Hydrologic Modeling System is designed to simulate the precipitation-runoff processes of dendritic drainage basins.HEC-HMS is a product of the Hydrologic Engineering Center within the U.S. Army Corps of Engineers.
HEC-RAS	A computer program that models the hydraulics of water flow through natural rivers and other channels developed by the US Department of Defense, Army Corps of Engineers.
HFL	Highest Flood Level
IDF	Intensity Duration Frequency
L/B	Left bank
LFL	Lowest Flood Level
LGED	Local Government Engineering Department
mPWD	RL found against a PWD benchmark in meters
PWD	Public Works Department
R\B	Right Bank
RHD	Roads and Highway Department
RL	Reduced Level
TBM	Temporary Benchmark
UDD	Urban Development Directorate

EXECUTIVE SUMMARY

This report presents the hydrological survey data obtained during the hydrological survey works conducted at Shibpur Upazila under Narshingdi district. The task is a part of the project, “Preparation of Development Plan for Fourteen Upazilas”, Package-2. Bathymetric survey of Arial Khan River, Kalagachia (Paharia River) Channel and Brahmaputra river at Shibpur Upazila is still to be done when the monsoon water subsides. During the survey works, information regarding any existing water control structure, river crossings, distributaries and tributaries were collected. It also presents the detailed survey data of the existing drains within the township. While collecting data for existing drainage systems, information about water logging zones or water logging points were collected. For the natural perennial channels, cross sections were surveyed at the locations of the existing structures on the rivers, at junctions with and of other channels or rivers. For drains, sizes were charted at starting locations, junctions and end points. The reduced levels of the existing ground at those locations were measured too. To measure the reduced levels on the field, dumpy levels were used. The levels were measured with respect to nearby benchmarks or temporary benchmarks of authorized organizations like Bangladesh Water Development Board, Public Works Department, Roads and Highways Department, Local Government Engineering Department, etc. GPS locations at each BM/TBM location, at the point of start of each cross section, at any structure location and at all the control points of the drains were recorded. Other collected data include flow directions, channel names, presence of tidal effects etc. The information will be incorporated with the DEM on GIS and if needed, adjusted according to the established GCPs. This will subsequently facilitate any sort of numerical watershed analysis and hence extrapolate a prediction for the future. This report also presents the analyzed data of water level gauge stations, the rainfall data analysis and the project site data deduced from them.

CHAPTER 1
PROJECT OVERVIEW

1.0 Background and Objective

The project, “Preparation of Development Plan for Fourteen Upazilas” was initiated by Urban Development Directorate, Ministry of Housing and Public Works, Government of Bangladesh. The main objective of the project is upgrading the living standard of the local people. The Shitalakshya River, The Old Brahmaputra River, The Brahmaputra River, The Arial Khan River and The Kalagachia Channel (Paharia River) are the main drainage channels in the vicinity. The whole system of rivers in and around the Upazila are essentially connected to the Mighty Meghna River on the east. The area does not face heavy flooding during the monsoon but does face a drainage congestion during monsoon and post-monsoon. The urban areas lack proper drainage system. Flood modeling software should be used to understand flooding conditions, identify the water logging areas and establish the drainage requirements. Models should also be used to assess the efficiency of the existing and proposed drainage system.

One aspect of this Hydrological Survey is the bathymetric survey of the main rivers within the project area. The purpose of bathymetric survey is to provide bathymetric information of the Arial Khan River, Kalagachia Channel (Paharia River) and The Brahmaputra River on the south of the Upazila. Although flooding in the area is governed mainly by the Old Brahmaputra and The Meghna River, as the study area can be limited within the Upazila, the bathymetric survey of these two rivers will not be necessary. The water level data of those rivers will be used as boundary conditions for model analysis. The information obtained in the field will be incorporated in the DEM through a process called “Burning”. This will be necessary for analyzing the surface water flow to assess flood through flood modeling software. It is required to assess the flood conditions during different time period and season against different water levels and discharge *(Sample results shown in Fig: 1 & Fig: 2)*. If the actual cross-section of the river or channel is not obtained, the analysis will be faulty and will overstate the flood. This type of analysis will be helpful for preparation of effective and long lasting development plans for this Upazila. Hence, accuracy of the analysis is of prime importance.

To run a flood model of the area, water level, discharge and rainfall data of the vicinity have been collected from secondary source and analyzed. Water level data of BWDB gauge stations SW 177 at Lakpur, SW 229 at Toke, SW 274 at Narshingdi and SW 295 at Ajabur have been collected. The rainfall data of the stations CL 76 at Narshingdi and CL 79 at Shibpur have been collected to obtain a rational rainfall data by interpolation. The data are to be analyzed to obtain water level, discharge and rainfall data for different return period. The water level and discharge data are needed to set the boundary condition in flood models. The rainfall data will be used to obtain runoffs to calculate discharge at pour points of the sub-catchments.

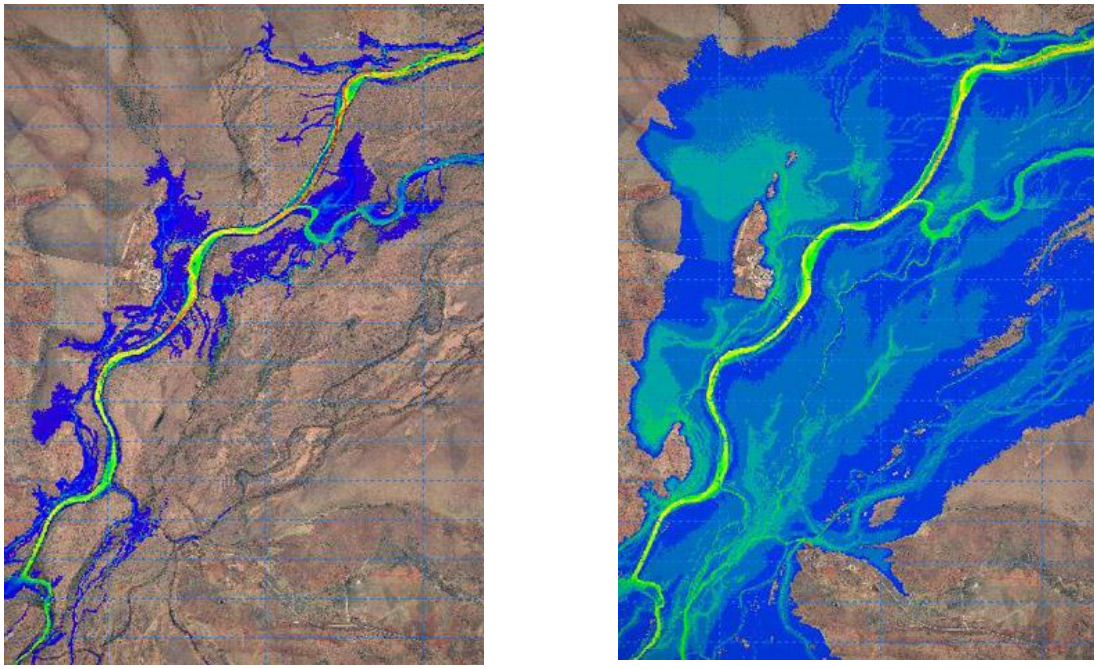


Fig-1: An integrated 1D-2D flood model on a flood plain showing flood conditions at different water level and flow time using Mike Flood (DHI)

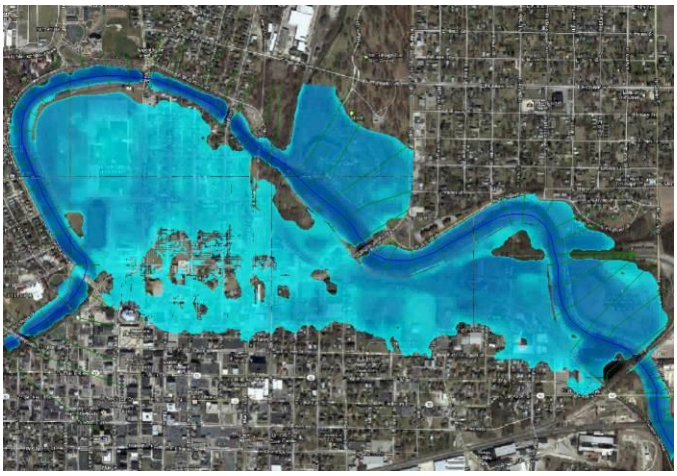


Fig-2: An integrated 1D-2D flood model showing flood conditions in a city area using HEC-RAS

Understanding the water logging problems within the town area and proposing a comprehensive drainage system is another aspect of the survey. Drainage system development is unavoidable when it comes to sustainable urbanization. It is necessary to plan ahead for an efficient drainage system. For this, assessment of capacity and utility of the existing drainage system is essential. Information of the existing drains in Shibpur have been collected. The information includes depth, width and EGL at the junction points of the drains. 3-hourly rainfall data, collected from Goddard Earth Sciences Data and Information Service Center, will be used to prepare the hourly rainfall data or the intensity duration frequency (IDF) curve for designing storm sewer system. This will be used to assess the

capacity of the existing drainage system and in designing the proposed drainage system. *(Fig: 3)*

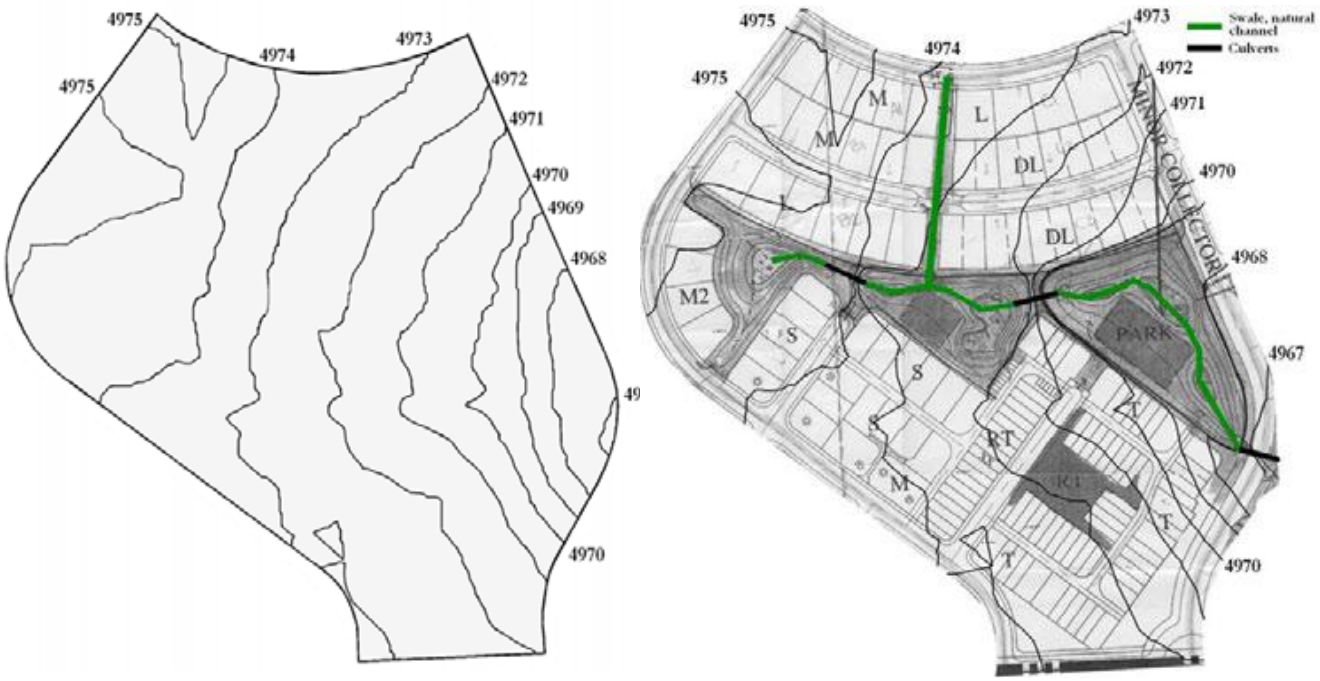


Fig-3: Model developed using EPA SWMM simulating undeveloped (left) and developed (right) conditions to calculate and compare the difference of discharge

With the above in view, the overall objectives of the survey are as listed below:

- Bathymetric survey of the major rivers.
- Identification of hydraulic structures and collecting information regarding capacity and sill levels of the structures.
- Identification of flood hazard locations.
- Identification of flow directions and tidal effects.
- Collection of observed flood levels in the field.
- Collecting information of any existing drainage system.
- Identification of water logging zones.
- Collecting information regarding encroachments of natural water bodies and drains.
- Collection of water level, discharge and rainfall data from secondary sources.

The analyses of the collected water level data done using EV I distribution are added in ANNEXURE - I(b). The Rest of the analysis using the Normal distribution, Log normal distribution and Log Pearson III distribution along with the goodness of fit analysis will be added in the final planning report of the project, “Preparation of Development Plan for Fourteen Upazilas”.

CHAPTER 2
METHODOLOGY

2.0 Survey Method

2.1 Measuring Reduced Levels

To measure the reduced levels, dumpy levels and 5m staffs were used. In case of rivers, the levels were measured with respect to the nearest known benchmarks of Bangladesh Water Development Board or temporary benchmarks of any authorized government organizations viz., Roads and Highways Department or Local Government Engineering Department etc. After establishing a horizontal line of collimation / line of sight with respect to a BM/TBM, staff readings are taken within the range of visibility of the dumpy level. For any reading beyond the visibility range, the dumpy level needs a change of station. A temporary benchmark is established and further measurements are made with respect to that. In case of a change of level of more than the height of the staff (5m generally), the levelling machine needs to be shifted and setup again. Subtracting the level of line of sight from the staff readings provides the reduced levels at the point concerned. In figure 4, a schematic diagram of survey method using Dumpy Levels is shown.

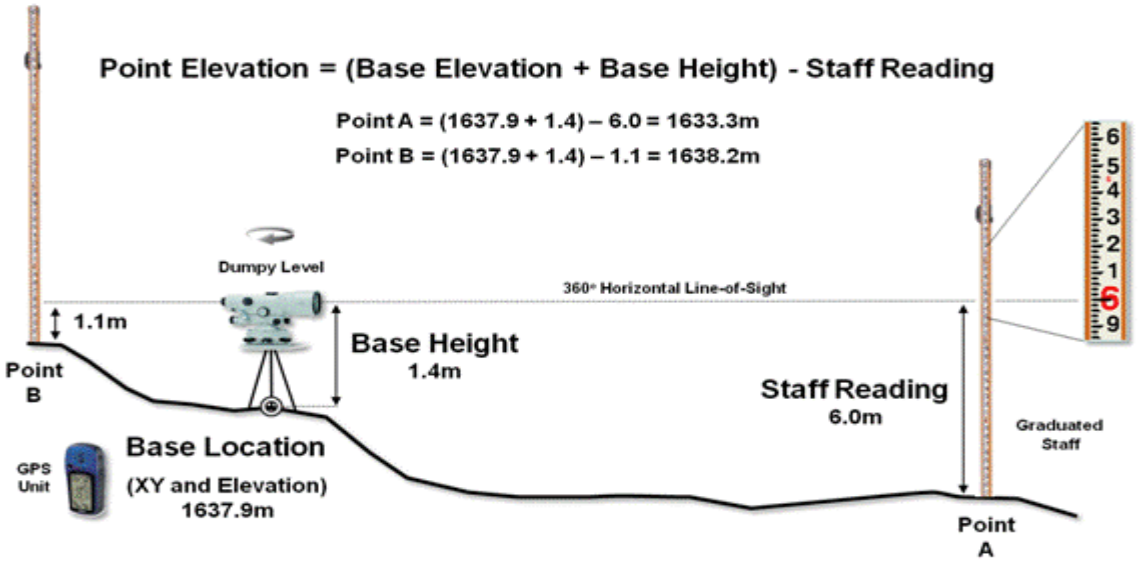


Fig-4: A Dumpy level establishes a horizontal plane to measure the relative elevation differences throughout a project area. A hand GPS is used to get the location of the base.

2.2 Identification of Location

A hand GPS was used to identify the location of the cross-sections, structures, drain control points etc.

2.3 Data Collection

To collect information regarding water control structures in the vicinity, the government organizations that are responsible for any development works regarding water resources development were contacted. The three government organizations that are active in the area are Bangladesh Water Development Board (BWDB), Local Government Engineering Department (LGED) and Bangladesh Agricultural Development Corporation (BADC). Key information of the structures about invert level, number and size of vents etc. were collected. *Plate-1* shows the bridge on Kalagachia Channel (Paharia River) at Shibpur Upazila under Narshingdi and *Plate-2* shows an abandoned bridge right next to the bridge in *Plate-1*.

Plate-1: Bridge on Kalagachia Channel (Paharia River) at Shibpur Paurashabha at Narshingdi.

Plate-2: Pire of an abandoned Bridge on Kalagachia Channel (Paharia River) at Shibpur Paurashabha at Narshingdi.

To identify locations that are prone to flood hazards or water logging problems, questionnaire was prepared and information was collected accordingly. The questionnaire is attached to ANNEXURE – II (a). During the engineering survey, information like highest and normal flood levels, highest tide levels and lowest tide levels were collected from the local farmers, fishermen or boatmen.

As for the secondary data, water level data of the gauge stations SW 177, SW 229, SW 274 and SW 295 of Bangladesh water development are collected. Daily Rainfall data of BWDB gauge CL 76 and CL 79 have also been collected.

CHAPTER 3
FINDINGS OF SURVEY WORKS

3.0 Survey Results

3.1 Survey of Main Rivers

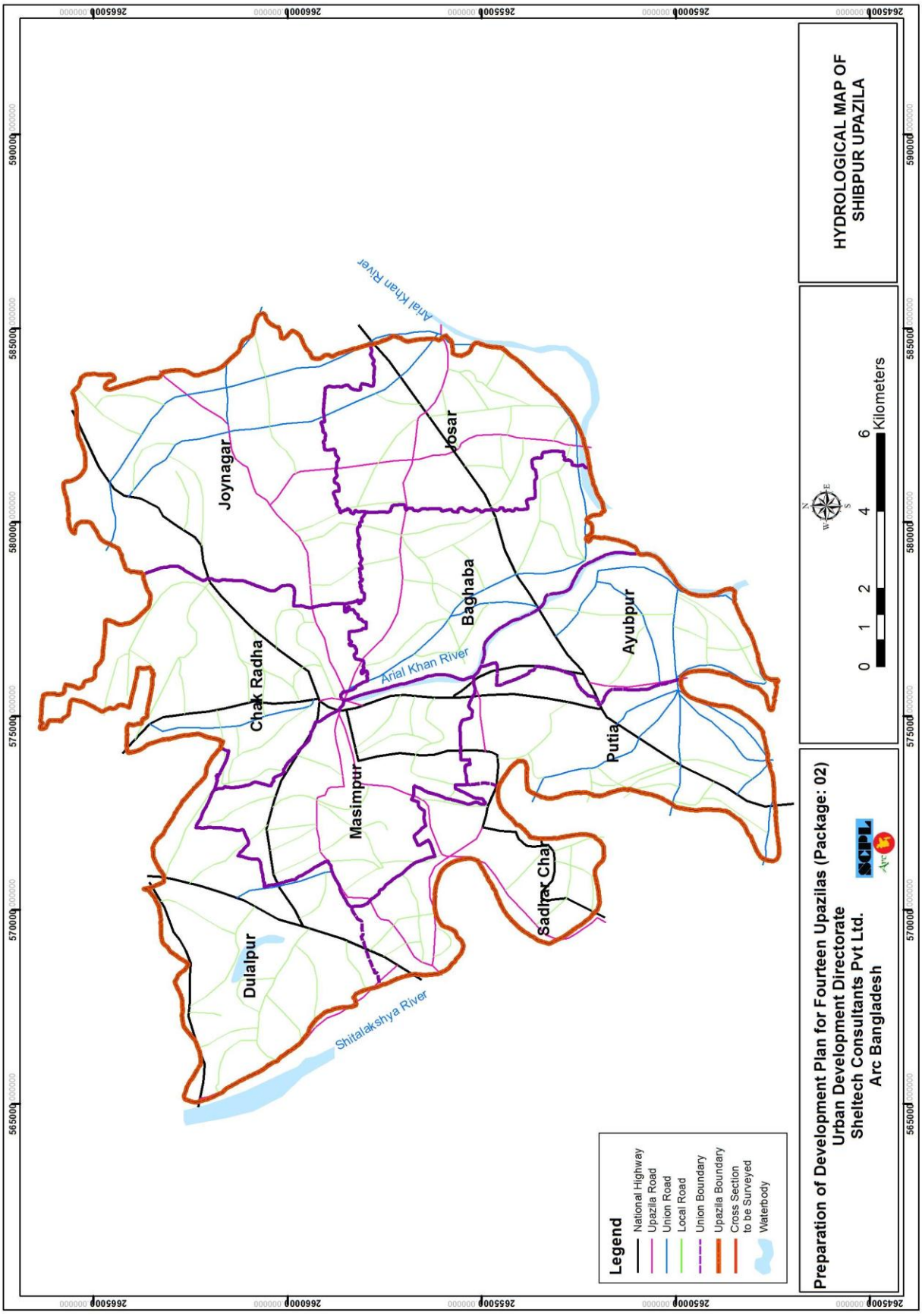
The bathymetric survey of the Arial Khan River, Kalagachia Channel (Paharia River) and The Brahmaputra Rivers are postponed due to monsoon water still not subsided making survey works complicated. As soon as the water subsides during the post monsoon, the cross-sectional survey works will be commenced. The main rivers and channels as identified are shown in *Map – 1 & 2.* Cross-sections will be prepared using the reduced levels obtained in the field against Bangladesh Water Development Board benchmarks. Later, when the photogrammetric images will be processed, the cross-sections will be converted to MSL datum. During the physical feature survey, information about hydraulic structures on the rivers and along the banks of the rivers has already been collected.

3.2 Dependencies

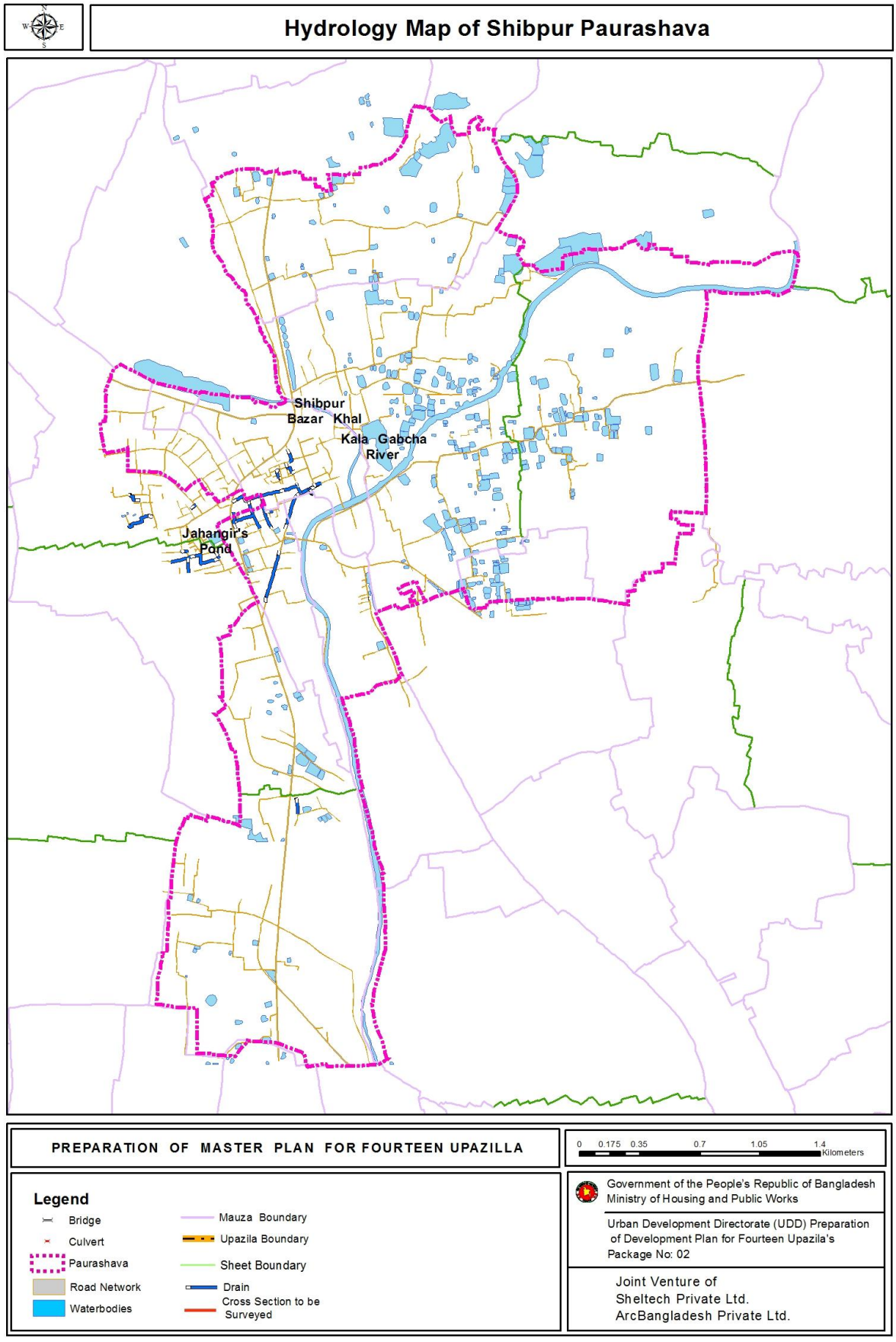
The hydrological works are dependent upon the land use survey, topographic survey and physical feature survey for the respective outcomes of those survey works done under this project. During Physical feature survey, information regarding hydraulic structures has been collected. The local offices of Government Agencies like BWDB, BADC and LGED have been contacted to get data about any irrigation projects or drainage projects that are either currently being operated or being planned by them. The responses of the local populace have been inquired to understand their attitude towards those projects.

The land use survey will be required to prepare the rainfall runoff model for Shibpur. Depending upon the use of land, the runoff over a certain segment of land will vary. On a surface exhibiting vegetation, the rainwater shall be impeded from reaching any natural or man-made drainage system. A portion of the precipitation will be intercepted by the canopy before the rain water can reach the ground, also the infiltration rate will be high. All these factors prevents the accumulation of rain water and thus reduces runoff. On the other hand, on a buildup area, much of the vegetation is gone and the land is more or less covered with impervious construction. Interception and infiltration hence reduces, resulting in an increase in net runoff.

Topographic survey is required to understand the undulations on the ground surface. On a steep slope, the water flows quicker towards drainage bodies which are vice versa for a flat land. The digital 3D stereo imageries that have been collected as a measure of the survey works will be used to prepare a Digital Elevation Model (DEM) of the land.



Map-1: Map showing the main drainage channels as identified at Shibpur Upazila under Narshingdi District.



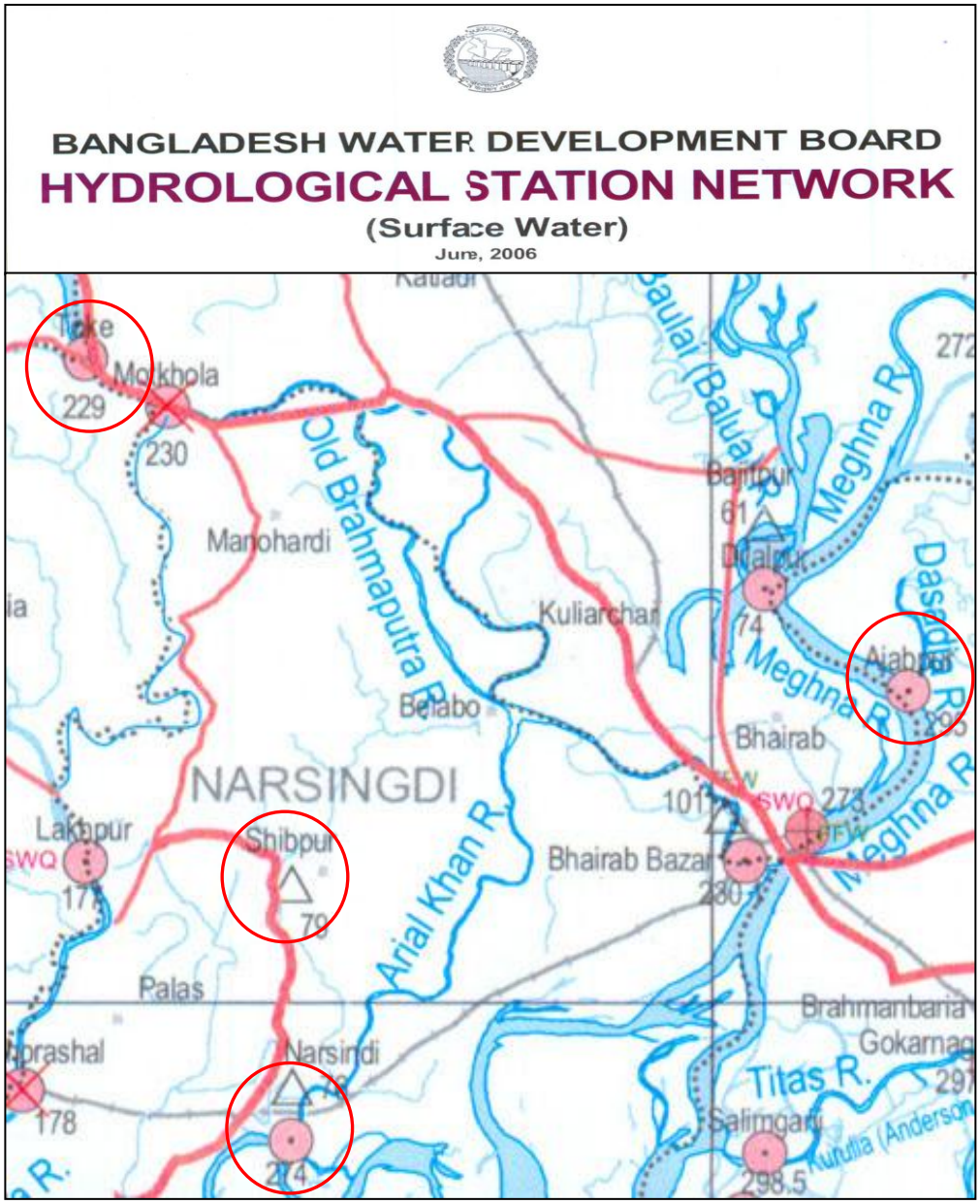
Map-2: Map showing the main drainage channels as identified at Shibpur Paurashava under Narshingdi District.

3.3 Survey of the Existing Drainage Systems

Information of existing drains at Shibpur regarding depth and width, RL and GPS locations at different junction points, starting points and ending points are obtained. Names of roads alongside the drains are also collected. Lining conditions (Lined or Unlined) of the existing drains have been identified during the survey. This information would be used to prepare a drainage inventory to assess the capacity of the existing drainage system and with a view to that; a drainage improvement plan will be prepared.

3.4 Samples of Collected Data

The BWDB Water Level, Discharge and Rainfall gauge stations of which the data has been collected are shown on *Map-3.* The sample data are charted from **Table – 3.1 to 3.4**



Map-3: Locations of BWDB Water Level, Discharge and Rainfall gauge stations at and around Shibpur, Narshingdi, of which the data has been collected (SW 40, SW 200, CL 316, CL 317, CL 322).

Table 3.1: Sample of Collected Rainfall data of BWDB station CL 76 & CL 79

District	StationID	StationName	DateTime	Rainfall
Narsingdi	CL76	Narsindi	01-Jan-81	0
Narsingdi	CL76	Narsindi	02-Jan-81	0
Narsingdi	CL76	Narsindi	03-Jan-81	0
Narsingdi	CL76	Narsindi	04-Jan-81	0
Narsingdi	CL76	Narsindi	05-Jan-81	0
Narsingdi	CL76	Narsindi	06-Jan-81	0
Narsingdi	CL76	Narsindi	07-Jan-81	0
Narsingdi	CL76	Narsindi	08-Jan-81	1.8
Narsingdi	CL76	Narsindi	09-Jan-81	0
Narsingdi	CL76	Narsindi	10-Jan-81	0
Narsingdi	CL76	Narsindi	11-Jan-81	0
Narsingdi	CL76	Narsindi	12-Jan-81	1.3
Narsingdi	CL76	Narsindi	13-Jan-81	0
Narsingdi	CL76	Narsindi	14-Jan-81	0
Narsingdi	CL76	Narsindi	15-Jan-81	0
Narsingdi	CL76	Narsindi	16-Jan-81	0
Narsingdi	CL76	Narsindi	17-Jan-81	0
Narsingdi	CL76	Narsindi	18-Jan-81	0
Narsingdi	CL76	Narsindi	19-Jan-81	0
Narsingdi	CL76	Narsindi	20-Jan-81	0
Narsingdi	CL76	Narsindi	21-Jan-81	0
Narsingdi	CL76	Narsindi	22-Jan-81	0
Narsingdi	CL76	Narsindi	23-Jan-81	0
Narsingdi	CL76	Narsindi	24-Jan-81	0
Narsingdi	CL76	Narsindi	25-Jan-81	0
Narsingdi	CL76	Narsindi	26-Jan-81	0
Narsingdi	CL76	Narsindi	27-Jan-81	0
Narsingdi	CL76	Narsindi	28-Jan-81	0
Narsingdi	CL76	Narsindi	29-Jan-81	0
Narsingdi	CL76	Narsindi	30-Jan-81	0

District	StationID	StationName	DateTime	Rainfall
Narsingdi	CL79	Shibpur	1-Jan-81	0
Narsingdi	CL79	Shibpur	2-Jan-81	0
Narsingdi	CL79	Shibpur	3-Jan-81	0
Narsingdi	CL79	Shibpur	4-Jan-81	0
Narsingdi	CL79	Shibpur	5-Jan-81	0
Narsingdi	CL79	Shibpur	6-Jan-81	0
Narsingdi	CL79	Shibpur	7-Jan-81	0
Narsingdi	CL79	Shibpur	8-Jan-81	0
Narsingdi	CL79	Shibpur	9-Jan-81	0
Narsingdi	CL79	Shibpur	10-Jan-81	0
Narsingdi	CL79	Shibpur	11-Jan-81	0
Narsingdi	CL79	Shibpur	12-Jan-81	0.5
Narsingdi	CL79	Shibpur	13-Jan-81	0
Narsingdi	CL79	Shibpur	14-Jan-81	0
Narsingdi	CL79	Shibpur	15-Jan-81	0
Narsingdi	CL79	Shibpur	16-Jan-81	0
Narsingdi	CL79	Shibpur	17-Jan-81	0
Narsingdi	CL79	Shibpur	18-Jan-81	0
Narsingdi	CL79	Shibpur	19-Jan-81	0
Narsingdi	CL79	Shibpur	20-Jan-81	0
Narsingdi	CL79	Shibpur	21-Jan-81	0
Narsingdi	CL79	Shibpur	22-Jan-81	0
Narsingdi	CL79	Shibpur	23-Jan-81	0
Narsingdi	CL79	Shibpur	24-Jan-81	0
Narsingdi	CL79	Shibpur	25-Jan-81	0
Narsingdi	CL79	Shibpur	26-Jan-81	0
Narsingdi	CL79	Shibpur	27-Jan-81	0
Narsingdi	CL79	Shibpur	28-Jan-81	0
Narsingdi	CL79	Shibpur	29-Jan-81	0
Narsingdi	CL79	Shibpur	30-Jan-81	0

Table 3.2: Sample of Collected Water level Data of BWDB Station SW 177 & SW 229

RiverName	StationName	StationID	DateTime	HighTide	LowTide
Lakhya	Lakhpur	SW177	01-04-1983	2.18	1.83
Lakhya	Lakhpur	SW177	02-04-1983	2.13	1.78
Lakhya	Lakhpur	SW177	03-04-1983	2.05	1.73
Lakhya	Lakhpur	SW177	04-04-1983	1.93	1.58
Lakhya	Lakhpur	SW177	05-04-1983	1.83	1.48
Lakhya	Lakhpur	SW177	06-04-1983	1.78	1.43
Lakhya	Lakhpur	SW177	07-04-1983	1.73	1.38
Lakhya	Lakhpur	SW177	08-04-1983	1.73	1.38
Lakhya	Lakhpur	SW177	09-04-1983	1.78	1.48
Lakhya	Lakhpur	SW177	10-04-1983	1.91	1.53
Lakhya	Lakhpur	SW177	11-04-1983	1.98	1.58
Lakhya	Lakhpur	SW177	12-04-1983	2.13	1.68
Lakhya	Lakhpur	SW177	13-04-1983	2.18	1.71
Lakhya	Lakhpur	SW177	14-04-1983	2.28	1.78
Lakhya	Lakhpur	SW177	15-04-1983	2.38	1.83
Lakhya	Lakhpur	SW177	16-04-1983	2.13	1.83
Lakhya	Lakhpur	SW177	17-04-1983	1.98	1.73
Lakhya	Lakhpur	SW177	18-04-1983	1.93	1.63
Lakhya	Lakhpur	SW177	19-04-1983	1.83	1.53
Lakhya	Lakhpur	SW177	20-04-1983	1.78	1.48
Lakhya	Lakhpur	SW177	21-04-1983	1.73	1.43
Lakhya	Lakhpur	SW177	22-04-1983	1.78	1.43
Lakhya	Lakhpur	SW177	23-04-1983	1.73	1.63
Lakhya	Lakhpur	SW177	24-04-1983	2.08	1.68
Lakhya	Lakhpur	SW177	25-04-1983	2.28	1.73
Lakhya	Lakhpur	SW177	26-04-1983	2.33	1.83
Lakhya	Lakhpur	SW177	27-04-1983	2.46	1.88
Lakhya	Lakhpur	SW177	28-04-1983	2.48	1.98
Lakhya	Lakhpur	SW177	29-04-1983	2.63	1.98
Lakhya	Lakhpur	SW177	30-04-1983	2.68	2.03
Lakhya	Lakhpur	SW177	01-05-1983	2.76	2.03
Lakhya	Lakhpur	SW177	02-05-1983	2.86	2.08

RiverName	StationName	StationID	DateTime	HighTide	LowTide
Old Brahmaputra	Toke	SW229	01-04-1981	1.36	1.05
Old Brahmaputra	Toke	SW229	02-04-1981	1.48	1.30
Old Brahmaputra	Toke	SW229	03-04-1981	1.66	1.45
Old Brahmaputra	Toke	SW229	04-04-1981	1.91	1.60
Old Brahmaputra	Toke	SW229	05-04-1981	2.12	1.78
Old Brahmaputra	Toke	SW229	06-04-1981	2.33	2.03
Old Brahmaputra	Toke	SW229	07-04-1981	2.36	2.12
Old Brahmaputra	Toke	SW229	08-04-1981	2.24	1.94
Old Brahmaputra	Toke	SW229	09-04-1981	2.12	1.88
Old Brahmaputra	Toke	SW229	10-04-1981	1.97	1.75
Old Brahmaputra	Toke	SW229	11-04-1981	1.97	1.69
Old Brahmaputra	Toke	SW229	12-04-1981	1.91	1.66
Old Brahmaputra	Toke	SW229	13-04-1981	1.94	1.75
Old Brahmaputra	Toke	SW229	14-04-1981	2.09	1.78
Old Brahmaputra	Toke	SW229	15-04-1981	2.12	1.99
Old Brahmaputra	Toke	SW229	16-04-1981	2.24	1.94
Old Brahmaputra	Toke	SW229	17-04-1981	2.48	2.18
Old Brahmaputra	Toke	SW229	18-04-1981	2.67	2.30
Old Brahmaputra	Toke	SW229	19-04-1981	2.76	2.61
Old Brahmaputra	Toke	SW229	20-04-1981	2.76	2.70
Old Brahmaputra	Toke	SW229	21-04-1981	2.79	2.70
Old Brahmaputra	Toke	SW229	22-04-1981	2.76	2.67
Old Brahmaputra	Toke	SW229	23-04-1981	2.70	2.58
Old Brahmaputra	Toke	SW229	24-04-1981	2.61	2.42
Old Brahmaputra	Toke	SW229	25-04-1981	2.45	2.27
Old Brahmaputra	Toke	SW229	26-04-1981	2.36	2.15
Old Brahmaputra	Toke	SW229	27-04-1981	2.27	2.03
Old Brahmaputra	Toke	SW229	28-04-1981	2.15	1.94
Old Brahmaputra	Toke	SW229	29-04-1981	2.15	1.83
Old Brahmaputra	Toke	SW229	30-04-1981	2.04	1.83
Old Brahmaputra	Toke	SW229	01-05-1981	2.01	1.80
Old Brahmaputra	Toke	SW229	02-05-1981	2.29	2.01

Table 3.2: Sample of Collected Water level Data of BWDB Station SW 274 & SW 295

RiverName	StationName	StationID	DateTime	HighTide	LowTide
Surma-Meghna	Narsingdi	SW274	01-04-1981	1.13	0.98
Surma-Meghna	Narsingdi	SW274	02-04-1981	1.44	1.07
Surma-Meghna	Narsingdi	SW274	03-04-1981	1.50	1.09
Surma-Meghna	Narsingdi	SW274	04-04-1981	1.71	1.22
Surma-Meghna	Narsingdi	SW274	05-04-1981	1.92	1.47
Surma-Meghna	Narsingdi	SW274	06-04-1981	2.14	1.65
Surma-Meghna	Narsingdi	SW274	07-04-1981	2.23	1.80
Surma-Meghna	Narsingdi	SW274	08-04-1981	2.23	1.83
Surma-Meghna	Narsingdi	SW274	09-04-1981	2.27	1.86
Surma-Meghna	Narsingdi	SW274	10-04-1981	2.11	1.80
Surma-Meghna	Narsingdi	SW274	11-04-1981	1.98	1.71
Surma-Meghna	Narsingdi	SW274	12-04-1981	1.89	1.68
Surma-Meghna	Narsingdi	SW274	13-04-1981	1.80	1.66
Surma-Meghna	Narsingdi	SW274	14-04-1981	1.80	1.65
Surma-Meghna	Narsingdi	SW274	15-04-1981	1.82	1.71
Surma-Meghna	Narsingdi	SW274	16-04-1981	2.23	1.95
Surma-Meghna	Narsingdi	SW274	17-04-1981	2.47	2.14
Surma-Meghna	Narsingdi	SW274	18-04-1981	2.55	2.17
Surma-Meghna	Narsingdi	SW274	19-04-1981	2.50	2.20
Surma-Meghna	Narsingdi	SW274	20-04-1981	2.50	2.24
Surma-Meghna	Narsingdi	SW274	21-04-1981	2.49	1.71
Surma-Meghna	Narsingdi	SW274	22-04-1981	2.44	1.68
Surma-Meghna	Narsingdi	SW274	23-04-1981	2.41	1.66
Surma-Meghna	Narsingdi	SW274	24-04-1981	2.41	1.65
Surma-Meghna	Narsingdi	SW274	25-04-1981	2.23	1.71
Surma-Meghna	Narsingdi	SW274	26-04-1981	2.17	1.95
Surma-Meghna	Narsingdi	SW274	27-04-1981	2.15	1.94
Surma-Meghna	Narsingdi	SW274	28-04-1981	2.04	1.92
Surma-Meghna	Narsingdi	SW274	29-04-1981	1.98	1.89
Surma-Meghna	Narsingdi	SW274	30-04-1981	2.08	1.89
Surma-Meghna	Narsingdi	SW274	01-05-1981	2.09	1.89
Surma-Meghna	Narsingdi	SW274	02-05-1981	2.17	1.82

RiverName	StationName	StationID	DateTime	HighTide	LowTide
Titas	Ajabpur	SW295	01-04-1981	1.50	1.34
Titas	Ajabpur	SW295	02-04-1981	1.68	1.40
Titas	Ajabpur	SW295	03-04-1981	1.98	1.57
Titas	Ajabpur	SW295	04-04-1981	2.11	1.77
Titas	Ajabpur	SW295	05-04-1981	2.27	2.01
Titas	Ajabpur	SW295	06-04-1981	2.46	2.21
Titas	Ajabpur	SW295	07-04-1981	2.47	2.32
Titas	Ajabpur	SW295	08-04-1981	2.43	2.29
Titas	Ajabpur	SW295	09-04-1981	2.36	2.23
Titas	Ajabpur	SW295	10-04-1981	2.32	2.18
Titas	Ajabpur	SW295	11-04-1981	2.27	2.12
Titas	Ajabpur	SW295	12-04-1981	2.24	2.11
Titas	Ajabpur	SW295	13-04-1981	2.20	2.11
Titas	Ajabpur	SW295	14-04-1981	2.24	2.11
Titas	Ajabpur	SW295	15-04-1981	2.30	2.17
Titas	Ajabpur	SW295	16-04-1981	2.38	2.27
Titas	Ajabpur	SW295	17-04-1981	2.49	2.36
Titas	Ajabpur	SW295	18-04-1981	2.70	2.52
Titas	Ajabpur	SW295	19-04-1981	2.79	2.67
Titas	Ajabpur	SW295	20-04-1981	2.88	2.79
Titas	Ajabpur	SW295	21-04-1981	2.85	2.78
Titas	Ajabpur	SW295	22-04-1981	2.81	2.75
Titas	Ajabpur	SW295	23-04-1981	2.78	2.73
Titas	Ajabpur	SW295	24-04-1981	2.73	2.64
Titas	Ajabpur	SW295	25-04-1981	2.67	2.62
Titas	Ajabpur	SW295	26-04-1981	2.59	2.49
Titas	Ajabpur	SW295	27-04-1981	2.43	2.36
Titas	Ajabpur	SW295	28-04-1981	2.39	2.27
Titas	Ajabpur	SW295	29-04-1981	2.30	2.23
Titas	Ajabpur	SW295	30-04-1981	2.36	2.21
Titas	Ajabpur	SW295	01-05-1981	2.39	2.21
Titas	Ajabpur	SW295	02-05-1981	2.48	2.29

CHAPTER 4
HYDROLOGIC DATA ANALYSIS

4.0 Analysis of Hydrological Data

4.1 Estimation of Design Discharge and Water Level

Estimation of both flood discharges and high water levels are necessary for bank protection design. Careful estimation of discharge and water level is important for all sites with erodible banks. This section describes the methods of assessing flood discharge and water level at the site under consideration. The design discharge and water level are determined for selected probability of exceedance or return period.

The design discharge and water level arising from floods should be selected after due consideration of the following:

- The maximum historical discharge as recorded at the site, or as calculated on the basis of recorded water level at the site, or as calculated on the basis of measured discharge at other points on the river from which corresponding site discharge can reasonably be inferred**.**
- The discharge derived from a frequency analysis using a probability of exceedance or return period which is appropriate to the importance and value of the protection work.
- The maximum historical water level as recorded at the site, or as inferred from observed or recorded water level at other points on the river from which level can reasonably be transferred to the site in question.
- The water level derived from a frequency analysis using a probability of exceedance or return period which is appropriate to the importance and value of the protection work.

In estimating high flows, primary reliance should be placed on careful field investigations, local enquiries and searches of historical records. Data so obtained should be compared with recorded data for hydrometric stations, and supplemented by analytical procedure using stage-discharge curves. At most hydrometric gauging stations reasonably stable relationship exists between water level and discharge. At some sites, however, the stage discharge curve may be quite unstable because of aggradation or degradation at channel bed or backwater effect from downstream, and may change drastically during major floods. A persistent trend of rising or lowering of curve indicates progressive channel aggradation or degradation. The stage corresponding to design flood which exceeds any recorded flow obtained by extrapolating the stage-discharge relationships.

The most commonly used method for estimating design discharge and water level examines the observed discharge and water level to arrive at suitable estimates. The method, known as frequency analysis, is founded on statistical analyses of discharge and water level records. For locations where records of stream flows are available, or where flows from another basin can be transported to the design location, design flood magnitude and water level can be estimated directly from those records by means of frequency analysis.

4.2 Frequency Analysis

Frequency of a hydrological event, such as the annual peak flow is the probability that a value will be equaled or exceeded in any year. This is more appropriately called the exceedance probability, P (F). The reciprocal of the exceedance probability is the return period T in years, that is, $T = 1/P(F)$. The length of record should be sufficient to justify extrapolating the frequency relationship. For example, it might be reasonable to estimate a 50-year flood on the basis of a 30-year record, but to estimate a 100-year flood on the basis of a 10-year record would normally be absurd (Neill 1973) [(1)]. Viessman and Lewis (1996) [(2)] noted that as a general rule, frequency analysis is cautioned when working with shorter records and estimating frequencies of hydrological events greater than twice the record length.

Frequency analysis can be conducted in two ways: one is the analytical approach and the other is the graphical technique in which flood magnitudes are usually plotted against probability of exceedance.

Here in the following sections, procedures are given mostly for discharge frequency analysis; the similar procedures can also be followed for water level frequency analysis.

4.3 Analytical Frequency Analysis

Analytical frequency analysis is based on fitting theoretical probability distributions to given data. Numerous distributions have been suggested on the basis of their ability to 'fit' the plotted data from streams (Linsley et al. 1982) [(3)]. The Log-Pearson Type III (LP3) has been adopted for use in the United States Federal Agencies for flood analysis. The first asymptotic distribution of extreme values (EV1), commonly called Gumbel Distribution has been widely used and is recommended in the United Kingdom. For this project, all the collected data will be analyzed using Normal distribution, Log-Normal distribution, Log-Pearson III distribution and Extreme Variable Distribution and the best fit distribution will be adopted for analysis.

4.3.1 Extreme Value Distributions:

Distributions of the extreme values selected from sets of samples of any probability distribution converge to any one of three forms of Extreme Value Distributions, called Type I, II, and III, respectively, when the number of selected extreme values is large. The three limiting forms are special cases of a single distribution called Generalized Extreme Value (GEV) Distribution (Chow et al. 1988) [(4)]. The cumulative distribution function for the GEV is:

$$F(x) = \exp\left[-\left(1-\kappa\frac{x-u}{\alpha}\right)^{1/\kappa}\right] \qquad (1)$$

Here κ, u, and α are parameters to be determined. For EVI Distribution x is unbounded, while for EVII, x is bounded from below, and for EVIII, x is bounded from above. The EVI and EVII Distributions are also known as the Gumbel and Frechet Distributions, respectively.

The Extreme Value Type I (EVI) cumulative distribution function is:

$$F(x) = \exp\left[-\exp\left(-\frac{x-u}{\alpha}\right)\right] \qquad -\infty \le x \le \infty \qquad (2)$$

The parameters are estimated by

$$\alpha = \frac{\sqrt{6}}{\pi} s \quad \text{and} \quad u = \bar{x} - 0.5772\alpha \tag{3}$$

Eq (2) can be expressed as

$$F(x) = e^{-e^{-y}} \tag{4}$$

Where y is the reduced variate defined as

$$y = \frac{x - u}{\alpha} \tag{5}$$

Solving Eq (4) for y:

$$y = -\ln\left[\ln\left(\frac{1}{F(x)}\right)\right] \tag{6}$$

Noting that the probability of occurrence of an event $x \geq x_T$ is the inverse of its return period T, we can write

$$\frac{1}{T} = P(x \geq x_T) = 1 - P(x \leq x_T) = 1 - F(x_T)$$

So,

$$F(x_T) = 1 - \frac{1}{T}$$

Substituting for $F(x_T)$ into Eq (6)

$$y_T = -\ln\left[\ln\left(\frac{T}{T-1}\right)\right] \tag{7}$$

For a given return period x_T is related to y_T by Eq (5), or

$$x_T = u + \alpha y_T \tag{8}$$

4.3.2 Frequency Analysis using Frequency Factors

Calculating the magnitudes of extreme events by the method outlined in the above example requires that the probability distribution function be invertible, that is, given a value of *T* or $F(x_T) = 1 - \frac{1}{T}$, the corresponding value of x_T can be determined. Some probability distribution functions are not readily invertible, like the Normal and Pearson Type III Distributions. Thus an alternative method based on frequency factor is used for calculating the magnitudes of extreme events. Chow (1951) [(5)] has shown that most frequency functions can be generalized to

$$x_T = \bar{x} + K_T s \tag{9}$$

where x_T is a flood of specified probability or return period *T*, $\bar{x}$ is the mean of the flood series, s is the standard deviation of the series; and K_T is the frequency factor and is a function of return period and type of probability distribution, as well as coefficient of skewness for skewed distributions, such as LP3.

In the event that the variable analyzed is $y = \log x$, for example as in Lognormal and LP3 Distributions, the same method is applied to the statistics for the logarithms of data using $y_T = \bar{y} + K_T s_y$, and the required value of x_T is found taking antilog of y_T.

Chow (1951) [5] proposed the frequency factor as in Eq (9), and it is applicable to many probability distributions used in hydrological frequency analysis. The K-T relationship can be expressed in mathematical terms or by a table.

Normal Distribution: From Eq (9) the frequency factor can be expressed as

$$K_T = \frac{x_T - \bar{x}}{s} = z \qquad (10)$$

Thus, for Normal Distribution K_T is the same as the standard normal variable z. The value of z and hence K_T can be obtained from Table 1 in ANNEXURE – I(a).

Lognormal Distribution: The recommended procedure for use of the Lognormal Distribution is to convert the data series to logarithms and compute:

1) $y_i = \log x_i$
2) Compute the mean, $\bar{y}$ and standard deviation s_y
3) Compute $y_T = \bar{y} + K_T s_y$

$$K_T = \frac{y_T - \bar{y}}{s_y} = z$$

So, K_T can be taken from Table 1 in ANNEXURE – I(a).

4) Finally compute $x_T = anti \log y_T$

Log-Pearson Type III (LP3) Distribution: The recommended procedure for use of the LP3 Distribution is to convert the data series to logarithms and compute:

1) $y_i = \log x_i$
2) Compute the mean, $\bar{y}$ and standard deviation s_y
3) Compute coefficient of skewness

$$C_s = \frac{n\sum (y_i - \bar{y})^3}{(n-1)(n-2)s_y{}^3}$$

4) Compute $y_T = \bar{y} + K_T s_y$ (11)

Where K_T is taken from Table 2 in ANNEXURE – I(a)..

5) Finally compute $x_T = anti \log y_T$

Table 3 in ANNEXURE – I(a) gives values of the frequency factors for the LP3 Distribution for various values of return period and coefficient of skewness, C_s. When C_s =0, the frequency factor is equal to the standard normal variable z (Table 1 in ANNEXURE – I(a)).

Extreme Value I (EVI) Distribution: Chow (1951) [5] derived the following expression for frequency factor for the EVI Distribution

$$K_T = -\frac{\sqrt{6}}{\pi}\left[0.5772 + \ln\left\{\ln\left(\frac{T}{T-1}\right)\right\}\right] \qquad (12)$$

When $x_T = \mu$, Eq (9) (in population term) gives $K_T = 0$ and Eq (12) gives T=2.33 years. This is the return period of the mean of the EVI Distribution.

Table of frequency factors for the EVI Distribution, given in Table 3 in ANNEXURE – I(a), is taken from Haan (1977) [6]. The values computed from the above equation are equivalent to an infinite sample size in Table 3.

4.3.3 Goodness of Fit Test

The goodness of fit of a probability distribution can be tested by comparing the theoretical and sample values of the relative frequency or the cumulative frequency function. In the case of the relative frequency function, the χ^2 – test is used and with cumulative frequency function the Kolmogorov-Smirnov test is used.

Chi-Square Test: The test statistic is given by

$$\chi^2 = \sum_{i=1}^{k} \frac{n[f_s(x_i) - p(x_i)]^2}{p(x_i)} \qquad (13)$$

Where, *k* is the number of intervals; the sample value of the relative frequency of interval *i* is, $f_s(x_i) = n_i/n$; the theoretical value of the relative frequency function (also called incremental probability function) is $p(x_i) = F(x_i) - F(x_{i-1})$. It may be noted that $nf_s(x_i) = n_i$, the observed number of occurrences in interval *i*, and $np(x_i)$ is the corresponding expected number of occurrences in interval *i*.

To describe the χ^2 test, the χ^2 probability distribution must be defined. A χ^2 distribution with $\upsilon = k-l-1$ degrees of freedom (*l* is the number of parameters used in fitting the proposed distribution) is the distribution for the sum of squares of υ independent standard normal random variables z_i. The critical χ^2 distribution function is tabulated (in Table 4 in ANNEXURE – I(a)) from Haan (1977) [6]. A confidence level is chosen for the test; it is often expressed as 1-*α*, where *α* is termed the significance level.

Kolmogorov-Smirnov Test: The theoretical and sample values of the cumulative frequency are compared with the Kolmogorov-Smirnov (S-K) test. The test statistic *D*, which is based on deviations of the sample distribution function *P*(*x*) from the completely specified continuous hypothetical distribution function $P_o(x)$, such that:

$$D = \max\left|P(x) - P_o(x)\right|$$

Developed by Kolmogorov (Kite 1988) [7] in 1933, the test requires that the value of D computed from the sample distribution be less than the tabulated value of D (Table 5) at the required confidence level. Kolmogorov-Smirnov test for Gumbel's Extremal Distribution gives better result in Bangladesh.

4.4 Disaggregation of Daily Rainfall Data

4.4.1 Rainfall Cascade Disaggregation Model

Cascade level refers to the time series at a certain resolution. The transition from one cascade level to the higher one, corresponding to a doubling of resolution, is called *modulation*. A time interval at an arbitrary cascade level (i.e. time scale) is termed a *box*, which is characterized by an associated precipitation amount (0 if dry, >0 if wet). The

break-up of a wet box into two equally sized sub-boxes is denoted *branching*. In one branching, the total amount is redistributed according to two multiplicative weights, $0 \leq W_1 \leq 1$ and $0 \leq W_2 \leq 1$ ($W_1 + W_2 = 1$). The model is a multiplicative random cascade of branching number 2 with exact conservation of mass (micro canonical property as opposed to canonical cascades where the volume is only approximately conserved). The model divides daily precipitation into non overlapping time intervals. If the precipitation in a day is P_d, $P_1 = P_d W_1$ is the precipitation amount assigned to the first half of the day, and $P_2 = P_d W_2$ the amount assigned to the second half. Similarly, each half is then branched to a doubled resolution, and so on. The implementation of cascade – based model allows the conversion of daily amount into 12-hourly (1 steps), 6-hourly (2 steps), and 3-hourly (3 steps) values. The short-time intensity disaggregation model (Connolly et al. 1998) [8], is used to have three fine-resolution time interval that are 1-hour, 1/2-hour and 10-minutes. A single Poisson distribution parameter represents the number of events, N, on a rainy day. The density function of the Poisson distribution (adjusted so that N > =1) has the form:

$$f(N) = \frac{\eta^{N-1} \cdot e^{-\eta}}{(N-1)!} \tag{14}$$

Where η is a fitted coefficient. Mean (μ_N) and variance (σ^2_N) are given as:

$$\mu_N = \eta + 1 \tag{15}$$

$$\sigma^2_N = \eta \tag{16}$$

The simulated number of event N is the lowest integer to satisfy:

$$\sum_{i=1}^{N} \frac{\eta^{i-1} \cdot e^{-\eta}}{(i-1)!} \geq U \quad N \geq 1 \tag{17}$$

Where U is a uniform random number in the range 0–1.

The duration of each event, D, is represented with a gamma distribution. The scale parameter of the gamma distribution, α, has to be estimated and the shape parameter, β, is set held at 2. It results the following density function:

$$f(D) = \alpha^2 \cdot D \cdot e^{-\alpha \cdot D} \tag{18}$$

A uniform random number in the range 0–1, U, is generated and the event duration is simulated by solving the cumulative density function of the gamma distribution using Newton's method:

$$1 - (1 + \alpha \cdot D) \cdot e^{-\alpha \cdot D} = U \tag{19}$$

With these estimated point (10′-30′-1 h, 3 h, 6 h, 12 h and 24 h) following the procedures for the frequency distribution, it is possible to define the rainfall probability curves.

Using the above equations, daily and monthly basis analysis of water level data have been prepared which is shown in **ANNEXURE -I (b).**

CHAPTER 5
DESIGNING STORM SEWER

5.0 Capacity Estimate and Designing Drain Sections (Prismatic)

5.1 Manning's Formula

The Manning's formula is a widely used formula around the world to estimate capacity of an open channel or design required section. The formula is also known as Gauckler-Manning-Strickler formula. It is an empirical formula to estimate the average velocity of water flowing through an open channel. The Manning's equation is as follows:

$$V = \frac{K_n}{n} R^{\frac{2}{3}} s^{\frac{1}{2}} \quad (20)$$

Where, V = average velocity of flow (SI unit: m/s; Imperial: ft/s)

K_n = Unit conversion factor (1.00 for SI unit and 1.49 for Imperial unit)

R = Hydraulic Radius = $\frac{P}{A}$ (SI unit: m, Imperial: ft)

Here, P = Wetted Perimeter (SI unit: m, Imperial: ft)

A = Cross-sectional area of flow (SI unit: m^2, Imperial: ft^2)

s = hydraulic gradient of flow (SI unit: m/m, Imperial: ft/ft)

n = Manning's dimensionless roughness coefficient

Manning's roughness coefficient may be selected using the following **Table-5.1.**

Table-5.1: Manning's n for Channels (Chow (1951)) [5].

Type of Channel and Description	Minimum	Normal	Maximum
Natural streams - minor streams (top width at floodstage < 100 ft)			
1. Main Channels			
a. clean, straight, full stage, no rifts or deep pools	0.025	0.03	0.033
b. same as above, but more stones and weeds	0.03	0.035	0.04
c. clean, winding, some pools and shoals	0.033	0.04	0.045
d. same as above, but some weeds and stones	0.035	0.045	0.05
e. same as above, lower stages, more ineffective slopes and sections	0.04	0.048	0.055
f. same as "d" with more stones	0.045	0.05	0.06
g. sluggish reaches, weedy, deep pools	0.05	0.07	0.08
h. very weedy reaches, deep pools, or floodways with heavy stand of timber and underbrush	0.075	0.1	0.15
2. Mountain streams, no vegetation in channel, banks usually steep, trees and brush along banks submerged at high stages			

Table-5.1: Manning's n for Channels (Chow (1951)) [5].

Type of Channel and Description	Minimum	Normal	Maximum
a. bottom: gravels, cobbles, and few boulders	0.03	0.04	0.05
b. bottom: cobbles with large boulders	0.04	0.05	0.07
3. Floodplains			
a. Pasture, no brush			
1.short grass	0.025	0.03	0.035
2. high grass	0.03	0.035	0.05
b. Cultivated areas			
1. no crop	0.02	0.03	0.04
2. mature row crops	0.025	0.035	0.045
3. mature field crops	0.03	0.04	0.05
c. Brush			
1. scattered brush, heavy weeds	0.035	0.05	0.07
2. light brush and trees, in winter	0.035	0.05	0.06
3. light brush and trees, in summer	0.04	0.06	0.08
4. medium to dense brush, in winter	0.045	0.07	0.11
5. medium to dense brush, in summer	0.07	0.1	0.16
d. Trees			
1. dense willows, summer, straight	0.11	0.15	0.2
2. cleared land with tree stumps, no sprouts	0.03	0.04	0.05
3. same as above, but with heavy growth of sprouts	0.05	0.06	0.08
4. heavy stand of timber, a few down trees, little undergrowth, flood stage below branches	0.08	0.1	0.12
5. Same as 4. with flood stage reaching branches	0.1	0.12	0.16
4. Excavated or Dredged Channels			
a. Earth, straight, and uniform			
1. clean, recently completed	0.016	0.018	0.02
2. clean, after weathering	0.018	0.022	0.025
3. gravel, uniform section, clean	0.022	0.025	0.03
4. with short grass, few weeds	0.022	0.027	0.033
b. Earth winding and sluggish			
1. no vegetation	0.023	0.025	0.03
2. grass, some weeds	0.025	0.03	0.033
3. dense weeds or aquatic plants in deep channels	0.03	0.035	0.04
4. earth bottom and rubble sides	0.028	0.03	0.035
5. stony bottom and weedy banks	0.025	0.035	0.04
6. cobble bottom and clean sides	0.03	0.04	0.05
c. Dragline-excavated or dredged			
1. no vegetation	0.025	0.028	0.033
2. light brush on banks	0.035	0.05	0.06

Table-5.1: Manning's n for Channels (Chow (1951)) [5].

Type of Channel and Description	Minimum	Normal	Maximum
d. Rock cuts			
1. smooth and uniform	0.025	0.035	0.04
2. jagged and irregular	0.035	0.04	0.05
e. Channels not maintained, weeds and brush uncut			
1. dense weeds, high as flow depth	0.05	0.08	0.12
2. clean bottom, brush on sides	0.04	0.05	0.08
3. same as above, highest stage of flow	0.045	0.07	0.11
4. dense brush, high stage	0.08	0.1	0.14
5. Lined or Constructed Channels			
a. Cement			
1. neat surface	0.01	0.011	0.013
2. mortar	0.011	0.013	0.015
b. Wood			
1. planed, untreated	0.01	0.012	0.014
2. planed, creosoted	0.011	0.012	0.015
3. un-planed	0.011	0.013	0.015
4. plank with battens	0.012	0.015	0.018
5. lined with roofing paper	0.01	0.014	0.017
c. Concrete			
1. trowel finish	0.011	0.013	0.015
2. float finish	0.013	0.015	0.016
3. finished, with gravel on bottom	0.015	0.017	0.02
4. unfinished	0.014	0.017	0.02
5. gunite, good section	0.016	0.019	0.023
6. gunite, wavy section	0.018	0.022	0.025
7. on good excavated rock	0.017	0.02	
8. on irregular excavated rock	0.022	0.027	
d. Concrete bottom float finish with sides of:			
1. dressed stone in mortar	0.015	0.017	0.02
2. random stone in mortar	0.017	0.02	0.024
3. cement rubble masonry, plastered	0.016	0.02	0.024
4. cement rubble masonry	0.02	0.025	0.03
5. dry rubble or riprap	0.02	0.03	0.035
e. Gravel bottom with sides of:			
1. formed concrete	0.017	0.02	0.025
2. random stone mortar	0.02	0.023	0.026
3. dry rubble or riprap	0.023	0.033	0.036
f. Brick			
1. glazed	0.011	0.013	0.015
2. in cement mortar	0.012	0.015	0.018

Table-5.1: Manning's n for Channels (Chow (1951)) [5].

Type of Channel and Description	Minimum	Normal	Maximum
g. Masonry			
1. cemented rubble	0.017	0.025	0.03
2. dry rubble	0.023	0.032	0.035
h. Dressed ashlar/stone paving	0.013	0.015	0.017
i. Asphalt			
1. smooth	0.013	0.013	
2. rough	0.016	0.016	
j. Vegetal lining	0.03		0.5

Estimation of capacity of the existing drains and drainage channels will be estimated using Manning's formula. Design sections of the proposed sections will also be calculated using this formula.

CHAPTER 6
CONCLUSION

6.0 Conclusion

The findings and the collected data during the survey works will be used in the subsequent planning stage of the project, “Preparation of Development Plan for Fourteen Upazilas”. The prepared DEM will be used for Delineation of Catchment area and preparing contours of the project area. The collected water level, rainfall and discharge data will be analyzed and tested for fitness with observed data and successively used to predict the respective data for different time periods. These are going to be incorporated in the final planning report. The results should assist in preparing a development plan that will be sustainable from the hydrologic point of view. The surveyed cross sections, drainage inventories and list of the road name along the drains will be updated after accumulation and processing of physical feature data.

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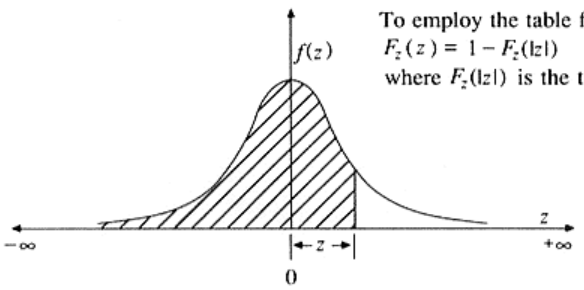
TABLES

Table 1: Cumulative probability of the Standard Normal Distribution

Cumulative probability of the standard normal distribution

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998

Source: Grant, E. L., and R. S. Leavenworth, *Statistical Quality and Control*, Table A, p.643, McGraw-Hill, New York, 1972. Used with permission.



To employ the table for $z < 0$, use
$F_z(z) = 1 - F_z(|z|)$
where $F_z(|z|)$ is the tabulated value.

Table 2: Frequency factors for Pearson Type III Distribution

K_T values for Pearson Type III distribution (positive skew)

Skew coefficient C_s or C_w	Return period in years						
	2	5	10	25	50	100	200
	Exceedence probability						
	0.50	0.20	0.10	0.04	0.02	0.01	0.005
3.0	–0.396	0.420	1.180	2.278	3.152	4.051	4.970
2.9	–0.390	0.440	1.195	2.277	3.134	4.013	4.909
2.8	–0.384	0.460	1.210	2.275	3.114	3.973	4.847
2.7	–0.376	0.479	1.224	2.272	3.093	3.932	4.783
2.6	–0.368	0.499	1.238	2.267	3.071	3.889	4.718
2.5	–0.360	0.518	1.250	2.262	3.048	3.845	4.652
2.4	–0.351	0.537	1.262	2.256	3.023	3.800	4.584
2.3	–0.341	0.555	1.274	2.248	2.997	3.753	4.515
2.2	–0.330	0.574	1.284	2.240	2.970	3.705	4.444
2.1	–0.319	0.592	1.294	2.230	2.942	3.656	4.372
2.0	–0.307	0.609	1.302	2.219	2.912	3.605	4.298
1.9	–0.294	0.627	1.310	2.207	2.881	3.553	4.223
1.8	–0.282	0.643	1.318	2.193	2.848	3.499	4.147
1.7	–0.268	0.660	1.324	2.179	2.815	3.444	4.069
1.6	–0.254	0.675	1.329	2.163	2.780	3.388	3.990
1.5	–0.240	0.690	1.333	2.146	2.743	3.330	3.910
1.4	–0.225	0.705	1.337	2.128	2.706	3.271	3.828
1.3	–0.210	0.719	1.339	2.108	2.666	3.211	3.745
1.2	–0.195	0.732	1.340	2.087	2.626	3.149	3.661
1.1	–0.180	0.745	1.341	2.066	2.585	3.087	3.575
1.0	–0.164	0.758	1.340	2.043	2.542	3.022	3.489
0.9	–0.148	0.769	1.339	2.018	2.498	2.957	3.401
0.8	–0.132	0.780	1.336	1.993	2.453	2.891	3.312
0.7	–0.116	0.790	1.333	1.967	2.407	2.824	3.223
0.6	–0.099	0.800	1.328	1.939	2.359	2.755	3.132
0.5	–0.083	0.808	1.323	1.910	2.311	2.686	3.041
0.4	–0.066	0.816	1.317	1.880	2.261	2.615	2.949
0.3	–0.050	0.824	1.309	1.849	2.211	2.544	2.856
0.2	–0.033	0.830	1.301	1.818	2.159	2.472	2.763
0.1	–0.017	0.836	1.292	1.785	2.107	2.400	2.670
0.0	0	0.842	1.282	1.751	2.054	2.326	2.576

Cont….

Table 2 Continued

K_T values for Pearson Type III distribution (negative skew)

Skew coefficient C_s or C_w	Return period in years						
	2	5	10	25	50	100	200
	Exceedence probability						
	0.50	0.20	0.10	0.04	0.02	0.01	0.005
–0.1	0.017	0.846	1.270	1.716	2.000	2.252	2.482
–0.2	0.033	0.850	1.258	1.680	1.945	2.178	2.388
–0.3	0.050	0.853	1.245	1.643	1.890	2.104	2.294
–0.4	0.066	0.855	1.231	1.606	1.834	2.029	2.201
–0.5	0.083	0.856	1.216	1.567	1.777	1.955	2.108
–0.6	0.099	0.857	1.200	1.528	1.720	1.880	2.016
–0.7	0.116	0.857	1.183	1.488	1.663	1.806	1.926
–0.8	0.132	0.856	1.166	1.448	1.606	1.733	1.837
–0.9	0.148	0.854	1.147	1.407	1.549	1.660	1.749
–1.0	0.164	0.852	1.128	1.366	1.492	1.588	1.664
–1.1	0.180	0.848	1.107	1.324	1.435	1.518	1.581
–1.2	0.195	0.844	1.086	1.282	1.379	1.449	1.501
–1.3	0.210	0.838	1.064	1.240	1.324	1.383	1.424
–1.4	0.225	0.832	1.041	1.198	1.270	1.318	1.351
–1.5	0.240	0.825	1.018	1.157	1.217	1.256	1.282
–1.6	0.254	0.817	0.994	1.116	1.166	1.197	1.216
–1.7	0.268	0.808	0.970	1.075	1.116	1.140	1.155
–1.8	0.282	0.799	0.945	1.035	1.069	1.087	1.097
–1.9	0.294	0.788	0.920	0.996	1.023	1.037	1.044
–2.0	0.307	0.777	0.895	0.959	0.980	0.990	0.995
–2.1	0.319	0.765	0.869	0.923	0.939	0.946	0.949
–2.2	0.330	0.752	0.844	0.888	0.900	0.905	0.907
–2.3	0.341	0.739	0.819	0.855	0.864	0.867	0.869
–2.4	0.351	0.725	0.795	0.823	0.830	0.832	0.833
–2.5	0.360	0.711	0.771	0.793	0.798	0.799	0.800
–2.6	0.368	0.696	0.747	0.764	0.768	0.769	0.769
–2.7	0.376	0.681	0.724	0.738	0.740	0.740	0.741
–2.8	0.384	0.666	0.702	0.712	0.714	0.714	0.714
–2.9	0.390	0.651	0.681	0.683	0.689	0.690	0.690
–3.0	0.396	0.636	0.666	0.666	0.666	0.667	0.667

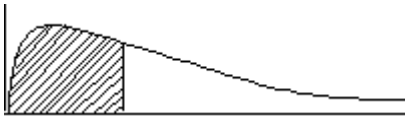
Source: U. S. Water Resources Council (1981).

Table 3: Frequency factors for Pearson Type III Distribution

	Return Period								
Sample	5	10	15	20	25	50	75	100	1000
15	0.967	1.703	2.117	2.410	2.632	3.321	3.721	4.005	6.265
20	0.919	1.625	2.023	2.302	2.517	3.179	3.563	3.836	6.006
25	0.888	1.575	1.963	2.235	2.444	3.088	3.463	3.729	5.842
30	0.866	1.541	1.922	2.188	2.393	3.026	3.393	3.653	5.727
35	0.851	1.516	1.891	2.152	2.354	2.979	3.341	3.598	
40	0.838	1.495	1.866	2.126	2.326	2.943	3.301	3.554	5.576
45	0.829	1.478	1.847	2.104	2.303	2.913	3.268	3.520	
50	0.820	1.466	1.831	2.086	2.283	2.889	3.241	3.491	5.478
55	0.813	1.455	1.818	2.071	2.267	2.869	3.219	3.467	
60	0.807	1.446	1.806	2.059	2.253	2.852	3.200	3.446	
65	0.801	1.437	1.796	2.048	2.241	2.837	3.183	3.429	
70	0.797	1.430	1.788	2.038	2.230	2.824	3.169	3.413	5.359
75	0.972	1.423	1.780	2.029	2.220	2.812	3.155	3.400	
80	0.788	1.417	1.773	2.020	2.212	2.802	3.145	3.387	
85	0.785	1.413	1.767	2.013	2.205	2.793	3.135	3.376	
90	0.782	1.409	1.762	2.007	2.198	2.785	3.125	3.367	
95	0.780	1.405	1.757	2.002	2.193	2.777	3.116	3.357	
100	0.779	1.401	1.752	1.998	2.187	2.770	3.109	3.349	5.261
α	0.719	1.305	1.635	1.866	2.044	2.592	2.911	3.137	4.936

Source: Journal American Statistical Association 47:425-441, 1952.Z.W. Birnbaum.

Table 4: χ^2 Distribution



DOF v	$x^2_{.995}$	$x^2_{.99}$	$x^2_{.975}$	$x^2_{.95}$	$x^2_{.90}$	$x^2_{.75}$	$x^2_{.50}$	$x^2_{.25}$	$x^2_{.10}$	$x^2_{.05}$	$x^2_{.025}$	$x^2_{.01}$	$x^2_{.005}$
1	7.88	6.63	5.02	3.84	2.71	1.32	0.455	0.102	0.0158	0.0039	0.0010	0.0002	0.0000
2	10.6	9.21	7.38	5.99	4.61	2.77	1.39	0.575	.211	.103	.0506	.0201	.0100
3	12.8	11.3	9.35	7.81	6.25	4.11	2.37	1.21	.584	.352	.216	.115	.072
4	14.9	13.3	11.1	9.49	7.78	5.39	3.36	1.92	1.06	.711	.484	.297	.207
5	16.7	15.1	12.8	11.1	9.24	6.63	4.35	2.67	1.61	1.15	.831	.554	.412
6	18.5	16.8	14.4	12.6	10.6	7.84	5.35	3.45	2.20	1.64	1.24	.872	.676
7	20.3	18.5	16.0	14.1	12.0	9.04	6.35	4.25	2.83	2.17	1.69	1.24	.989
8	22.0	20.1	17.5	15.5	13.4	10.2	7.34	5.07	3.49	2.73	2.18	1.65	1.34
9	23.6	21.7	19.0	16.9	14.7	11.4	8.34	5.90	4.17	3.33	2.70	2.09	1.73
10	25.2	23.2	20.5	18.3	16.0	12.5	9.34	6.74	4.87	3.94	3.25	2.56	2.16
11	26.8	24.7	21.9	19.7	17.3	13.7	10.3	7.58	5.58	4.57	3.82	3.05	2.60
12	28.3	26.2	23.3	21.0	18.5	14.8	11.3	8.44	6.30	5.23	4.40	3.57	3.07
13	29.8	27.7	24.7	22.4	19.8	16.0	12.3	9.30	7.04	5.89	5.01	4.11	3.57
14	31.3	29.1	26.1	23.7	21.1	17.1	13.3	10.2	7.79	6.57	5.63	4.66	4.07
15	32.8	30.6	27.5	25.0	22.3	18.2	14.3	11.0	8.55	7.26	6.26	5.23	4.60
16	34.3	32.0	28.8	26.3	23.5	19.4	15.3	11.9	9.31	7.96	6.91	5.81	5.14
17	35.7	33.4	30.2	27.6	24.8	20.5	16.3	12.8	10.1	8.67	7.56	6.41	5.70
18	37.2	34.8	31.5	28.9	26.0	21.6	17.3	13.7	10.9	9.39	8.23	7.01	6.26
19	38.6	36.2	32.9	30.1	27.2	22.7	18.3	14.6	11.7	10.1	8.91	7.63	6.84
20	40.0	37.6	34.2	31.4	28.4	23.8	19.3	15.5	12.4	10.9	9.59	8.26	7.43
21	41.4	38.9	35.5	32.7	29.6	24.9	20.3	16.3	13.2	11.6	10.3	8.90	8.03
22	42.8	40.3	36.8	33.9	30.8	26.0	21.3	17.2	14.0	12.3	11.0	9.54	8.64

23	44.2	41.6	38.1	35.2	32.0	27.1	22.3	18.1	14.8	13.1	11.7	10.2	9.26
24	45.6	43.0	39.4	36.4	33.2	28.2	23.3	19.0	15.7	13.8	12.4	10.9	9.89
25	46.9	44.3	40.6	37.7	34.4	29.3	24.3	19.9	16.5	14.6	13.1	11.5	10.5
26	48.3	45.6	41.9	38.9	35.6	30.4	25.3	20.8	17.3	15.4	13.8	12.2	11.2
27	49.6	47.0	43.2	40.1	36.7	31.5	26.3	21.7	18.1	16.2	14.6	12.9	11.8
28	51.0	48.3	44.5	41.3	37.9	32.6	27.3	22.7	18.9	16.9	15.3	13.6	12.5
29	52.3	49.6	45.7	42.6	39.1	33.7	28.3	23.6	19.8	17.7	16.0	14.3	13.1
30	53.7	50.9	47.0	43.8	40.3	34.8	29.3	24.5	20.6	18.5	16.8	15.0	13.8
40	66.8	63.7	59.3	55.8	51.8	45.6	39.3	33.7	29.1	26.5	24.4	22.2	20.7
50	79.5	76.2	71.4	67.5	63.2	56.3	49.3	42.9	37.7	34.8	32.4	29.7	28.0
60	92.0	88.4	83.3	79.1	74.4	67.0	59.3	52.3	46.5	43.2	40.5	37.5	35.5
70	104.2	100.4	95.0	90.5	85.5	77.6	69.3	61.7	55.3	51.7	48.8	45.4	43.3
80	116.3	112.3	106.6	101.9	96.6	88.1	79.3	71.1	64.3	60.4	57.2	53.5	51.2
90	128.3	124.1	118.1	113.1	107.6	98.6	89.3	80.6	73.3	69.1	65.6	61.8	59.2
100	140.2	135.8	129.6	124.3	118.5	109.1	99.3	90.1	82.4	77.9	74.2	70.1	67.3

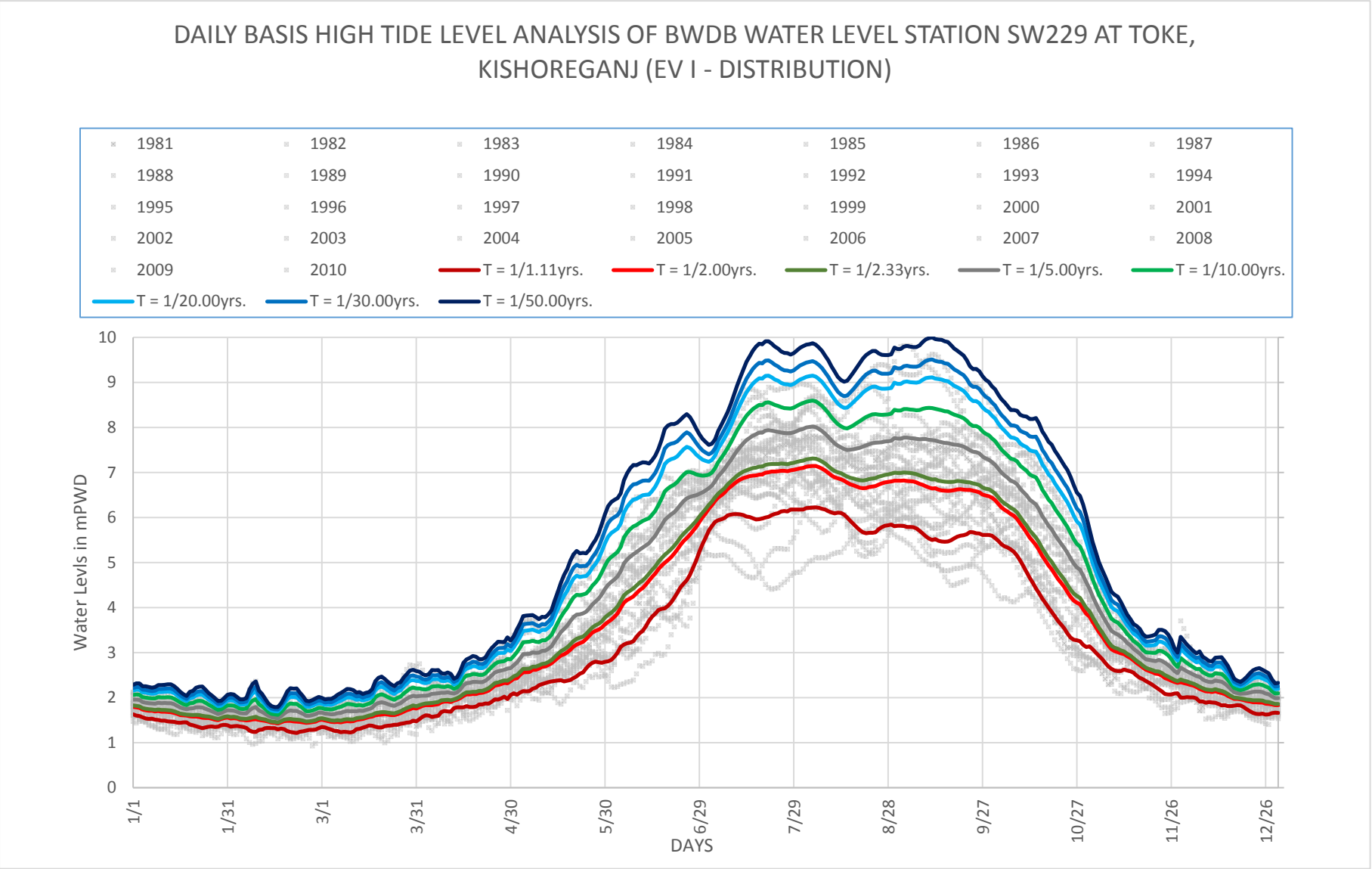
Source: Catherine M. Thompson, Table of percentage points of the χ^2 distribution, Biometrika, Vol. 32 (1941), by permission of the author and publisher.

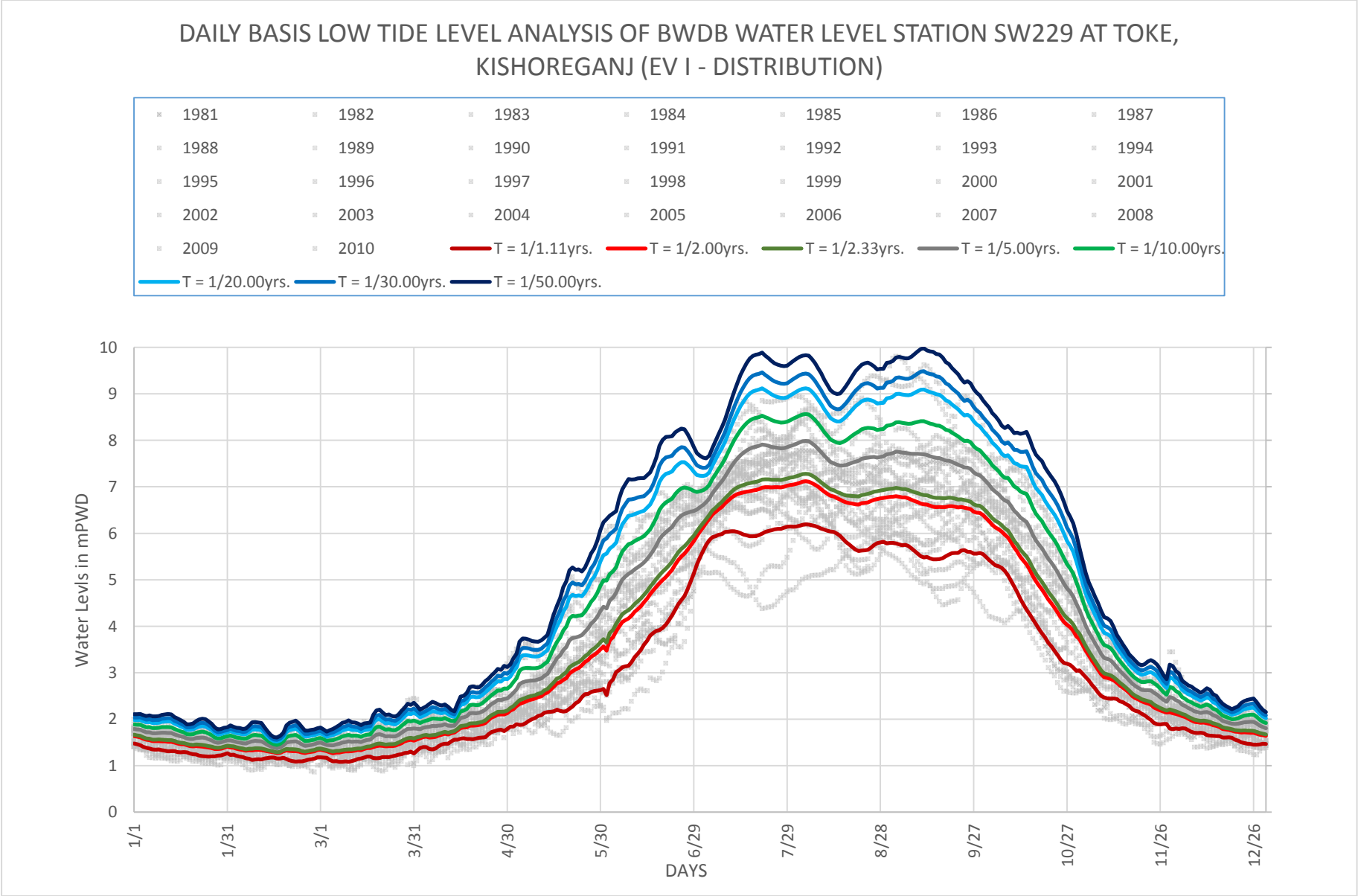
Table 5: Kolmogorov-Smirnov Distribution

Sample size (n)	Significance Level				
	.20	0.15	0.10	0.05	0.01
1	.900	.925	.950	.975	.995
2	.684	.726	.776	.842	.929
3	.565	.597	.642	.708	.829
4	.494	.725	.564	.624	.734
5	.446	.474	.510	.563	.669
6	.410	.436	.470	.521	.618
7	.381	.405	.438	.486	.577
8	.358	.381	.411	.457	.543
9	.339	.360	.388	.432	.514
10	.322	.342	.368	.409	.486
11	.307	.326	.352	.391	.468
12	.295	.313	.338	.375	.450
13	.284	.302	.325	.361	.433
14	.274	.292	.314	.349	.418
15	.266	.283	.304	.338	.404
16	.258	.274	.295	.328	.391
17	.250	.266	.286	.318	.380
18	.244	.259	.278	.309	.370
19	.237	.252	.272	.301	.361
20	.231	.246	.264	.294	.352
25	.21	.22	.24	.264	.32
30	.19	.20	.22	.242	.29
35	.18	.19	.21	.23	.27
40				.21	.25
50				.19	.23
60				.17	.21
70				.16	.19
80				.15	.18
90				.14	
100				.14	
Asymptotic Formula	$\frac{1.70}{\sqrt{n}}$	$\frac{1.14}{\sqrt{n}}$	$\frac{1.22}{\sqrt{n}}$	$\frac{1.36}{\sqrt{n}}$	$\frac{1.63}{\sqrt{n}}$

Source: Journal American Statistical Association 47:425-441, 1952.Z.W. Birnbaum.

A.1b.1 ANALYSED RESULTS OF BWDB WATER LEVEL GAUGE STATION SW 229 ON THE OLD BRAHMAPUTRA RIVER




DAILY BASIS LOW TIDE LEVEL ANALYSIS OF BWDB WATER LEVEL STATION SW229 AT TOKE, KISHOREGANJ (EV I - DISTRIBUTION)
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
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2000
2001
2002
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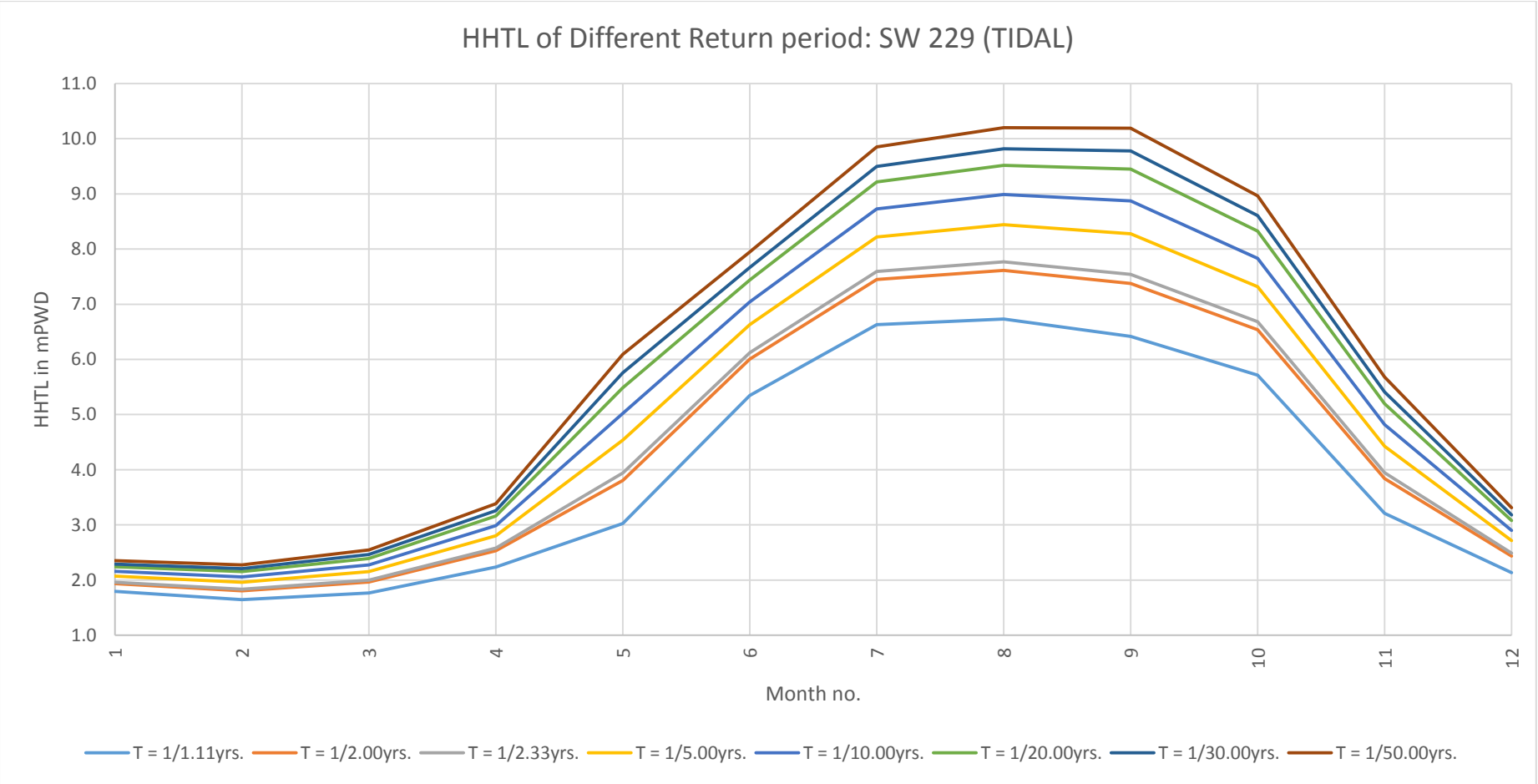
2004
2005
2006
2007
2008
2009
2010
T = 1/1.11yrs.
T = 1/2.00yrs.
T = 1/2.33yrs.
T = 1/5.00yrs.
T = 1/10.00yrs.
T = 1/20.00yrs.
T = 1/30.00yrs.
T = 1/50.00yrs.
Water Levls in mPWD
0
1
2
3
4
5
6
7
8
9
10
1/1
1/31
3/1
3/31
4/30
5/30
6/29
7/29
8/28
9/27
10/27
11/26
12/26
DAYS

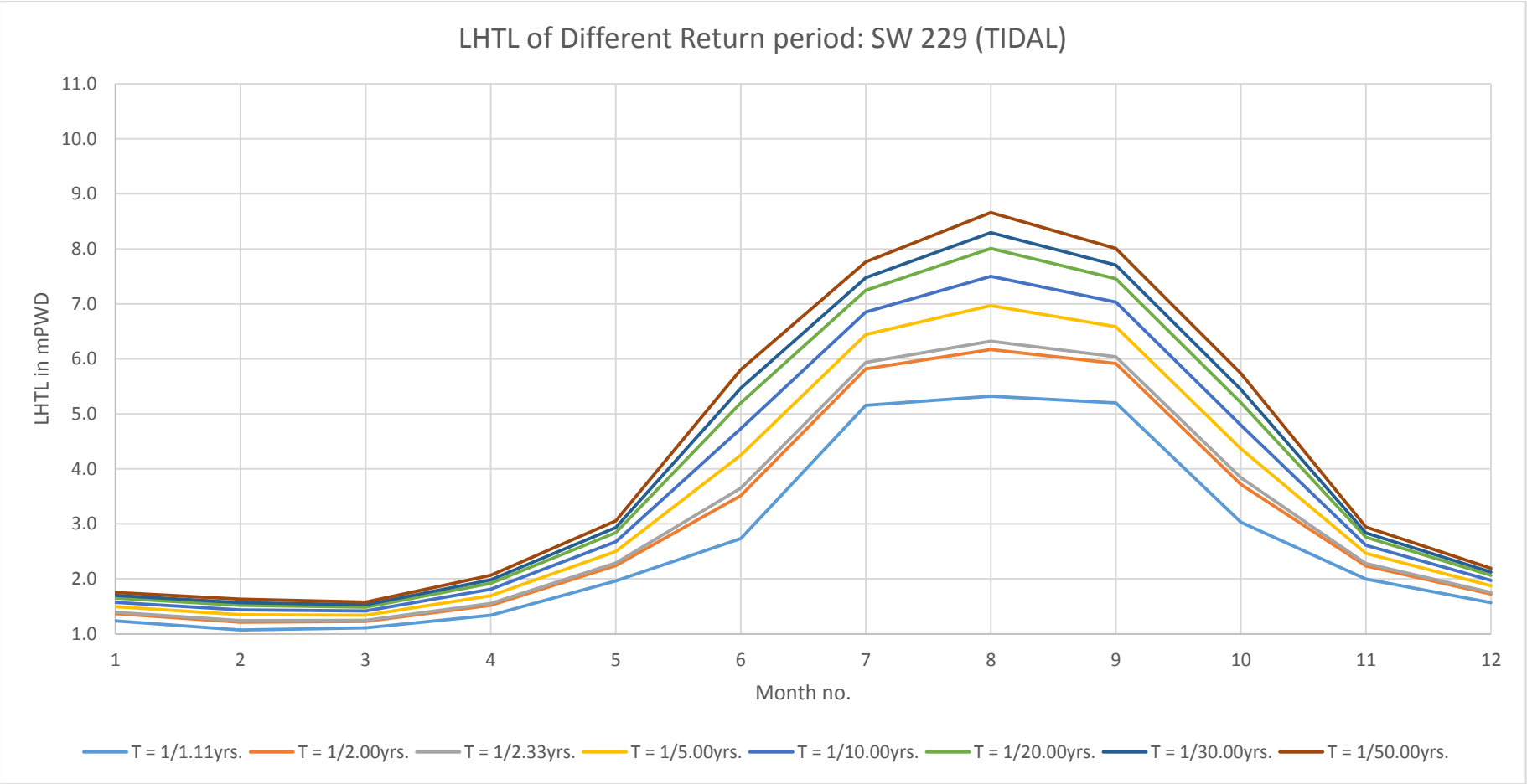
MONTHLY BASIS ANALYSIS OF DATA OF WATER LEVEL GAUGE STATION SW 229 (HTL)

Monthly Data				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
WL			Year	Monthly Maximum HTL (mPWD)												Monthly Minimum HTL (mPWD)											
			1981				02.79	03.51	04.88	07.71	07.80	07.65	06.07	02.90	02.71				01.36	02.01	03.63	05.27	07.07	06.22	02.90	02.20	01.62
			1982	01.83	01.62	01.71	02.59	03.78	06.87	07.34	08.01	07.12	06.64	02.76	02.00	01.22	01.10	01.13	01.77	02.26	02.65	06.90	05.84	05.75	02.59	01.64	01.40
			1983	01.73	01.69	02.23	02.64	03.86	05.70	06.92	07.76	07.99	07.53	04.24	02.36	01.15	00.96	01.18	01.60	02.26	03.43	05.72	06.20	07.10	04.46	02.25	01.63
			1984	01.94	01.74	01.96	02.54	05.02	06.77	08.19	08.71	08.97	08.40	04.40	02.23	01.36	00.92	01.20	01.41	02.31	04.61	06.00	06.30	06.28	04.58	02.14	01.53
			1985	01.67	02.36	02.08	02.75	03.44	06.45	08.16	08.38	07.43	06.73	03.78	02.50	01.26	01.08	01.36	01.55	02.45	03.25	06.23	06.23	06.53	03.88	02.38	01.84
			1986	01.99	01.76	01.86	02.82	02.87	05.28	06.81	06.83	07.30	07.38	04.20	02.51	01.38	01.07	00.99	01.26	02.21	02.22	05.60	05.13	06.16	04.39	02.27	01.59
			1987	01.92	01.70	01.75	02.57	02.61	05.17	07.95	08.92	07.85	07.70	04.02	02.53	01.31	01.13	01.10	01.43	02.22	02.48	05.32	08.01	07.48	04.24	02.29	01.83
			1988	01.99	01.82	02.06	02.64	05.82	07.04	08.66	09.46	09.81	06.49	04.11	03.53	01.31	01.32	01.39	01.65	02.19	04.88	06.44	07.06	06.32	04.36	02.51	01.83
			1989	01.94	01.98	01.88	02.20	04.54	06.07	07.57	06.98	07.07	06.94	04.27	02.18	01.44	01.26	01.19	01.18	02.16	04.65	05.08	05.92	05.98	04.43	02.21	01.56
			1990	01.73	01.69	02.00	02.87	04.19	06.58	07.52	07.60	06.85	07.42	04.17	02.55	01.26	01.11	01.13	01.50	02.47	04.47	06.39	05.94	05.53	04.34	02.21	01.80
			1991	02.28	01.97	01.80	02.23	05.19	06.94	08.25	07.47	08.10	07.58	04.88	02.55	01.42	01.35	01.14	01.52	02.35	05.08	06.60	06.76	07.04	05.06	02.35	01.89
			1992	02.11	02.01	02.18	02.46	03.43	05.64	06.80	06.39	06.00	05.74	03.43	02.26	01.49	01.36	01.46	01.82	02.32	03.02	05.94	05.18	05.14	03.59	02.35	01.71
			1993	01.98	02.09	02.03	02.30	04.54	06.91	08.08	07.95	08.27	06.56	03.67	02.56	01.43	01.31	01.33	01.40	02.29	03.72	06.70	07.28	05.84	03.77	02.34	01.77
			1994	02.13	01.88	02.72	02.75	03.02	05.60	05.69	05.82	05.56	04.48	02.95	02.25	01.39	01.28	01.34	02.05	02.04	02.73	04.40	04.78	04.58	02.71	01.76	01.54
			1995	01.80	01.67	01.90	02.23	04.36	06.82	08.85	08.21	07.49	07.19	03.67	02.54	01.10	01.14	01.02	01.52	01.94	03.67	06.85	06.38	05.86	03.38	02.59	01.83
			1996	01.87	01.86	02.00	02.29	04.49	05.05	07.87	07.62	06.90	05.43	04.69	02.42	01.33	01.28	01.21	01.78	02.34	03.58	05.42	06.23	05.35	03.54	02.50	01.98
			1997	02.12	01.88	01.92	02.13	02.91	05.67	07.61	06.76	06.87	06.80	02.88	02.09	01.50	01.41	01.34	01.59	01.81	02.92	05.49	05.66	05.75	02.90	01.95	01.69
			1998	01.96	01.73	02.09	02.77	04.00	06.44	08.94	09.39	09.62	06.65	04.96	02.84	01.44	01.25	01.25	01.63	02.11	04.11	06.47	08.51	06.72	04.08	02.70	01.98
			1999	02.15	01.76	01.84	02.41	03.37	06.20	07.30	07.53	07.82	06.01	04.84	02.42	01.56	01.42	01.38	01.41	02.50	03.46	06.47	06.11	06.06	05.02	02.45	01.96
			2000	02.02	01.80	02.04	03.17	04.70	06.76	06.96	07.81	07.61	07.21	04.17	02.44	01.55	01.39	01.31	01.58	02.87	04.91	06.10	06.16	06.87	03.50	02.29	01.94
			2001	01.95	01.90	01.88	02.32	03.27	05.33	05.68	06.80	06.95	06.29	03.91	02.72	01.58	01.40	01.36	01.48	02.08	03.33	04.65	05.42	05.82	03.89	02.50	01.89
			2002	02.07	01.75	02.15	03.30	03.78	06.54	08.15	08.65	06.70	05.83			01.55	01.33	01.35	01.70	03.17	03.48	06.50	06.86	04.49	02.85		
			2003	01.97	01.71	01.91										01.60	01.40	01.31									
			2004																								
			2005																								
			2006																								
			2007																								
			2008																								
			2009																								
			2010																								
			2011																								
			2012																								
			2013																								
			2014																								
			2015																								
			MAX	02.28	02.36	02.72	03.30	05.82	07.04	08.94	09.46	09.81	08.40	04.96	03.53	01.60	01.42	01.46	02.05	03.17	05.08	06.90	08.51	07.48	05.06	02.70	01.98
			MIN	01.67	01.62	01.71	02.13	02.61	04.88	05.68	05.82	05.56	04.48	02.76	02.00	01.10	00.92	00.99	01.18	01.81	02.22	04.40	04.78	04.49	02.59	01.64	01.40
			N	22	22	22	22	22	22	22	22	22	22	21	21	22	22	22	22	22	22	22	22	22	22	21	21
			AVE.	01.96	01.83	02.00	02.58	03.94	06.12	07.59	07.77	07.54	06.68	03.95	02.49	01.39	01.24	01.25	01.55	02.29	03.65	05.93	06.32	06.04	03.84	02.28	01.75
			σ	00.15	00.17	00.21	00.31	00.83	00.70	00.87	00.94	01.02	00.88	00.67	00.32	00.14	00.15	00.13	00.20	00.30	00.83	00.71	00.90	00.76	00.73	00.26	00.17
ANALYSED DATA:																											
T = 1/1.11yrs.	$K_{1.11}$	=	-1.10	01.79	01.65	01.77	02.24	03.03	05.35	06.63	06.73	06.42	05.71	03.21	02.13	01.24	01.07	01.11	01.34	01.96	02.73	05.16	05.32	05.20	03.03	02.00	01.57
T = 1/2.00yrs.	$K_{2.00}$	=	-0.16	01.94	01.81	01.96	02.53	03.80	06.01	07.45	07.61	07.37	06.54	03.84	02.43	01.37	01.21	01.23	01.52	02.24	03.51	05.82	06.17	05.91	03.72	02.24	01.72
T = 1/2.33yrs.	$K_{2.33}$	=	0.00	01.96	01.83	02.00	02.58	03.94	06.12	07.59	07.77	07.54	06.69	03.95	02.49	01.39	01.24	01.25	01.55	02.29	03.65	05.93	06.32	06.04	03.84	02.28	01.75
T = 1/5.00yrs.	$K_{5.00}$	=	0.72	02.07	01.96	02.15	02.80	04.54	06.63	08.22	08.44	08.28	07.32	04.43	02.71	01.49	01.35	01.34	01.70	02.50	04.25	06.44	06.97	06.59	04.37	02.46	01.87
T = 1/10.00yrs.	$K_{10.00}$	=	1.30	02.16	02.06	02.27	02.99	05.02	07.04	08.73	08.99	08.87	07.83	04.82	02.90	01.57	01.44	01.41	01.81	02.67	04.73	06.85	07.50	07.03	04.79	02.61	01.97
T = 1/20.00yrs.	$K_{20.00}$	=	1.87	02.24	02.15	02.39	03.16	05.49	07.44	09.22	09.52	09.45	08.32	05.19	03.08	01.65	01.52	01.49	01.92	02.84	05.20	07.25	08.01	07.46	05.21	02.76	02.07
T = 1/30.00yrs.	$K_{30.00}$	=	2.19	02.29	02.21	02.46	03.26	05.76	07.67	09.50	09.82	09.78	08.61	05.41	03.18	01.70	01.57	01.53	01.98	02.94	05.47	07.48	08.30	07.70	05.44	02.84	02.12
T = 1/50.00yrs.	$K_{50.00}$	=	2.59	02.35	02.28	02.55	03.38	06.09	07.95	09.85	10.20	10.19	08.96	05.68	03.31	01.76	01.63	01.58	02.06	03.05	05.80	07.76	08.66	08.01	05.74	02.94	02.19

MONTHLY BASIS ANALYSIS OF DATA OF WATER LEVEL GAUGE STATION SW 229 (HTL)



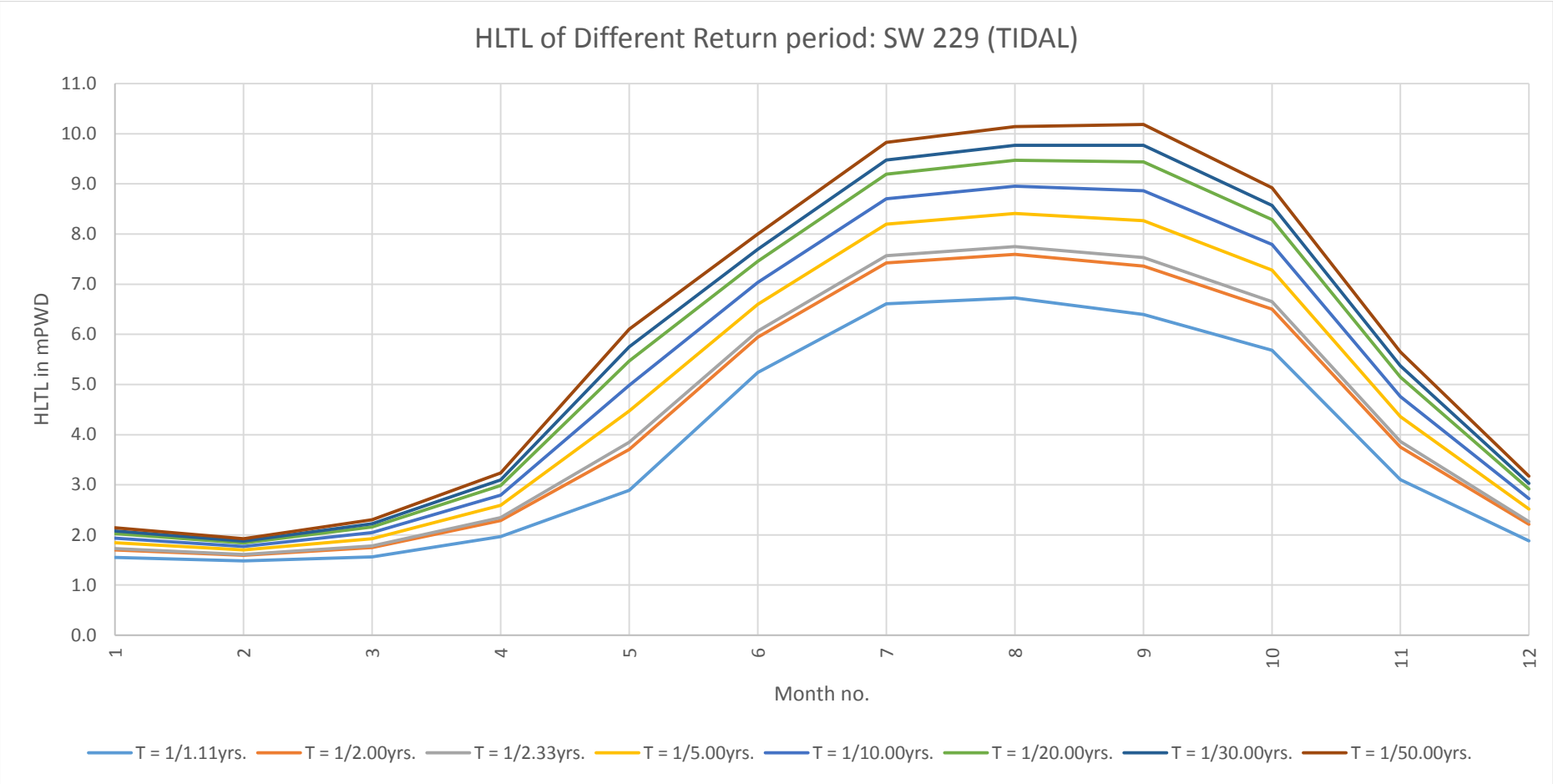
MONTHLY BASIS ANALYSIS OF DATA OF WATER LEVEL GAUGE STATION SW 229 (HTL)



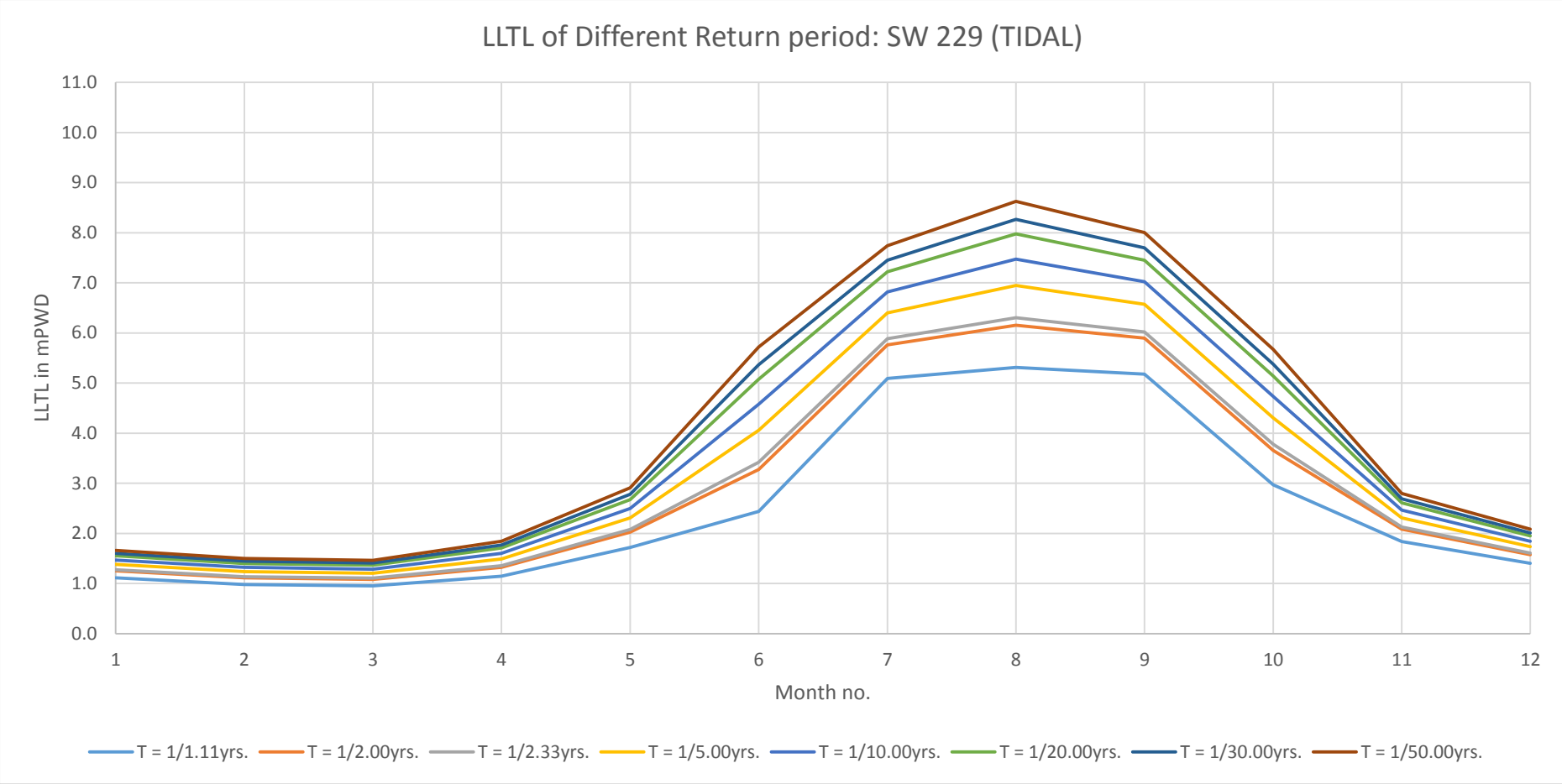
MONTHLY BASIS ANALYSIS OF DATA OF WATER LEVEL GAUGE STATION SW 229 (LTL)

Monthly Data		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
WL	Year	Monthly Maximum LTL (mPWD)												Monthly Minimum LTL (mPWD)											
	1981				02.70	03.35	04.76	07.68	07.77	07.65	06.01	02.74	02.47				01.05	01.80	03.57	05.12	07.07	06.16	02.80	01.98	01.40
	1982	01.52	01.40	01.49	02.35	03.75	06.82	07.29	08.01	07.12	06.55	02.64	01.72	01.10	01.01	00.98	01.55	02.04	02.56	06.88	05.84	05.75	02.56	01.46	01.23
	1983	01.46	01.46	01.97	02.43	03.83	05.65	06.91	07.75	07.97	07.49	04.14	02.05	01.05	00.90	01.04	01.32	02.05	03.40	05.71	06.17	07.09	04.39	02.03	01.48
	1984	01.65	01.54	01.72	02.27	05.01	06.76	08.17	08.70	08.95	08.32	04.32	02.06	01.21	00.86	01.01	01.17	02.06	04.58	05.99	06.29	06.28	04.51	02.08	01.43
	1985	01.47	01.49	01.87	02.61	03.32	06.43	08.11	08.37	07.43	06.72	03.73	02.16	01.14	01.02	01.19	01.42	02.22	02.96	06.22	06.22	06.52	03.84	02.18	01.61
	1986	01.76	01.58	01.59	02.54	02.76	04.96	06.81	06.81	07.28	07.38	04.12	02.25	01.27	01.00	00.88	01.08	02.13	02.02	05.41	05.12	06.12	04.30	02.13	01.46
	1987	01.63	01.52	01.53	02.28	02.47	05.10	07.86	08.91	07.83	07.67	03.93	02.18	01.13	01.01	00.92	01.23	01.95	02.26	05.27	07.95	07.48	04.14	02.14	01.60
	1988	01.68	01.58	01.82	02.19	05.71	07.04	08.66	09.28	09.81	06.45	04.01	03.45	01.16	01.16	01.21	01.44	01.93	04.86	06.38	07.05	06.31	04.26	02.30	01.71
	1989	01.74	01.74	01.67	02.00	04.36	06.06	07.54	06.98	07.05	06.90	04.19	02.03	01.29	01.23	01.02	01.00	01.96	04.60	05.07	05.91	05.95	04.36	02.06	01.38
	1990	01.53	01.52	01.75	02.64	04.12	06.53	07.51	07.59	06.83	07.42	04.10	02.25	01.14	00.98	00.97	01.28	02.34	04.29	06.38	05.90	05.53	04.27	02.02	01.66
	1991	01.98	01.71	01.56	01.96	05.18	06.90	08.24	07.46	08.10	07.55	04.80	02.36	01.26	01.18	00.90	01.30	01.79	05.02	06.57	06.74	07.03	04.98	02.20	01.72
	1992	01.84	01.82	01.92	02.19	03.40	05.49	06.79	06.39	06.00	05.69	03.37	02.04	01.38	01.24	01.30	01.56	02.15	02.89	05.81	05.17	05.12	03.53	02.08	01.53
	1993	01.73	01.82	01.77	01.98	04.52	06.87	08.08	07.91	08.26	06.54	03.66	02.28	01.27	01.15	01.14	01.22	02.00	03.66	06.66	07.25	05.84	03.74	02.14	01.59
	1994	01.84	01.66	02.43	02.45	02.85	05.60	05.67	05.82	05.54	04.42	02.70	01.95	01.26	01.16	01.16	01.75	01.79	02.55	04.38	04.78	04.53	02.62	01.62	01.37
	1995	01.54	01.46	01.62	01.97	04.35	06.81	08.84	08.21	07.41	07.13	03.59	02.36	01.01	01.00	00.90	01.32	01.70	03.64	06.78	06.34	05.85	03.31	02.41	01.71
	1996	01.68	01.68	01.81	02.07	04.48	04.91	07.86	07.58	06.90	05.42	04.65	02.28	01.28	01.20	01.16	01.61	02.13	03.55	05.26	06.21	05.34	03.50	02.34	01.81
	1997	01.94	01.73	01.73	01.96	02.70	05.63	07.59	06.76	06.86	06.78	02.84	01.97	01.38	01.29	01.22	01.45	01.65	02.80	05.41	05.65	05.74	02.84	01.88	01.64
	1998	01.79	01.63	01.91	02.54	03.94	06.43	08.93	09.39	09.62	06.56	04.89	02.72	01.37	01.17	01.14	01.45	02.03	04.10	06.46	08.50	06.68	04.08	02.62	01.91
	1999	02.01	01.64	01.72	02.15	03.23	06.05	07.30	07.49	07.82	06.00	04.77	02.29	01.46	01.34	01.28	01.30	02.20	03.36	06.43	06.09	06.03	04.98	02.36	01.87
	2000	01.81	01.67	01.95	03.10	04.60	06.73	06.96	07.81	07.60	07.17	04.09	02.23	01.49	01.28	01.26	01.48	02.77	01.97	06.10	06.13	06.87	03.49	02.22	01.83
	2001	01.82	01.75	01.70	02.10	03.00	05.33	05.63	06.78	06.93	06.28	03.86	02.51	01.51	01.33	01.24	01.34	01.94	03.19	04.64	05.42	05.78	03.83	02.36	01.75
	2002	01.89	01.59	01.95	03.12	03.73	06.53	08.07	08.64	06.66	05.82			01.43	01.23	01.20	01.49	03.04	03.37	06.47	06.82	04.46	02.77		
	2003	01.72	01.48	01.72										01.48	01.26	01.22									
	2004																								
	2005																								
	2006																								
	2007																								
	2008																								
	2009																								
	2010																								
	2011																								
	2012																								
	2013																								
	2014																								
	2015																								
	MAX	02.01	01.82	02.43	03.12	05.71	07.04	08.93	09.39	09.81	08.32	04.89	03.45	01.51	01.34	01.30	01.75	03.04	05.02	06.88	08.50	07.48	04.98	02.62	01.91
	MIN	01.46	01.40	01.49	01.96	02.47	04.76	05.63	05.82	05.54	04.42	02.64	01.72	01.01	00.86	00.88	01.00	01.65	01.97	04.38	04.78	04.46	02.56	01.46	01.23
	N	22	22	22	22	22	22	22	22	22	22	21	21	22	22	22	22	22	22	22	22	22	22	21	21
	AVE.	01.73	01.61	01.78	02.35	03.85	06.06	07.57	07.75	07.53	06.65	03.86	02.27	01.28	01.14	01.11	01.36	02.08	03.42	05.88	06.30	06.02	03.78	02.12	01.60
	σ	00.16	00.12	00.20	00.34	00.87	00.75	00.87	00.92	01.02	00.88	00.69	00.35	00.15	00.14	00.14	00.19	00.32	00.89	00.72	00.90	00.77	00.73	00.26	00.18
ANALYSED DATA:																									
T = 1/1.11yrs.	$K_{1.11}$ = -1.10	01.55	01.48	01.56	01.97	02.89	05.24	06.61	06.73	06.40	05.68	03.10	01.88	01.11	00.98	00.95	01.15	01.72	02.44	05.09	05.31	05.18	02.97	01.84	01.40
T = 1/2.00yrs.	$K_{2.00}$ = -0.16	01.70	01.59	01.75	02.29	03.71	05.94	07.43	07.59	07.36	06.50	03.75	02.21	01.25	01.11	01.08	01.32	02.02	03.27	05.76	06.15	05.89	03.66	02.08	01.57
T = 1/2.33yrs.	$K_{2.33}$ = 0.00	01.73	01.61	01.78	02.35	03.85	06.06	07.57	07.75	07.53	06.65	03.86	02.27	01.28	01.14	01.11	01.36	02.08	03.42	05.88	06.30	06.02	03.78	02.12	01.60
T = 1/5.00yrs.	$K_{5.00}$ = 0.72	01.84	01.70	01.93	02.59	04.47	06.60	08.20	08.41	08.27	07.28	04.36	02.52	01.38	01.24	01.21	01.49	02.31	04.06	06.40	06.95	06.57	04.30	02.31	01.74
T = 1/10.00yrs.	$K_{10.00}$ = 1.30	01.94	01.77	02.04	02.79	04.98	07.04	08.71	08.95	08.87	07.79	04.76	02.72	01.47	01.32	01.29	01.60	02.50	04.58	06.82	07.47	07.02	04.73	02.46	01.84
T = 1/20.00yrs.	$K_{20.00}$ = 1.87	02.03	01.84	02.16	02.98	05.47	07.46	09.20	09.47	09.44	08.29	05.15	02.92	01.55	01.40	01.36	01.71	02.68	05.08	07.22	07.97	07.45	05.14	02.61	01.95
T = 1/30.00yrs.	$K_{30.00}$ = 2.19	02.08	01.88	02.22	03.10	05.75	07.70	09.48	09.77	09.77	08.57	05.37	03.03	01.60	01.44	01.41	01.77	02.78	05.36	07.45	08.26	07.70	05.38	02.69	02.01
T = 1/50.00yrs.	$K_{50.00}$ = 2.59	02.14	01.92	02.30	03.23	06.10	08.00	09.83	10.14	10.19	08.92	05.65	03.17	01.66	01.50	01.46	01.84	02.91	05.72	07.74	08.63	08.01	05.67	02.79	02.08

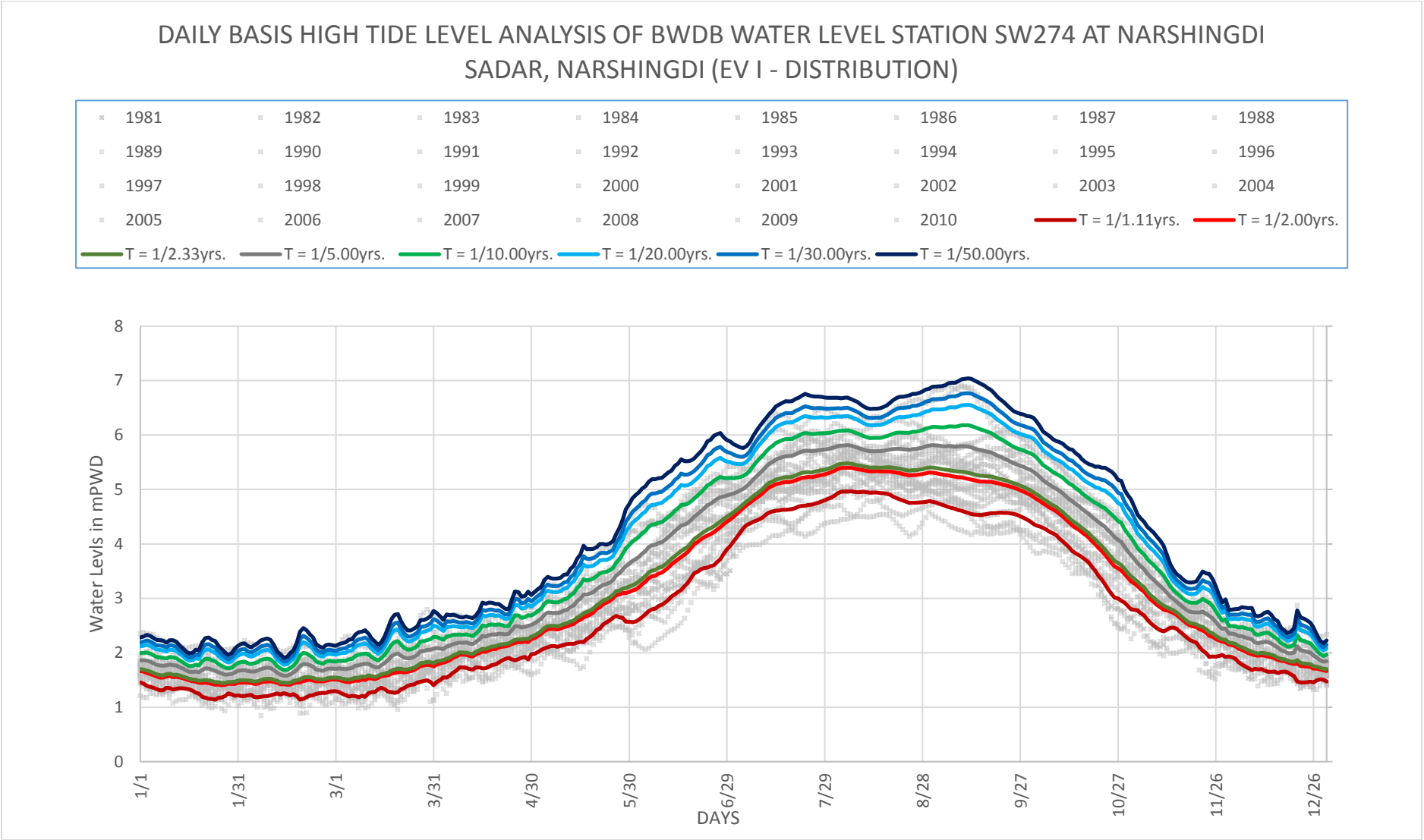
MONTHLY BASIS ANALYSIS OF DATA OF WATER LEVEL GAUGE STATION SW 229 (LTL)

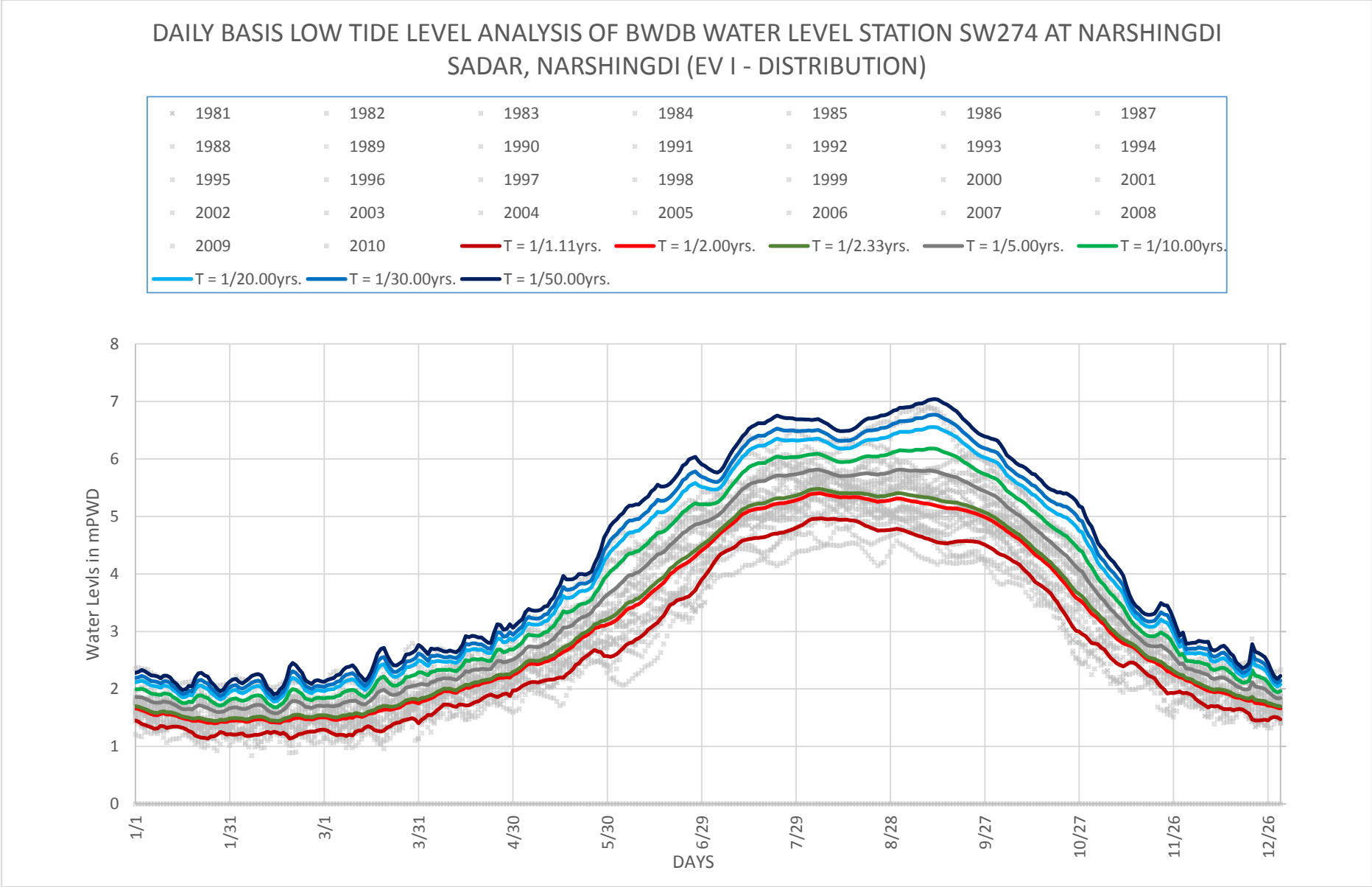


MONTHLY BASIS ANALYSIS OF DATA OF WATER LEVEL GAUGE STATION SW 229 (LTL)



A.1b.2 ANALYSED RESULTS OF BWDB WATER LEVEL GAUGE STATION SW 274 ON THE MEGHNA RIVER

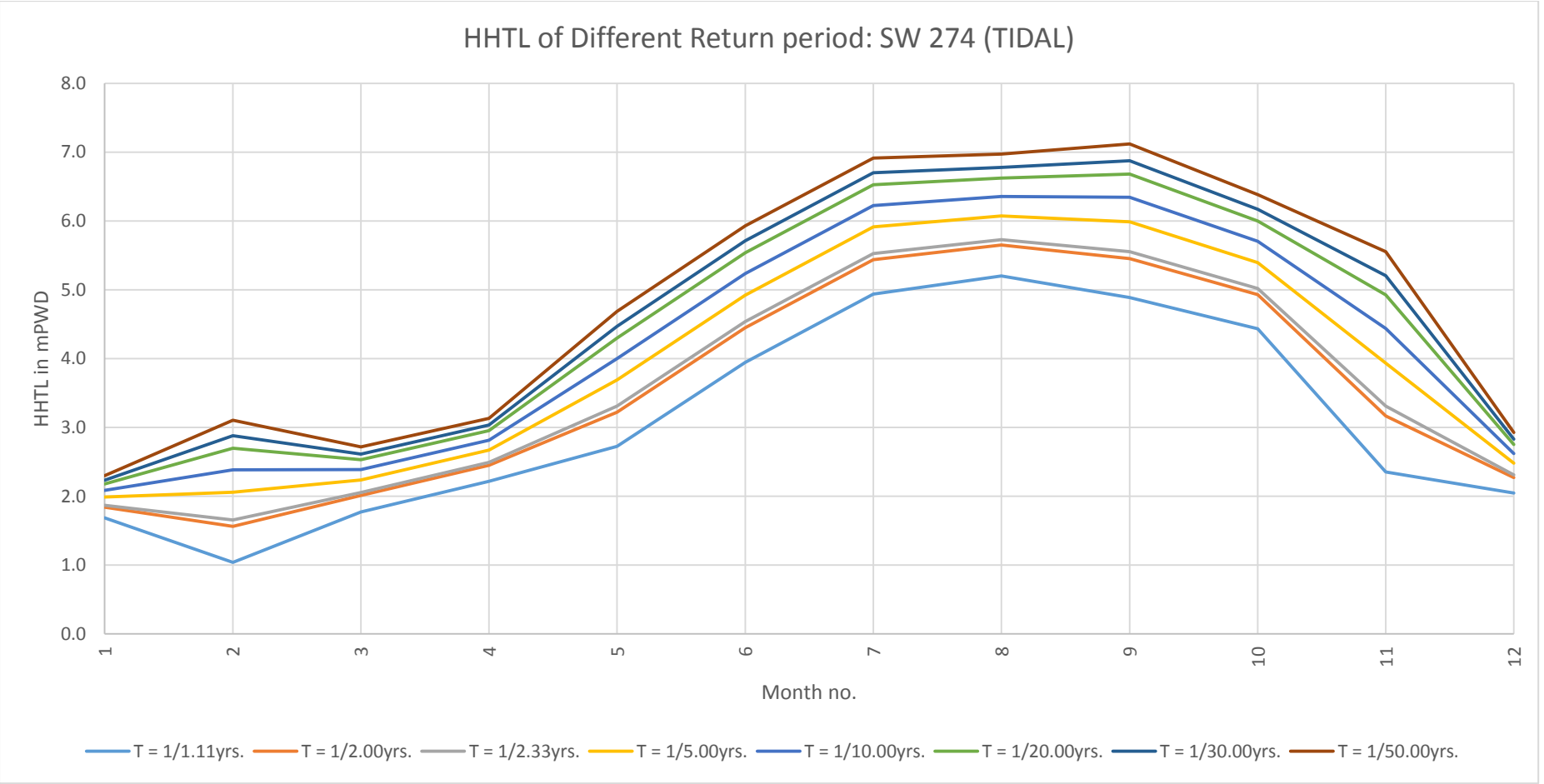



DAILY BASIS LOW TIDE LEVEL ANALYSIS OF BWDB WATER LEVEL STATION SW274 AT NARSHINGDI SADAR, NARSHINGDI (EV I - DISTRIBUTION)
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
T = 1/1.11yrs.
T = 1/2.00yrs.
T = 1/2.33yrs.
T = 1/5.00yrs.
T = 1/10.00yrs.
T = 1/20.00yrs.
T = 1/30.00yrs.
T = 1/50.00yrs.
Water Levls in mPWD
0
1
2
3
4
5
6
7
8
1/1
1/31
3/1
3/31
4/30
5/30
6/29
7/29
8/28
9/27
10/27
11/26
12/26
DAYS

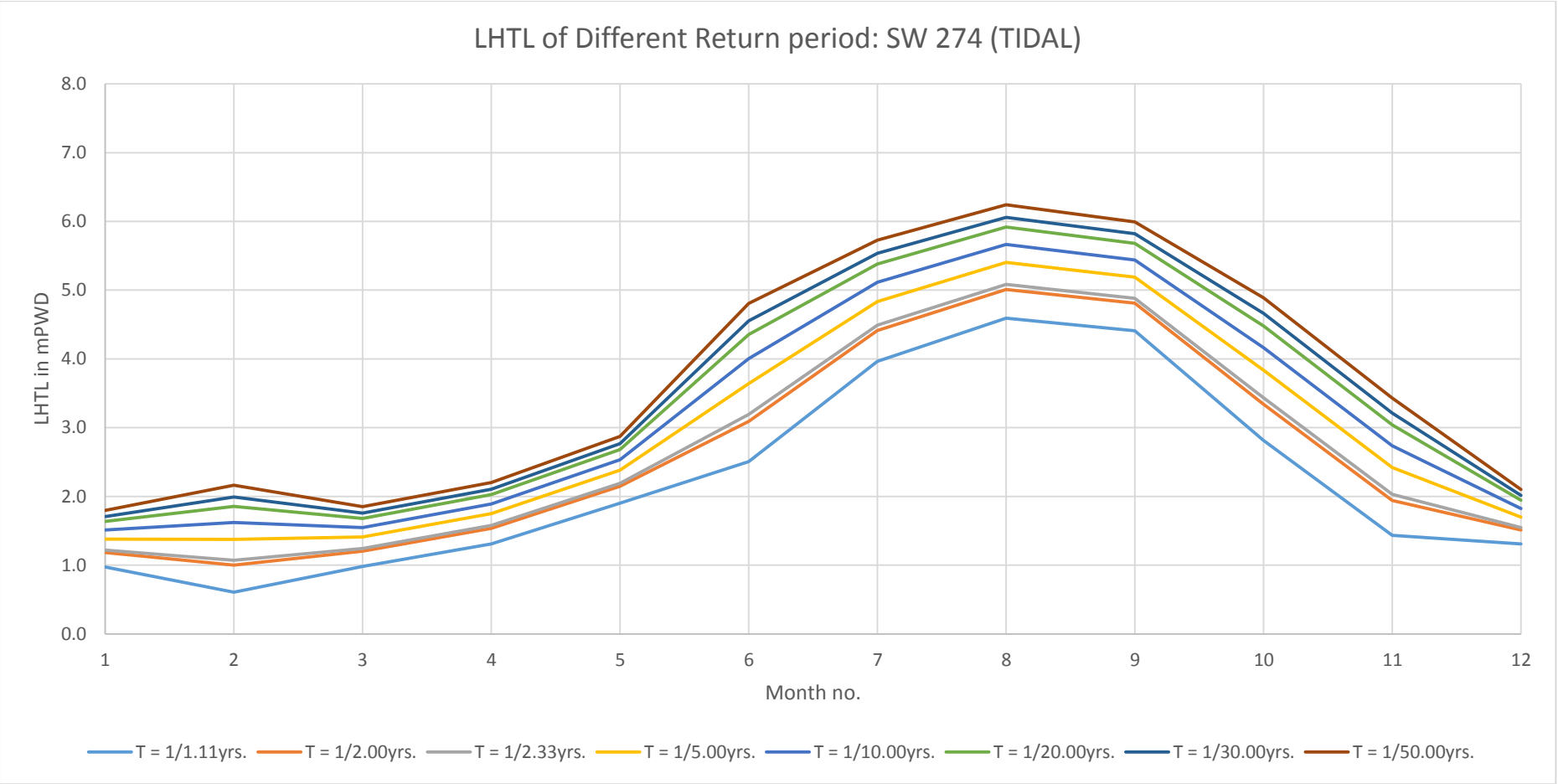
MONTHLY BASIS ANALYSIS OF DATA OF WATER LEVEL GAUGE STATION SW 274 (HTL)

Monthly Data				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
WL			Year	Monthly Maximum HTL (mPWD)												Monthly Minimum HTL (mPWD)											
			1981				02.55	02.97	03.60	05.38	05.70	05.50	04.85	02.90	02.38				01.13	02.04	02.87	03.51	05.32	04.94	02.65	02.11	01.34
			1982	01.65	01.60	01.78	02.40	02.46	04.53	05.15	05.62	05.14	04.69	02.81	01.99	01.04	01.07	01.04	01.75	02.24	02.20	04.55	04.99	04.73	02.43	01.51	01.37
			1983	01.75	01.79	02.42	02.84	03.18	04.18	05.09	05.79	06.04	05.89	04.04	02.23	01.15	00.84	01.18	01.74	02.45	03.09	04.19	05.13	05.69	04.09	02.09	01.54
			1984	02.01	01.82	02.08	02.69	04.16	04.98	06.08	06.21	06.11	05.78	03.52	02.06	01.32	01.04	01.19	01.54	02.29	04.19	04.84	04.95	05.12	03.58	01.77	01.41
			1985	01.67	01.84	02.20	02.47	03.02	04.50	05.48	05.67	05.16	04.74	03.63	02.31	01.02	01.08	01.24	01.68	02.17	03.02	04.55	04.97	04.72	03.67	02.14	01.46
			1986	01.83	01.63	01.88	02.72	02.86	03.69	04.83	05.15	04.99	04.86	03.91	02.35	01.09	00.89	00.96	01.25	02.15	02.06	03.75	04.51	04.68	03.94	02.30	01.36
			1987	01.83	01.80	01.86	02.54	02.50	04.06	05.59	06.27	05.90	05.78	03.54	02.31	01.13	01.14	00.98	01.50	02.06	02.40	04.18	05.69	05.58	03.54	02.07	01.62
			1988	01.91	01.90	02.12	02.61	04.34	05.01	06.40	06.70	06.90	05.20	03.60	02.55	01.17	01.24	01.24	01.71	02.04	04.26	05.03	05.39	05.20	03.74	02.48	01.44
			1989	01.79	01.98	01.94	02.30	03.24	04.68	05.48	05.58	05.10	05.02	03.98	02.32	01.21	01.15	01.06	01.14	02.06	03.26	04.31	05.05	05.02	04.04	02.08	01.42
			1990	01.76	01.84	02.15	03.08	03.64	04.75	05.27	05.32	04.95	05.41	03.74	02.41	01.19	01.01	01.28	01.55	02.41	03.64	04.66	04.97	04.51	03.84	02.08	01.49
			1991	02.02	01.67	01.88	02.29	04.21	05.15	05.46	05.27	05.72	05.48	03.95	02.87	01.09	01.08	01.10	01.65	02.46	04.23	05.02	04.95	05.10	03.98	02.27	01.43
			1992	01.88	01.87	02.05	02.45	02.79	03.83	04.82	04.71	04.53	04.14	03.28	02.03	01.18	01.19	01.24	01.79	02.02	02.56	03.87	04.14	04.16	03.40	02.13	01.57
			1993	01.83	02.13	01.97	02.18	03.56	05.28	06.07	05.90	05.67	05.02	03.26	02.38	01.25	01.11	01.36	01.38	02.26	03.47	05.22	05.51	04.86	03.28	02.07	01.53
			1994	01.86	01.82	02.79	02.74	02.96	04.35	04.53	05.11	04.95	03.94	02.86	02.16	00.98	01.13	01.31	02.09	02.24	02.77	04.14	04.40	04.03	02.62	01.60	01.32
			1995	01.72	01.54	01.78	02.08	03.75	05.14	06.10	05.97	05.79	05.23	03.19	02.41	00.93	00.97	00.98	01.43	01.91	03.05	05.13	05.08	04.86	03.05	02.45	01.58
			1996	01.93	01.76	02.15	02.41	03.39	03.83	05.94	05.76	05.60	04.61	03.44	02.24	01.24	01.16	01.08	01.95	02.43	03.36	04.10	05.20	04.67	03.25	02.28	01.72
			1997	01.95	01.62	01.92	02.05	02.84	04.06	05.69	05.45	05.10	05.06	02.53	01.89	01.16	01.25	01.23	01.47	01.59	02.77	04.03	04.85	04.72	02.39	01.62	01.40
			1998	01.84	00.00	02.12	02.50	03.32	04.83	06.49	06.65	06.91	04.97	03.59	02.74	01.12	00.00	01.12	01.73	02.00	03.35	04.83	06.29	05.07	03.48	02.55	01.73
			1999	02.08	01.86	01.85	02.45	03.12	04.51	05.70	05.94	05.95	05.27	04.26	02.42	01.37	01.39	01.40	01.47	02.46	03.18	04.76	05.30	05.30	04.37	02.44	01.80
			2000	02.00	01.84	02.26	02.72	04.00	05.42	05.43	05.86	05.75	05.55	00.00	02.05	01.36	01.38	01.50	01.80	02.83	04.05	04.95	04.95	05.44	03.38	00.00	01.63
			2001	01.80	01.86	01.92	02.30	03.20	04.50	04.75	05.49	05.16	04.70	03.79	02.20	01.47	01.42	01.42	01.45	01.85	03.20	04.37	04.86	04.74	03.87	02.10	01.55
			2002	01.62	00.00	01.68	02.44	03.32	04.96	05.90	05.95	05.29	04.20	03.00	02.53	01.33	00.00	01.33	01.47	02.25	03.28	04.80	05.36	04.24	02.92	02.54	02.30
			2003	02.37	02.24	02.40										02.02	02.02	02.05									
			2004																								
			2005																								
			2006																								
			2007																								
			2008																								
			2009																								
			2010																								
			2011																								
			2012																								
			2013																								
			2014																								
			2015																								
			MAX	02.37	02.24	02.79	03.08	04.34	05.42	06.49	06.70	06.91	05.89	04.26	02.87	02.02	02.02	02.05	02.09	02.83	04.26	05.22	06.29	05.69	04.37	02.55	02.30
			MIN	01.62	00.00	01.68	02.05	02.46	03.60	04.53	04.71	04.53	03.94	00.00	01.89	00.93	00.00	00.96	01.13	01.59	02.06	03.51	04.14	04.03	02.39	00.00	01.32
			N	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
			AVE.	01.87	01.66	02.05	02.49	03.31	04.54	05.53	05.73	05.56	05.02	03.31	02.31	01.22	01.07	01.24	01.58	02.19	03.19	04.49	05.08	04.88	03.43	02.03	01.55
			σ	00.17	00.56	00.26	00.25	00.53	00.54	00.54	00.48	00.60	00.53	00.87	00.24	00.22	00.42	00.24	00.24	00.26	00.62	00.48	00.45	00.43	00.56	00.54	00.21
ANALYSED DATA:																											
T = 1/1.11yrs.	$K_{1.11}$	=	-1.10	01.68	01.04	01.77	02.22	02.72	03.95	04.94	05.20	04.89	04.44	02.35	02.05	00.97	00.61	00.98	01.31	01.90	02.51	03.96	04.59	04.41	02.81	01.43	01.31
T = 1/2.00yrs.	$K_{2.00}$	=	-0.16	01.84	01.56	02.01	02.45	03.22	04.45	05.44	05.65	05.46	04.93	03.17	02.27	01.18	01.00	01.20	01.54	02.15	03.09	04.41	05.01	04.81	03.34	01.94	01.51
T = 1/2.33yrs.	$K_{2.33}$	=	0.00	01.87	01.66	02.05	02.49	03.31	04.54	05.53	05.73	05.56	05.02	03.31	02.31	01.22	01.07	01.24	01.58	02.19	03.19	04.49	05.08	04.88	03.43	02.03	01.55
T = 1/5.00yrs.	$K_{5.00}$	=	0.72	01.99	02.06	02.24	02.67	03.69	04.92	05.91	06.08	05.99	05.40	03.93	02.48	01.38	01.37	01.41	01.75	02.38	03.64	04.83	05.41	05.19	03.84	02.42	01.70
T = 1/10.00yrs.	$K_{10.00}$	=	1.30	02.08	02.38	02.39	02.81	04.00	05.24	06.23	06.36	06.34	05.70	04.44	02.62	01.51	01.62	01.55	01.89	02.53	04.00	05.11	05.67	05.44	04.16	02.74	01.83
T = 1/20.00yrs.	$K_{20.00}$	=	1.87	02.18	02.70	02.53	02.95	04.30	05.54	06.53	06.62	06.68	06.00	04.93	02.75	01.64	01.86	01.68	02.03	02.68	04.35	05.38	05.92	05.68	04.48	03.04	01.95
T = 1/30.00yrs.	$K_{30.00}$	=	2.19	02.23	02.88	02.61	03.03	04.47	05.71	06.70	06.78	06.88	06.17	05.21	02.83	01.71	01.99	01.76	02.11	02.77	04.55	05.54	06.06	05.82	04.66	03.21	02.01
T = 1/50.00yrs.	$K_{50.00}$	=	2.59	02.30	03.10	02.72	03.13	04.69	05.93	06.92	06.97	07.12	06.38	05.55	02.93	01.80	02.16	01.85	02.20	02.87	04.81	05.73	06.24	05.99	04.89	03.43	02.10

MONTHLY BASIS ANALYSIS OF DATA OF WATER LEVEL GAUGE STATION SW 274 (HTL)



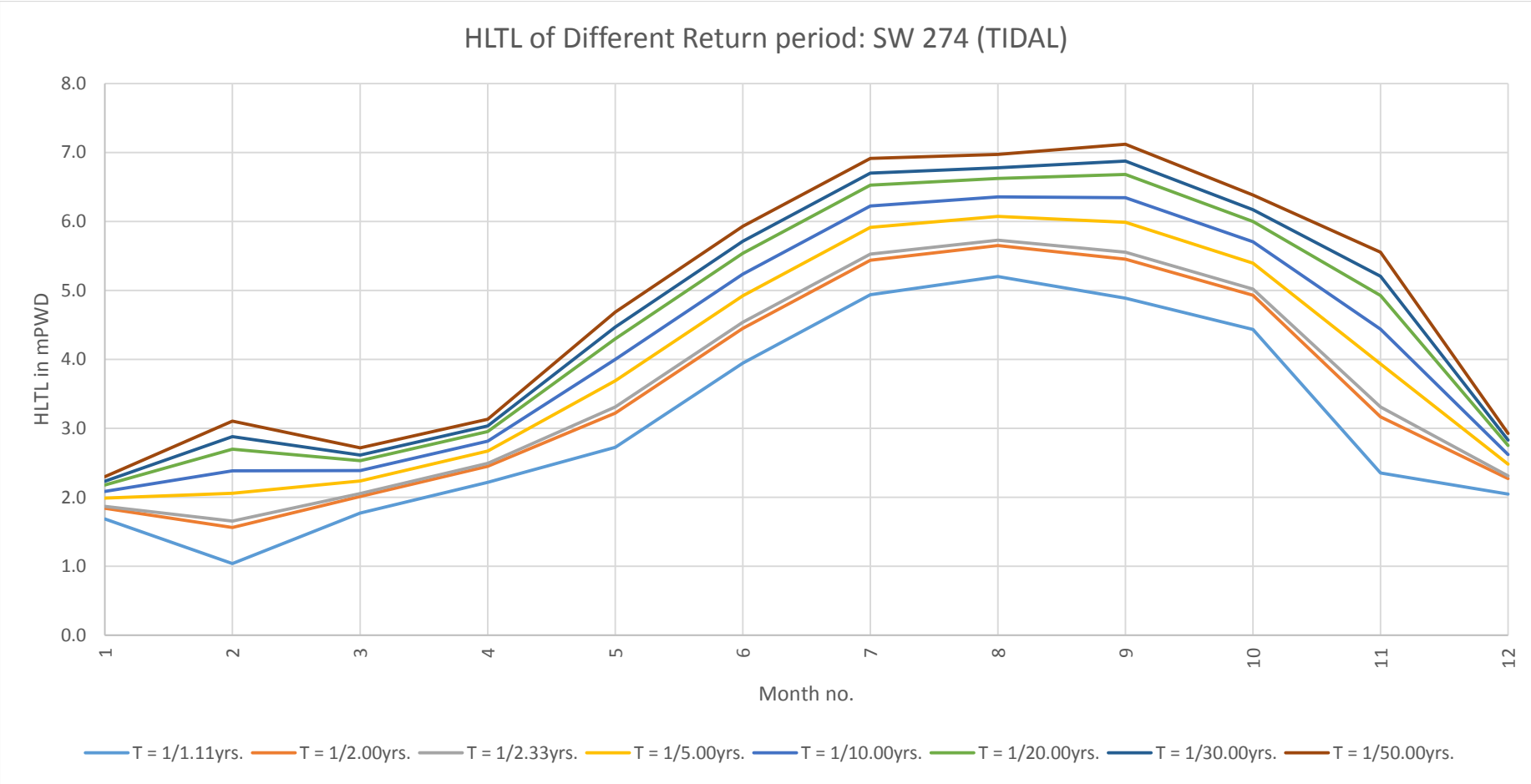
MONTHLY BASIS ANALYSIS OF DATA OF WATER LEVEL GAUGE STATION SW 274 (HTL)



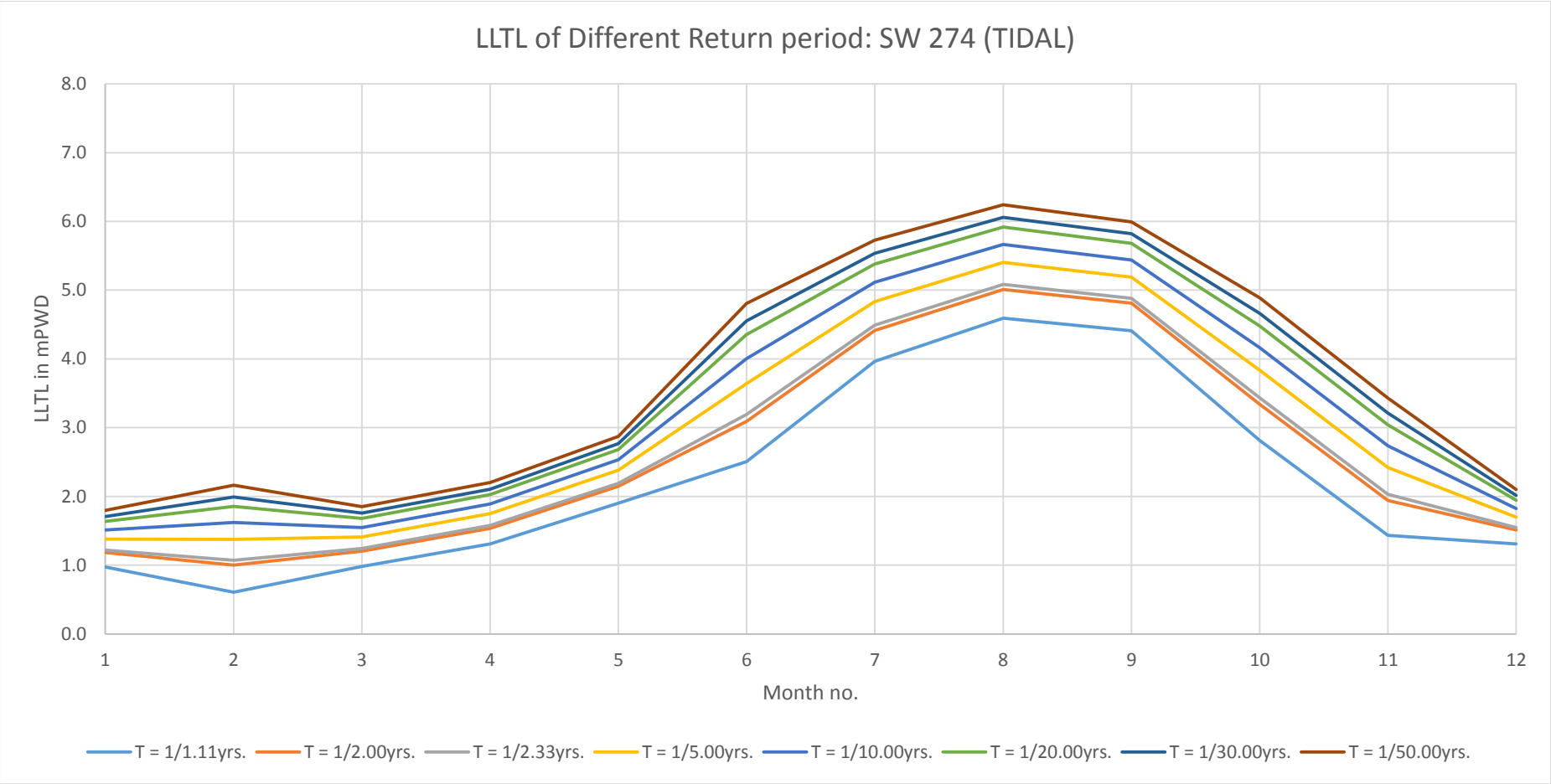
MONTHLY BASIS ANALYSIS OF DATA OF WATER LEVEL GAUGE STATION SW 274 (LTL)

Monthly Data		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
WL	Year	Monthly Maximum LTL (mPWD)												Monthly Minimum LTL (mPWD)											
	1981				02.55	02.97	03.60	05.38	05.70	05.50	04.85	02.90	02.38				01.13	02.04	02.87	03.51	05.32	04.94	02.65	02.11	01.34
	1982	01.65	01.60	01.78	02.40	02.46	04.53	05.15	05.62	05.14	04.69	02.81	01.99	01.04	01.07	01.04	01.75	02.24	02.20	04.55	04.99	04.73	02.43	01.51	01.37
	1983	01.75	01.79	02.42	02.84	03.18	04.18	05.09	05.79	06.04	05.89	04.04	02.23	01.15	00.84	01.18	01.74	02.45	03.09	04.19	05.13	05.69	04.09	02.09	01.54
	1984	02.01	01.82	02.08	02.69	04.16	04.98	06.08	06.21	06.11	05.78	03.52	02.06	01.32	01.04	01.19	01.54	02.29	04.19	04.84	04.95	05.12	03.58	01.77	01.41
	1985	01.67	01.84	02.20	02.47	03.02	04.50	05.48	05.67	05.16	04.74	03.63	02.31	01.02	01.08	01.24	01.68	02.17	03.02	04.55	04.97	04.72	03.67	02.14	01.46
	1986	01.83	01.63	01.88	02.72	02.86	03.69	04.83	05.15	04.99	04.86	03.91	02.35	01.09	00.89	00.96	01.25	02.15	02.06	03.75	04.51	04.68	03.94	02.30	01.36
	1987	01.83	01.80	01.86	02.54	02.50	04.06	05.59	06.27	05.90	05.78	03.54	02.31	01.13	01.14	00.98	01.50	02.06	02.40	04.18	05.69	05.58	03.54	02.07	01.62
	1988	01.91	01.90	02.12	02.61	04.34	05.01	06.40	06.70	06.90	05.20	03.60	02.55	01.17	01.24	01.24	01.71	02.04	04.26	05.03	05.39	05.20	03.74	02.48	01.44
	1989	01.79	01.98	01.94	02.30	03.24	04.68	05.48	05.58	05.10	05.02	03.98	02.32	01.21	01.15	01.06	01.14	02.06	03.26	04.31	05.05	05.02	04.04	02.08	01.42
	1990	01.76	01.84	02.15	03.08	03.64	04.75	05.27	05.32	04.95	05.41	03.74	02.41	01.19	01.01	01.28	01.55	02.41	03.64	04.66	04.97	04.51	03.84	02.08	01.49
	1991	02.02	01.67	01.88	02.29	04.21	05.15	05.46	05.27	05.72	05.48	03.95	02.87	01.09	01.08	01.10	01.65	02.46	04.23	05.02	04.95	05.10	03.98	02.27	01.43
	1992	01.88	01.87	02.05	02.45	02.79	03.83	04.82	04.71	04.53	04.14	03.28	02.03	01.18	01.19	01.24	01.79	02.02	02.56	03.87	04.14	04.16	03.40	02.13	01.57
	1993	01.83	02.13	01.97	02.18	03.56	05.28	06.07	05.90	05.67	05.02	03.26	02.38	01.25	01.11	01.36	01.38	02.26	03.47	05.22	05.51	04.86	03.28	02.07	01.53
	1994	01.86	01.82	02.79	02.74	02.96	04.35	04.53	05.11	04.95	03.94	02.86	02.16	00.98	01.13	01.31	02.09	02.24	02.77	04.14	04.40	04.03	02.62	01.60	01.32
	1995	01.72	01.54	01.78	02.08	03.75	05.14	06.10	05.97	05.79	05.23	03.19	02.41	00.93	00.97	00.98	01.43	01.91	03.05	05.13	05.08	04.86	03.05	02.45	01.58
	1996	01.93	01.76	02.15	02.41	03.39	03.83	05.94	05.76	05.60	04.61	03.44	02.24	01.24	01.16	01.08	01.95	02.43	03.36	04.10	05.20	04.67	03.25	02.28	01.72
	1997	01.95	01.62	01.92	02.05	02.84	04.06	05.69	05.45	05.10	05.06	02.53	01.89	01.16	01.25	01.23	01.47	01.59	02.77	04.03	04.85	04.72	02.39	01.62	01.40
	1998	01.84	00.00	02.12	02.50	03.32	04.83	06.49	06.65	06.91	04.97	03.59	02.74	01.12	00.00	01.12	01.73	02.00	03.35	04.83	06.29	05.07	03.48	02.55	01.73
	1999	02.08	01.86	01.85	02.45	03.12	04.51	05.70	05.94	05.95	05.27	04.26	02.42	01.37	01.39	01.40	01.47	02.46	03.18	04.76	05.30	05.30	04.37	02.44	01.80
	2000	02.00	01.84	02.26	02.72	04.00	05.42	05.43	05.86	05.75	05.55	00.00	02.05	01.36	01.38	01.50	01.80	02.83	04.05	04.95	04.95	05.44	03.38	00.00	01.63
	2001	01.80	01.86	01.92	02.30	03.20	04.50	04.75	05.49	05.16	04.70	03.79	02.20	01.47	01.42	01.42	01.45	01.85	03.20	04.37	04.86	04.74	03.87	02.10	01.55
	2002	01.62	00.00	01.68	02.44	03.32	04.96	05.90	05.95	05.29	04.20	03.00	02.53	01.33	00.00	01.33	01.47	02.25	03.28	04.80	05.36	04.24	02.92	02.54	02.30
	2003	02.37	02.24	02.40										02.02	02.02	02.05									
	2004																								
	2005																								
	2006																								
	2007																								
	2008																								
	2009																								
	2010																								
	2011																								
	2012																								
	2013																								
	2014																								
	2015																								
	MAX	02.37	02.24	02.79	03.08	04.34	05.42	06.49	06.70	06.91	05.89	04.26	02.87	02.02	02.02	02.05	02.09	02.83	04.26	05.22	06.29	05.69	04.37	02.55	02.30
	MIN	01.62	00.00	01.68	02.05	02.46	03.60	04.53	04.71	04.53	03.94	00.00	01.89	00.93	00.00	00.96	01.13	01.59	02.06	03.51	04.14	04.03	02.39	00.00	01.32
	N	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
	AVE.	01.87	01.66	02.05	02.49	03.31	04.54	05.53	05.73	05.56	05.02	03.31	02.31	01.22	01.07	01.24	01.58	02.19	03.19	04.49	05.08	04.88	03.43	02.03	01.55
	σ	00.17	00.56	00.26	00.25	00.53	00.54	00.54	00.48	00.60	00.53	00.87	00.24	00.22	00.42	00.24	00.24	00.26	00.62	00.48	00.45	00.43	00.56	00.54	00.21
ANALYSED DATA:																									
T = 1/1.11yrs.	$K_{1.11}$ = -1.10	01.68	01.04	01.77	02.22	02.72	03.95	04.94	05.20	04.89	04.44	02.35	02.05	00.97	00.61	00.98	01.31	01.90	02.51	03.96	04.59	04.41	02.81	01.43	01.31
T = 1/2.00yrs.	$K_{2.00}$ = -0.16	01.84	01.56	02.01	02.45	03.22	04.45	05.44	05.65	05.46	04.93	03.17	02.27	01.18	01.00	01.20	01.54	02.15	03.09	04.41	05.01	04.81	03.34	01.94	01.51
T = 1/2.33yrs.	$K_{2.33}$ = 0.00	01.87	01.66	02.05	02.49	03.31	04.54	05.53	05.73	05.56	05.02	03.31	02.31	01.22	01.07	01.24	01.58	02.19	03.19	04.49	05.08	04.88	03.43	02.03	01.55
T = 1/5.00yrs.	$K_{5.00}$ = 0.72	01.99	02.06	02.24	02.67	03.69	04.92	05.91	06.08	05.99	05.40	03.93	02.48	01.38	01.37	01.41	01.75	02.38	03.64	04.83	05.41	05.19	03.84	02.42	01.70
T = 1/10.00yrs.	$K_{10.00}$ = 1.30	02.08	02.38	02.39	02.81	04.00	05.24	06.23	06.36	06.34	05.70	04.44	02.62	01.51	01.62	01.55	01.89	02.53	04.00	05.11	05.67	05.44	04.16	02.74	01.83
T = 1/20.00yrs.	$K_{20.00}$ = 1.87	02.18	02.70	02.53	02.95	04.30	05.54	06.53	06.62	06.68	06.00	04.93	02.75	01.64	01.86	01.68	02.03	02.68	04.35	05.38	05.92	05.68	04.48	03.04	01.95
T = 1/30.00yrs.	$K_{30.00}$ = 2.19	02.23	02.88	02.61	03.03	04.47	05.71	06.70	06.78	06.88	06.17	05.21	02.83	01.71	01.99	01.76	02.11	02.77	04.55	05.54	06.06	05.82	04.66	03.21	02.01
T = 1/50.00yrs.	$K_{50.00}$ = 2.59	02.30	03.10	02.72	03.13	04.69	05.93	06.92	06.97	07.12	06.38	05.55	02.93	01.80	02.16	01.85	02.20	02.87	04.81	05.73	06.24	05.99	04.89	03.43	02.10

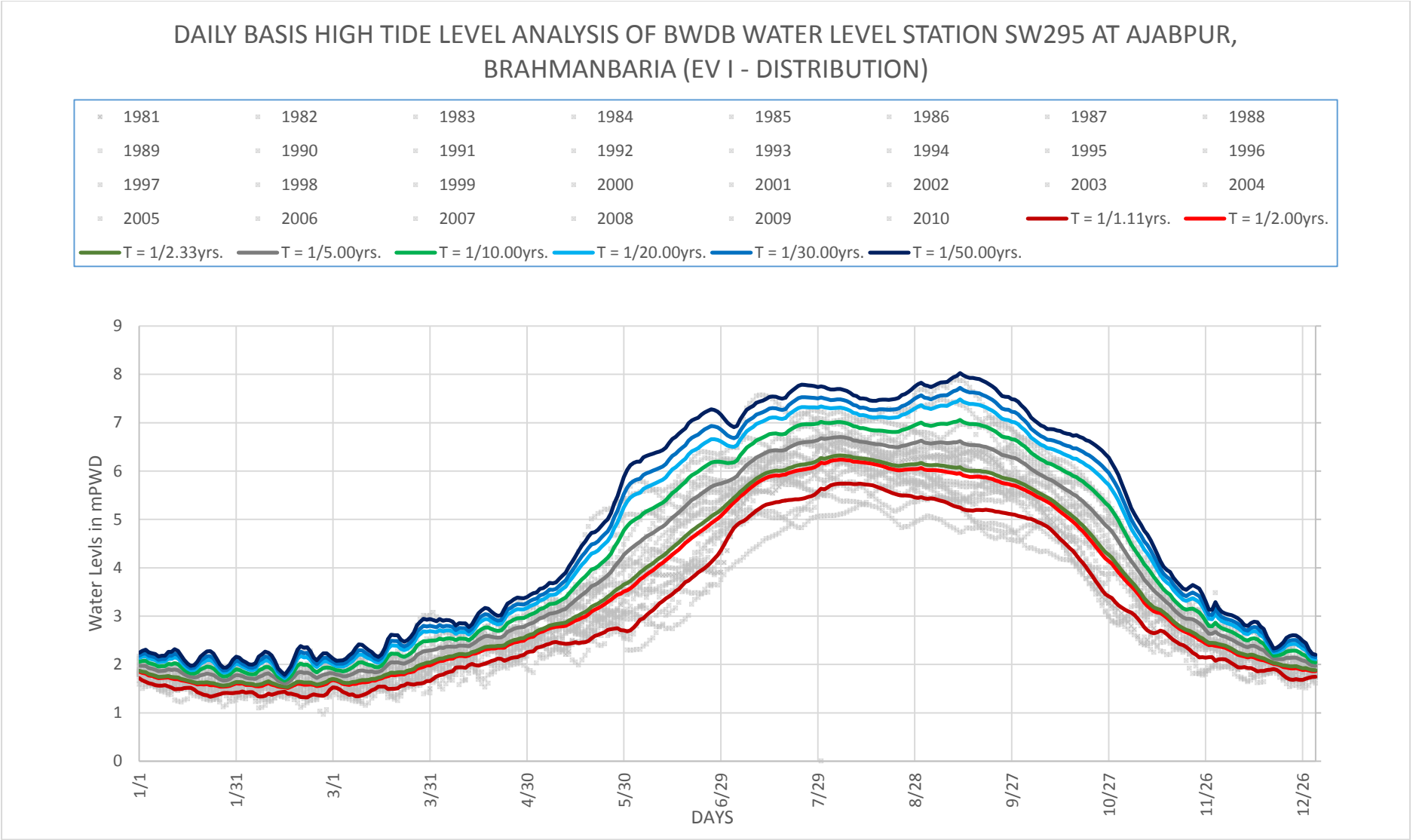
MONTHLY BASIS ANALYSIS OF DATA OF WATER LEVEL GAUGE STATION SW 274 (LTL)

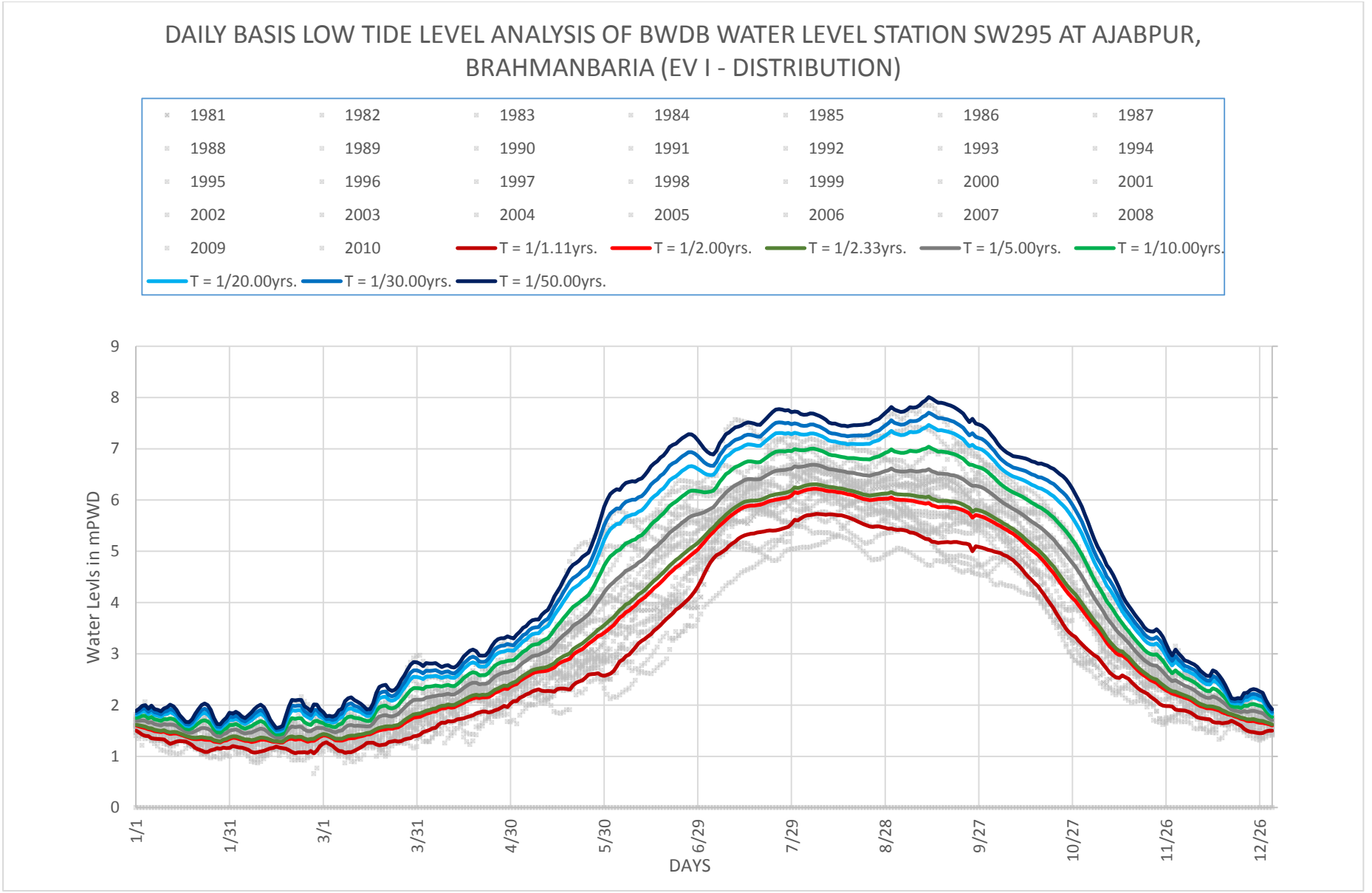


MONTHLY BASIS ANALYSIS OF DATA OF WATER LEVEL GAUGE STATION SW 274 (LTL)



A.1b.3 ANALYSED RESULTS OF BWDB WATER LEVEL GAUGE STATION SW 295 ON THE MEGHNA RIVER

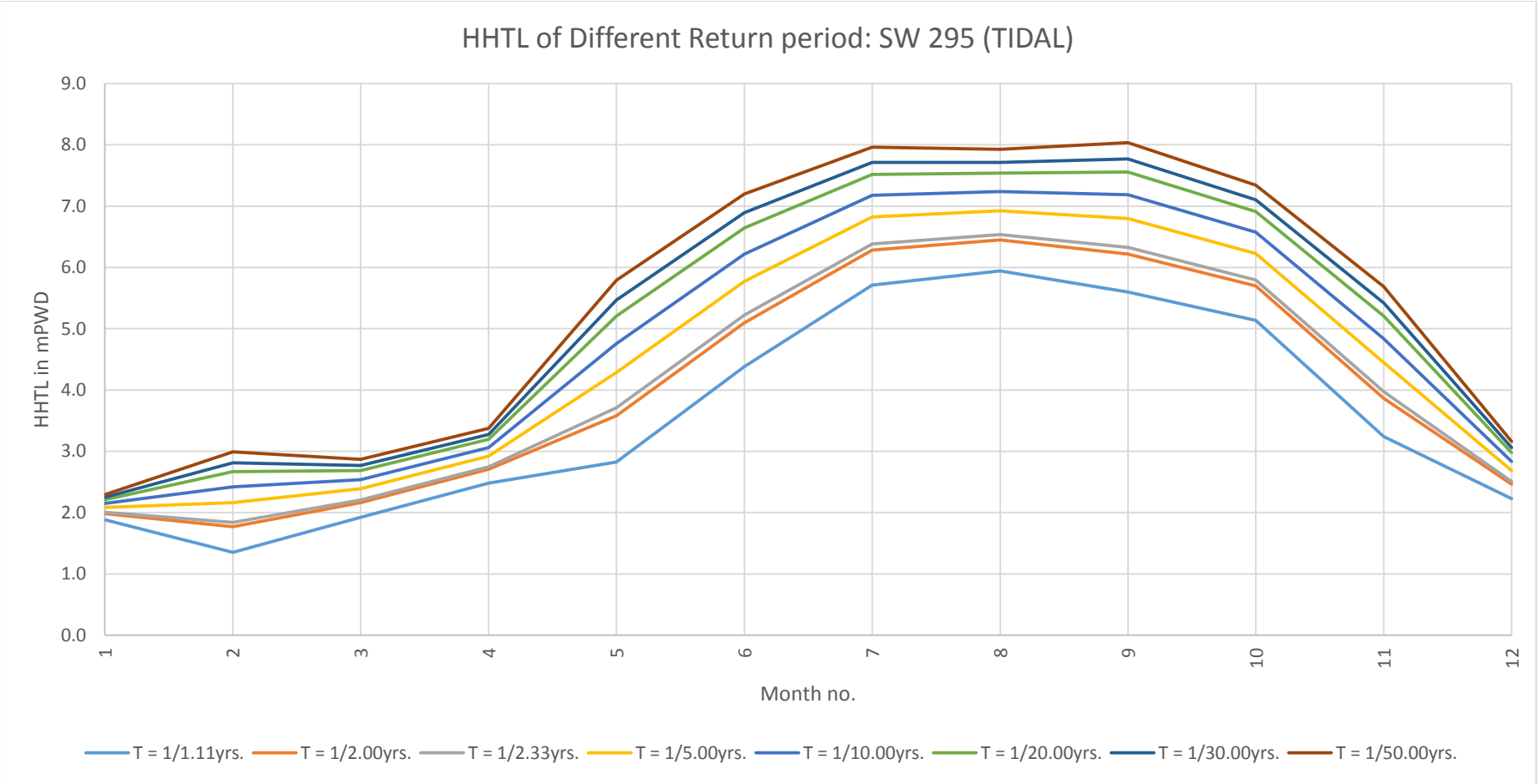



DAILY BASIS LOW TIDE LEVEL ANALYSIS OF BWDB WATER LEVEL STATION SW295 AT AJABPUR, BRAHMANBARIA (EV I - DISTRIBUTION)
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
T = 1/1.11yrs.
T = 1/2.00yrs.
T = 1/2.33yrs.
T = 1/5.00yrs.
T = 1/10.00yrs.
T = 1/20.00yrs.
T = 1/30.00yrs.
T = 1/50.00yrs.
Water Levls in mPWD
0
1
2
3
4
5
6
7
8
9
1/1
1/31
3/1
3/31
4/30
5/30
6/29
7/29
8/28
9/27
10/27
11/26
12/26
DAYS

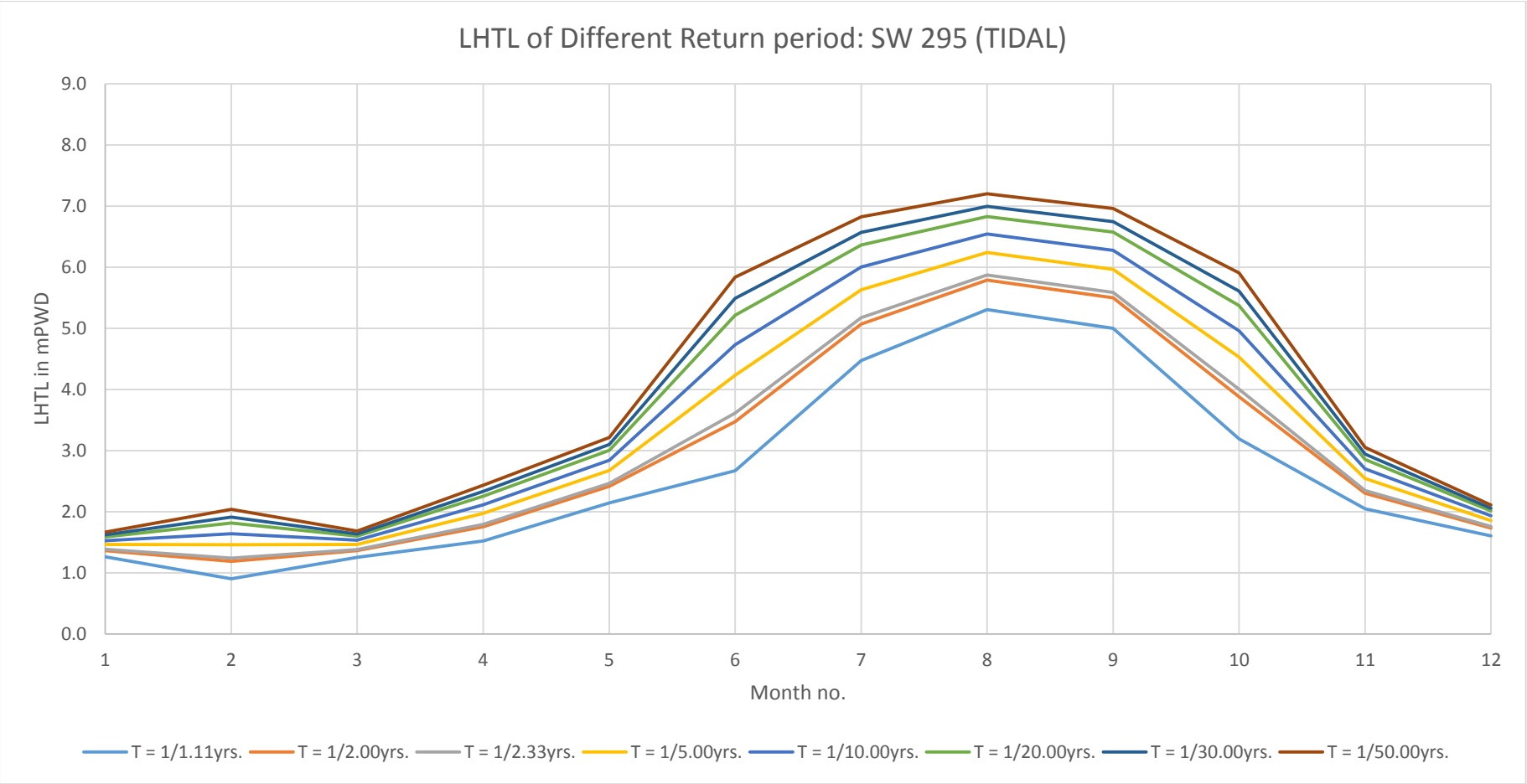
MONTHLY BASIS ANALYSIS OF DATA OF WATER LEVEL GAUGE STATION SW 295 (HTL)

Monthly Data				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
WL			Year	Monthly Maximum HTL (mPWD)												Monthly Minimum HTL (mPWD)											
			1981				02.88	03.60	04.02	06.25	06.60	06.42	05.67	03.05	02.71				01.50	02.21	03.45	04.11	06.10	05.72	03.13	02.29	01.69
			1982	01.91	01.77	01.97	02.77	03.01	05.39	06.14	06.60	05.84	05.55	02.93	02.17	01.33	01.31	01.28	01.84	02.40	02.51	05.44	05.77	05.44	02.85	01.78	01.53
			1983	01.90	01.95	02.67	02.99	03.69	04.76	06.06	06.80	06.97	06.70	04.92	02.53	01.27	01.10	01.36	02.00	02.93	03.54	04.79	06.13	06.65	05.02	02.45	01.78
			1984	02.08	01.85	02.12	02.79	05.07	05.77	07.09	07.06	07.10	06.62	03.96	02.21	01.49	00.97	01.33	01.67	02.47	04.97	05.53	05.77	05.77	04.06	02.10	01.61
			1985	01.78	01.91	02.39	02.83	03.09	05.43	06.51	06.54	05.91	05.51	03.86	02.48	01.35	01.29	01.58	01.94	02.41	03.29	05.46	05.83	05.50	03.95	02.39	01.76
			1986	01.96	01.76	02.09	02.95	02.94	03.75	05.51	05.78	05.61	05.77	04.75	02.77	01.29	01.11	01.25	01.49	02.47	02.29	03.85	05.17	05.37	04.84	02.69	01.67
			1987	01.98	01.84	01.96	02.70	02.71	04.76	06.54	07.11	06.70	06.69	04.02	02.53	01.37	01.35	01.23	01.78	02.29	02.62	04.94	06.71	06.12	04.17	02.35	01.83
			1988	01.99	01.95	02.20	02.68	05.43	06.24	07.57	07.69	07.89	06.23	04.39	03.17	01.24	01.36	01.48	01.88	02.28	05.08	06.20	06.24	06.29	04.51	02.68	01.85
			1989	02.00	02.08	02.08	02.63	03.57	05.12	06.52	06.62	06.08	05.84	04.86	02.40	01.51	01.36	01.38	01.41	02.67	03.54	04.98	05.99	05.84	04.96	02.48	01.72
			1990	01.99	02.01	02.41	03.30	03.96	05.63	06.15	06.25	05.94	06.24	04.45	02.59	01.39	01.34	01.41	01.84	02.96	04.08	05.62	05.98	05.30	04.61	02.30	01.85
			1991	02.27	01.99	02.08	02.65	05.39	06.27	06.33	06.06	06.56	06.40	04.80	02.40	01.40	01.41	01.38	02.07	02.61	05.43	05.82	05.73	05.68	04.88	02.33	01.82
			1992	02.03	02.01	02.18	02.56	03.05	04.30	05.74	05.49	05.07	04.88	03.91	02.27	01.42	01.32	01.47	01.99	02.17	02.77	04.49	04.83	04.73	04.01	02.31	01.75
			1993	01.99	02.35	02.19	02.35	04.09	06.40	07.20	06.91	06.49	05.80	03.68	02.48	01.43	01.29	01.59	01.70	02.41	04.03	06.26	06.33	05.57	03.77	02.28	01.67
			1994	02.09	01.90	03.01	03.07	03.04	04.89	05.17	05.80	05.68	04.55	03.08	02.33	01.30	01.33	01.45	02.38	02.33	02.93	04.83	05.07	04.64	03.00	01.86	01.51
			1995	01.86	01.78	01.95										01.12	01.26	01.15									
			1996				02.66	03.67	04.37	06.63	06.47	06.30	05.28	03.96	02.47				02.18	02.62	03.68	04.51	05.89	05.34	03.67	02.59	02.00
			1997	02.15	01.97	02.10	02.25	03.10	04.67	06.37	06.00	05.85	05.77	02.83	02.03	01.39	01.37	01.36	01.60	01.83	03.05	04.70	05.54	05.36	02.81	01.81	01.54
			1998	01.90	01.76	02.27	02.68	03.51	05.56	07.26	07.34	07.48	05.83	03.86	02.85	01.25	01.23	01.23	01.76	02.12	03.43	05.47	07.00	05.97	03.86	02.73	01.92
			1999	02.18	02.02	02.06	02.62	03.31	05.10	06.63	06.51	06.53	05.85	04.74	02.47	01.52	01.42	01.56	01.58	02.62	03.44	05.35	06.08	05.89	04.88	02.51	01.90
			2000	02.05	01.89	02.19	02.79	04.48	06.20	06.25	06.64	06.45	06.30	03.91	02.45	01.49	01.38	01.36	01.86	02.98	04.60	05.53	05.50	06.15	03.88	02.41	01.94
			2001	02.02	02.06	02.00	02.53	03.12	05.22	05.46	06.24	05.83	05.35	04.22	02.73	01.53	01.43	01.38	01.53	02.29	03.14	05.03	05.49	05.42	04.26	02.57	01.80
			2002	02.03	00.00	02.19	03.03	04.10	05.87	06.71	06.77	06.14	04.89	03.21	02.59	01.47	00.00	01.43	01.67	02.68	04.03	05.75	06.19	04.54	02.93	02.38	01.74
			2003	01.95	01.84											01.48	01.41	01.34									
			2004																								
			2005																								
			2006																								
			2007																								
			2008																								
			2009																								
			2010																								
			2011																								
			2012																								
			2013																								
			2014																								
			2015																								
			MAX	02.27	02.35	03.01	03.30	05.43	06.40	07.57	07.69	07.89	06.70	04.92	03.17	01.53	01.43	01.59	02.38	02.98	05.43	06.26	07.00	06.65	05.02	02.73	02.00
			MIN	01.78	00.00	01.95	02.25	02.71	03.75	05.17	05.49	05.07	04.55	02.83	02.03	01.12	00.00	01.15	01.41	01.83	02.29	03.85	04.83	04.54	02.81	01.78	01.51
			N	21	21	20	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21
			AVE.	02.00	01.84	02.21	02.75	03.71	05.22	06.39	06.54	06.33	05.80	03.97	02.51	01.38	01.24	01.38	01.79	02.46	03.61	05.17	05.87	05.59	04.00	02.35	01.76
			σ	00.11	00.44	00.26	00.24	00.80	00.76	00.61	00.54	00.66	00.60	00.66	00.25	00.11	00.31	00.12	00.25	00.29	00.86	00.64	00.51	00.53	00.73	00.27	00.14
ANALYSED DATA:																											
T = 1/1.11yrs.	$K_{1.11}$	=	-1.10	01.88	01.35	01.92	02.48	02.82	04.38	05.71	05.94	05.60	05.14	03.24	02.23	01.26	00.90	01.25	01.52	02.14	02.67	04.47	05.31	05.00	03.19	02.05	01.60
T = 1/2.00yrs.	$K_{2.00}$	=	-0.16	01.99	01.77	02.16	02.71	03.58	05.10	06.29	06.45	06.22	05.70	03.86	02.46	01.36	01.19	01.36	01.75	02.42	03.47	05.07	05.79	05.50	03.88	02.30	01.73
T = 1/2.33yrs.	$K_{2.33}$	=	0.00	02.00	01.84	02.21	02.75	03.71	05.23	06.39	06.54	06.33	05.80	03.97	02.51	01.38	01.24	01.38	01.79	02.46	03.62	05.17	05.87	05.59	04.00	02.35	01.76
T = 1/5.00yrs.	$K_{5.00}$	=	0.72	02.08	02.16	02.39	02.92	04.29	05.77	06.82	06.92	06.80	06.23	04.45	02.69	01.46	01.46	01.46	01.97	02.67	04.23	05.63	06.24	05.97	04.53	02.54	01.85
T = 1/10.00yrs.	$K_{10.00}$	=	1.30	02.15	02.42	02.54	03.06	04.76	06.22	07.18	07.24	07.19	06.58	04.83	02.84	01.53	01.64	01.53	02.11	02.84	04.73	06.00	06.54	06.28	04.96	02.70	01.93
T = 1/20.00yrs.	$K_{20.00}$	=	1.87	02.21	02.67	02.68	03.20	05.21	06.65	07.52	07.54	07.56	06.91	05.21	02.98	01.59	01.81	01.60	02.25	03.01	05.21	06.36	06.83	06.57	05.37	02.85	02.01
T = 1/30.00yrs.	$K_{30.00}$	=	2.19	02.25	02.81	02.77	03.28	05.47	06.89	07.72	07.71	07.77	07.10	05.42	03.06	01.62	01.91	01.64	02.33	03.10	05.49	06.57	07.00	06.74	05.61	02.94	02.05
T = 1/50.00yrs.	$K_{50.00}$	=	2.59	02.29	02.99	02.87	03.37	05.79	07.20	07.96	07.93	08.04	07.35	05.69	03.16	01.67	02.04	01.68	02.43	03.22	05.84	06.83	07.20	06.96	05.91	03.05	02.11

MONTHLY BASIS ANALYSIS OF DATA OF WATER LEVEL GAUGE STATION SW 295 (HTL)



MONTHLY BASIS ANALYSIS OF DATA OF WATER LEVEL GAUGE STATION SW 295 (HTL)



MONTHLY BASIS ANALYSIS OF DATA OF WATER LEVEL GAUGE STATION SW 295 (LTL)

Monthly Data			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
WL		Year	Monthly Maximum LTL (mPWD)												Monthly Minimum LTL (mPWD)											
		1981				02.79	03.32	04.02	06.25	06.60	06.42	05.67	03.05	02.62				01.34	02.12	03.45	04.11	06.10	05.72	03.13	02.29	01.50
		1982	01.66	01.56	01.86	02.69	02.89	05.39	06.14	06.60	05.84	05.52	02.81	01.94	01.10	01.04	01.05	01.69	02.32	02.51	05.44	05.77	05.44	02.81	01.67	01.34
		1983	01.62	01.64	02.53	02.93	03.66	04.75	06.02	06.79	06.97	06.68	04.87	02.33	01.07	00.87	01.20	01.86	02.89	03.52	04.78	06.09	06.64	04.98	02.36	01.62
		1984	01.89	01.66	01.89	02.56	05.04	05.76	07.08	07.06	07.10	06.60	03.89	02.02	01.26	00.66	01.06	01.46	02.30	04.95	05.53	05.77	05.77	04.00	01.95	01.43
		1985	01.54	01.70	02.26	02.72	02.98	05.40	06.47	06.53	05.89	05.50	03.83	02.27	01.19	01.02	01.35	01.76	02.27	03.11	05.45	05.82	04.59	03.92	02.28	01.52
		1986	01.72	01.56	01.88	02.88	02.83	03.66	05.51	05.77	05.59	05.77	04.72	02.62	01.04	00.92	01.00	01.28	02.33	02.12	03.77	05.15	05.36	04.80	02.60	01.48
		1987	01.73	01.62	01.77	02.56	02.63	04.69	06.45	07.10	06.69	06.69	03.98	02.30	01.13	01.06	00.99	01.59	02.15	02.50	04.83	06.60	06.11	04.11	02.24	01.62
		1988	01.72	01.70	01.96	02.42	05.28	06.22	07.57	07.68	07.85	06.19	04.30	03.06	01.00	01.22	01.26	01.65	02.10	05.07	06.19	06.24	06.27	04.46	02.46	01.65
		1989	01.72	01.83	01.82	02.45	03.46	05.12	06.45	06.60	06.08	05.83	04.81	02.27	01.28	01.26	01.16	01.19	02.51	03.50	04.97	05.98	05.81	04.91	02.33	01.45
		1990	01.74	01.72	02.19	03.24	03.96	05.62	06.14	06.24	05.92	06.23	04.41	02.33	01.15	01.10	01.16	01.62	02.90	03.99	05.61	05.97	05.27	04.56	02.13	01.68
		1991	02.06	01.77	01.75	02.42	05.38	06.25	06.32	06.05	06.53	06.39	04.74	02.17	01.19	01.20	01.15	01.82	02.20	05.40	05.81	05.71	05.66	04.86	02.22	01.71
		1992	01.81	01.83	01.89	02.32	02.91	04.23	05.74	05.49	05.06	04.87	03.86	02.07	01.17	01.07	01.20	01.70	01.98	02.67	04.42	04.83	04.69	03.97	02.13	01.51
		1993	01.69	02.16	01.93	02.17	04.08	06.38	07.19	06.90	06.48	05.80	03.67	02.24	01.18	01.06	01.38	01.47	02.25	04.01	06.25	06.32	05.54	03.73	02.10	01.45
		1994	01.77	01.68	02.92	02.97	02.96	04.89	05.16	05.79	05.66	04.51	02.92	02.04	00.99	01.07	01.15	02.25	02.24	02.84	04.82	05.06	04.60	02.96	01.72	01.33
		1995	01.62	01.52	01.70										00.95	01.00	00.89									
		1996				02.55	03.63	04.36	06.62	06.46	06.29	05.24	03.90	02.34				01.98	02.43	03.64	04.41	05.88	05.31	03.63	02.41	01.75
		1997	01.86	01.66	01.86	02.01	02.95	04.64	06.36	05.99	05.82	05.76	02.73	01.72	01.18	01.12	01.09	01.43	01.63	02.92	04.66	05.52	05.34	02.77	01.62	01.31
		1998	01.58	01.40	02.08	02.52	03.42	05.56	07.25	07.32	07.46	05.75	03.82	02.60	00.97	00.92	00.87	01.53	02.00	03.39	05.46	06.98	05.90	03.84	02.57	01.72
		1999	01.87	01.67	01.72	02.34	03.21	04.96	06.62	06.46	06.52	05.84	04.72	02.32	01.21	01.19	01.16	01.26	02.40	03.33	05.21	06.07	05.88	04.81	02.40	01.70
		2000	01.75	01.59	01.96	02.74	04.42	06.18	06.24	06.63	06.45	06.29	03.85	02.16	01.25	01.08	01.18	01.54	02.81	04.55	05.51	05.49	06.11	03.86	02.23	01.57
		2001	01.65	01.74	01.69	02.24	03.03	05.21	05.35	06.23	05.82	05.35	04.20	02.51	01.20	01.15	01.12	01.23	02.06	03.04	05.01	05.48	05.39	04.23	02.42	01.61
		2002	01.72	00.00	01.90	02.87	04.08	05.86	06.69	06.76	06.13	04.88	03.06	02.32	01.12	00.00	01.10	01.44	02.62	04.01	05.73	06.18	04.53	02.88	02.20	01.57
		2003	01.64	01.52	01.79										01.21	01.11	01.02									
		2004																								
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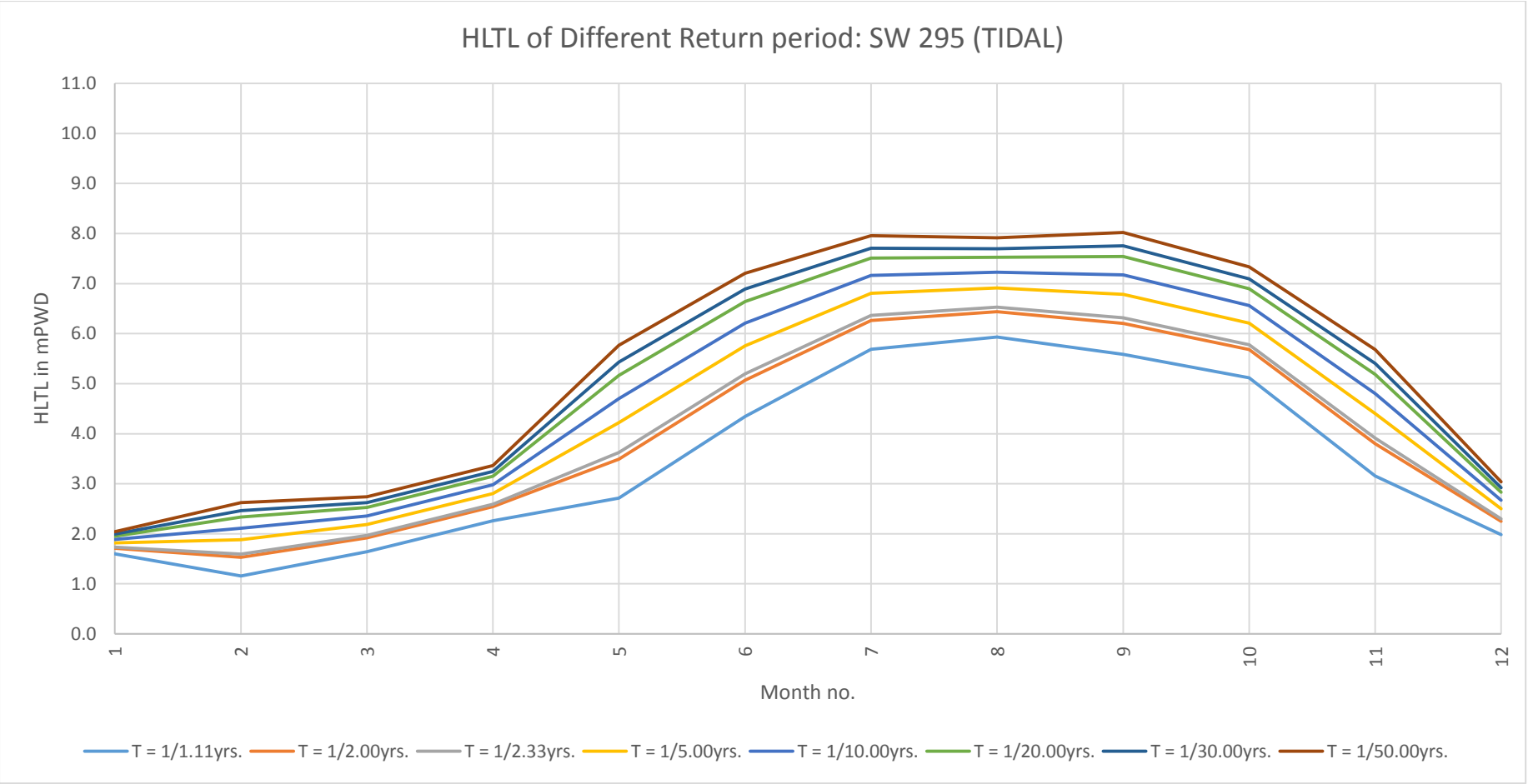
		2015																								
		MAX	02.06	02.16	02.92	03.24	05.38	06.38	07.57	07.68	07.85	06.69	04.87	03.06	01.28	01.26	01.38	02.25	02.90	05.40	06.25	06.98	06.64	04.98	02.60	01.75
		MIN	01.54	00.00	01.69	02.01	02.63	03.66	05.16	05.49	05.06	04.51	02.73	01.72	00.95	00.00	00.87	01.19	01.63	02.12	03.77	04.83	04.53	02.77	01.62	01.31
		N	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21
		AVE.	01.73	01.60	01.97	02.59	03.62	05.20	06.36	06.53	06.31	05.78	03.91	02.30	01.13	01.01	01.12	01.58	02.31	03.55	05.14	05.86	05.52	03.96	02.21	01.55
		σ	00.12	00.40	00.30	00.30	00.83	00.77	00.61	00.54	00.66	00.60	00.68	00.29	00.10	00.27	00.13	00.27	00.31	00.89	00.65	00.50	00.57	00.73	00.27	00.13
ANALYSED DATA:																										
T = 1/1.11yrs.	$K_{1.11}$	= -1.10	01.60	01.16	01.64	02.26	02.71	04.34	05.69	05.93	05.59	05.12	03.16	01.98	01.03	00.71	00.98	01.28	01.97	02.57	04.42	05.30	04.89	03.16	01.90	01.40
T = 1/2.00yrs.	$K_{2.00}$	= -0.16	01.71	01.53	01.92	02.54	03.49	05.07	06.26	06.44	06.20	05.68	03.80	02.25	01.12	00.96	01.10	01.53	02.26	03.40	05.03	05.77	05.43	03.84	02.16	01.53
T = 1/2.33yrs.	$K_{2.33}$	= 0.00	01.73	01.60	01.97	02.59	03.63	05.20	06.36	06.53	06.31	05.78	03.91	02.30	01.13	01.01	01.12	01.58	02.31	03.55	05.14	05.86	05.52	03.96	02.21	01.55
T = 1/5.00yrs.	$K_{5.00}$	= 0.72	01.82	01.88	02.18	02.81	04.22	05.75	06.80	06.91	06.79	06.21	04.40	02.50	01.21	01.20	01.21	01.77	02.53	04.19	05.61	06.22	05.93	04.49	02.40	01.64
T = 1/10.00yrs.	$K_{10.00}$	= 1.30	01.89	02.11	02.36	02.98	04.70	06.21	07.16	07.22	07.17	06.56	04.80	02.67	01.26	01.35	01.29	01.92	02.72	04.71	05.99	06.52	06.27	04.92	02.56	01.72
T = 1/20.00yrs.	$K_{20.00}$	= 1.87	01.95	02.34	02.52	03.15	05.17	06.64	07.51	07.53	07.54	06.90	05.19	02.83	01.32	01.50	01.36	02.07	02.89	05.21	06.36	06.80	06.59	05.32	02.71	01.80
T = 1/30.00yrs.	$K_{30.00}$	= 2.19	01.99	02.46	02.62	03.24	05.43	06.89	07.71	07.70	07.75	07.09	05.41	02.92	01.35	01.59	01.40	02.16	02.99	05.49	06.57	06.96	06.77	05.56	02.80	01.84
T = 1/50.00yrs.	$K_{50.00}$	= 2.59	02.04	02.62	02.74	03.37	05.77	07.20	07.95	07.92	08.02	07.34	05.68	03.04	01.39	01.70	01.45	02.26	03.12	05.85	06.84	07.16	07.00	05.86	02.91	01.89

MONTHLY BASIS ANALYSIS OF DATA OF WATER LEVEL GAUGE STATION SW 295 (LTL)



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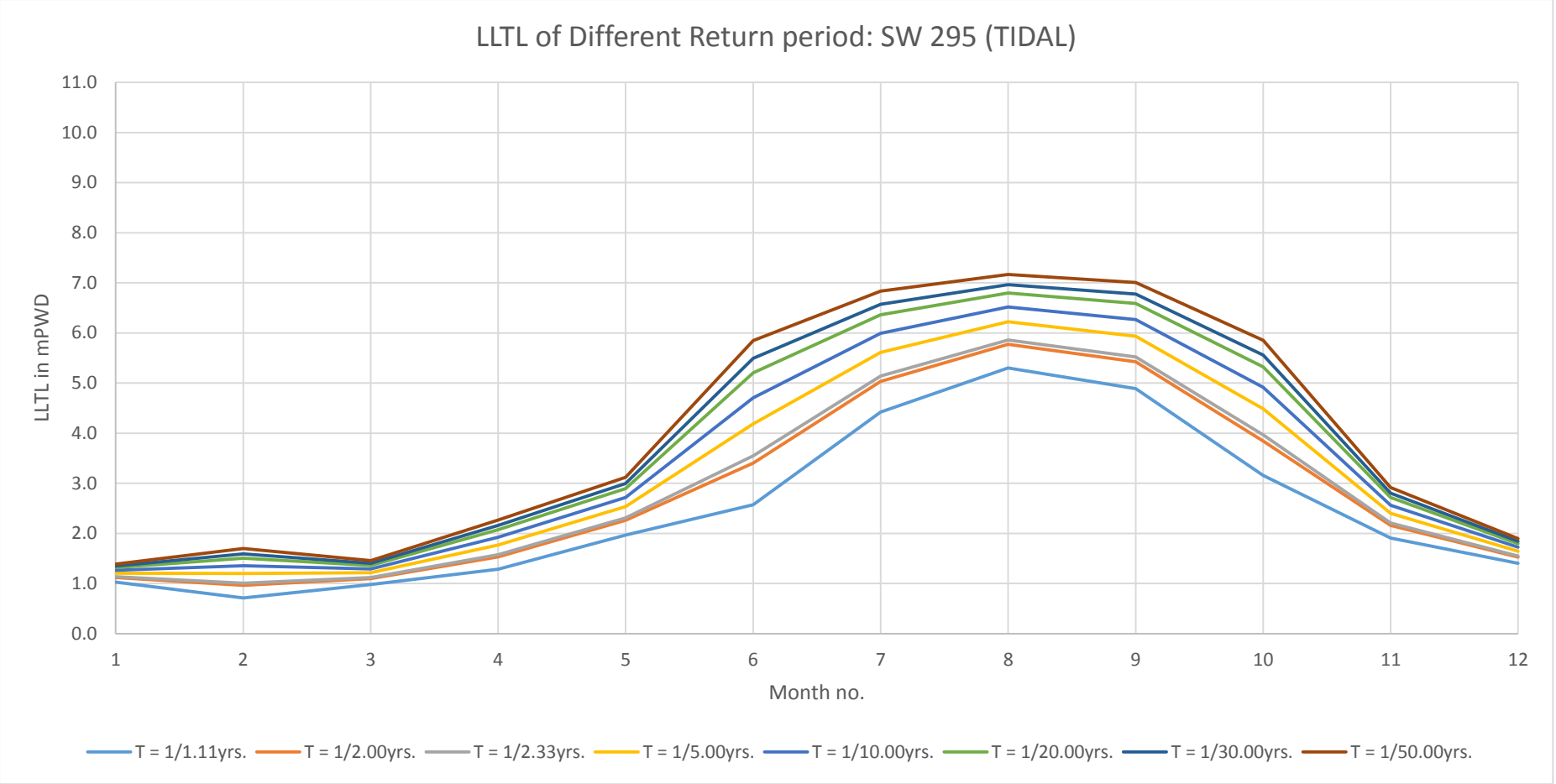

INSTRUCTIONS TO SURVEYORS:
INFORMATION TO BE COLLECTED DURING BATHYMETRIC SURVEY AND PHYSICAL FEATURE SURVEY:

1. During survey works, information regarding water levels should be collected. Information should include: a. Notable highest flood level (HFL) and lowest flood level (LFL) in the past. (ASK LOCALS) b. Notable Highest tide level (HTL) and lowest tide level (LTL) in the past. (ASK LOCALS) c. Present water level (PWL) during survey at the point of surveyed section should be measured.
2. Cross-sections should be collected at entry and exit of a bends of rivers, at centers of riffles of rivers at junctions with tributaries and distributaries and mouths of rivers, near locations of water level gauges and at locations of hydraulic structures.
3. GPS location of the surveyed section should be collected.
4. Local names of the rivers being surveyed and their tributaries (If any) should be collected. (ASK LOCALS)
5. Information regarding hydraulic structures have to be collected consulting with the government agencies like BWDB, BADC, LGED and RHD. Information should include: a. Sill level of regulators, rubber dams, weirs and culverts. b. Opening of the structures. c. Storage level of water retention structures and dams. d. Information of the projects that funded the construction of the structures if possible to collect.
6. Consulting with the local people, information regarding flash flood have to be collected. Information should include: a. Number of incident(s) of flash flood in a year. b. Probable time(s) of flash flood(s) to occur. c. Duration(s) of flash flood(s). d. Areas that are more prone to damage inflicted by flash flood.
7. Information regarding water logging should be collected. Local people should be consulted in this regard. Information should include: a. Name of the areas experiencing frequent water logging problems. b. Duration of water logging. c. Local idea about cause of water logging.
8. Information regarding drains should include: a. Size of drains: (Depth X Width) b. RL of drains at different locations.
    1. c. Construction type of drains: i. Lined / Unlined ii. Man-made / Natural d. Method of connection of households to the drains. e. Location of different point of the drains: i. Starting points ii. Junction points iii. End points f. Name of roads alongside the drains, ward no. / name of village. g. Use of drains: i. Sewer ii. Storm-sewer iii. Mixed
9. Information regarding encroachment of drains and natural channels should be collected.

Table A2.1: Dumpy level reading sheet

Ch.	Distance (m)		Staff reading			Height of instrument	RL	Remarks
(m)	(m)	(m)	BR (m)	IS (m)	FR (m)	(m)	(m)	

Table A2.2: Drainage Inventory

Upazila	Ward no.	By road	Reach	GPS location		RL (mPWD)		Reach Length	Depth	Width	Type
				Start	End	Start	End	(m)	(mm)	(mm)	

CROSS-SECTIONS OF RIVERS AND CHANNELS AS SURVEYED

Page No.

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Figures:

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List of Plates:

Annexures:

JV of SCPL-ABL
Preparation of Development Plan for Fourteen Upazilas Project (Package-02)

Ref: SCPL-ABL/UDD/2016/ Agriculture Survey Report/Shibpur Upazila Date:

To
The Project Director
"Preparation of Development Plan for fourteen Upazilas" Project
Urban Development Directorate
82, Segunbagicha, Dhaka, 1000.

Subject: Submission of the Final Agriculture Survey Report of Shibpur Upazila, Narsingdi.

Dear Sir,
We are pleased to submit herewith the Final Agriculture Survey Report of Shibpur Upazila, Narsingdi for your kind information and further action.

Thanking you and assuring you of our best services.

Your Sincerely,

(Dr. Nurul Islam Nazem)
Team Leader, Package -2

Dr. Santosh Sarker
Agriculture Expert, Package -2

Encl: As stated.

Copy to:
1. Project Manager, Package-2, 14 Upazila Project, UDD
2. Director, Sheltech Consultants Pvt. Limited
3. Chairman, Arc-Bangladesh limited, Dhaka

1/E/2 Paribagh (Mazar Road), Shahbagh, Dhaka-1000, Bangladesh
Phone: +880-2-9611171 Fax: +880-2-9611172
Email: scpl.mail@gmail.com

EXECUTIVE SUMMARY

Shibpur Upazila gets high potentials for its land and agricultural production. This Upazila holds an important arena in Narsingdi District with her natural resources and ecosystem. It is reported that natural disasters like drought, flood, decreasing ground water, heavy rain, early rain, erosion, water logging and hail-storm damage crops of this Upazila. The study is to determine the present scenario of agriculture practices and assessment of the potential sustainable future development of the sector. Both the primary and secondary data were reviewed for preparing the survey report. The proposed Preparation of Development Plan for Fourteen Upazilas, Package 02 is expected to contribute to achieving the objectives of the National Agriculture Policy**.**

The Agro-ecological zones of the Upazila are: Young Brahmaputra and Jamuna Floodplain (AEZ 8), Old Brahmaputra Floodplain (AEZ-9) and Madhupur tract (AEZ-28). Narsingdi gas field is situated in the Upazila adjacent to the Dhaka-Sylhet highway about 45 km away from Dhaka capital city. Shibpur Upazilla consists of one Municipality and 9 Unions.

The highest percentage is double cropped area (57%) followed by triple cropped area (32%), single crop area (10%) and more than three cropped area 1% under Shibpur Upazila. The cropping intensity of Shibpur Upazila is 208% which is higher than Narsingdi district (207%) and higher than average National cropping Intensities (190%).

The scenario of present cropping pattern under Shibpur Upazila is complex and predominantly Boro and T. Aman Rice, Jute, Vegetables, Oilseeds, Pulses Spices, Fruits Garden and Orchard based. Study finding shows that 13 different cropping pattern are practiced by Shibpur Upazila farmers. Shibpur Upazila present one main cropping pattern area is Boro (HYV/Hybrid) → Fallow→T. Aman (HYV) which is practiced 61.4% of the Net Cultivable Area (NCA). Boro(HYV/Hybrid)→-Dhaincha-→Fallow which is practiced 2% of the Net Cultivable Area (NCA). Similarly, winter vegetables→KHarif-1 vegetables→Kharif-2 summer vegetables which are practiced about 3% of the Net Cultivable Area (NCA). Mustard→Jute→T. Aman (HYV/LV) is covering about2 % of the NCA. Banana/Lemon/Zinger is the cropping pattern covering about 4% of the NCA. Fruits Garden is covered about 13% of the Net Cultivable Area. Spices→Jute→Fallow is practiced about 3% Net Cultivable Area

Rice, Jute, winter and summer vegetables, potato, mustard, groundnut and pulses, Banana, Lemon and various fruits crops are grown in 9 Unions under Shibpur Upazila. The present total different cropped area is **27350** ha of which rice cropped area are **19750** ha and the rest **7600** ha is covered by non-rice crops (Jute, Potato, W & S. vegetables, pulses, and oilseeds, Banana, Lemon and Fruits etc.). The rice and non-rice cropped area are about 72% and 28% respectively of the total cropped area. The highest land area was used for Boro (HYV/Hybrid), T. Aman (HYV) rice and Jute cultivation. HYV/Hybrid rice or others crops gives higher yield in compared to local variety crops. Total crop production is **215408.6** metric tons of which rice production is **67428.5** metric tons and non-rice production is **147980.1** metric tons**.** The highest contributions among the non-rice crops are: Fruits Garden (33%), winter vegetables (24%) followed by Banana/ Lemon (18%), Jute (11%) and summer vegetables respectively.

The main source of water is both surface and ground water. For Rabi crops cultivation ground water conservation and proper utilization in this Upazila is very important. A total of 3377 machine were used for irrigation under9 Unions in Shibpur Upazila. All 9 DTW has electricity facilities and also 2054 STW and 4LLP has electricity. Different Unions 1296 STW and also 14 LLP has no electricity facilities for irrigation. During Boro season power supply were acute problems under Shibpur Upazila. Framers wanted nonstop electricity supply during Boro season. Majority of the Farmers (92-100%) reported irrigation drainage system is not pucca which is causes wastage of irrigation water. Farmers wanted pucca drainage system.

Rice production cost of Boro and Aus are Tk.18.65 and Tk.18.64 per kg, and Aman rice production cost is Tk.17.61 per kg which is less than Boro and Aus. The present study was assessed financial profitability of Brinjal, Tomato, Potato and Cabbage/cauliflower vegetables production under Shibpur Upazila. Brinjal cultivation is more profitable (Tk655000/- per ha) followed by tomato (Tk300000/- per ha), Cabbage/Cauliflower (205000/- and potato (Tk180000/- per ha).

The HYV paddy cultivation area 116% was increased and 82% local variety rice was decreased during last ten years. Remarkable significant changed or increased during 10 years was occurred in summer vegetables (77%), winter vegetables (30%), oilseeds (106%), Spices (55%) and Banana/Lemon cultivation (103%) land use. Among the other purposes remarkable significant changed were occurred in poultry farm (742%) and Brick field (316%) and followed by gardening (85%) and Housing (79%) respectively.

Major problems to crop production in 9 Unions and 1 Municipality under Shibpur Upazila are natural disaster such as heavy rain, flood, water logging, drought, and river erosion, electricity power failure during Boro crop season, There is no wholesale market and infrastructure for agriculture product, no cold storage and large vegetables selling center or market under 9 Unions. Produce rice crops market price is less but production cost is high

Road network at local level, agro-processing and marketing infrastructure development, Re-excavation of canals and irrigation facilities need to be improved for mitigating impacts of crop production related vulnerabilities and climate change. Reconstruction of damaged water management infrastructures need to be made. Each Union one wholesale market infrastructure need to be constructed. DAE may arrange joint collaborative soil testing and recommendation and training program for beneficiaries. Financial support needs to be provided to DAE from project.

Agro-based processing center & industries need to be establishment under 9 unions and Municipality. There is a need for construction of infrastructure for some agro-base processing center. There is a need to integrated effort for industrial effluents and waste management.

List of Abbreviations

AEO	Agriculture Extension Officer
AEZ	Agro-Ecological Zone
BARI	Bangladesh Agriculture Research Institute
BCR	Benefit Cost Ratio
BINA	Bangladesh Institute of Nuclear Agriculture
BRRI	Bangladesh Rice Research Institute
BSRI	Bangladesh Sugarcane Research Institute
BBS	Bangladesh Bureau of Statistics
CC	Climate Change
CA	Commercial Area
CDS	Coastal Development Strategy
DAE	Department of Agricultural Extension
DTW-	Deep Tube Well
DS/m	Deci-Siemens/meter
d-Base	Data Base
FAO	Food and Agricultural Organization
GO-	Government Organization
HYV-	High Yielding Variety
HHS	Household Survey
IPM	Integrated Pest Management
IPMP	Integrated Pest Management Plan (IPMP)
ICZMP	Integrated Coastal Zone Management Programme
KII-	Key informant Interview
LIV	Local Improved Variety
LLP	Low Lift Pump
NCA	Net Cultivable Area
NLUP	National Land Use policy
NWP	National Water Policy
NIPM	National Integrated Pest Management
NWMP	National Water Management Policy
P^H	Negative Logarithm of Hydrogen ion concentration
PRA	Participatory Rapid Appraisal
SAAO	Sub-Assistant Agricultural Officer
SRDI	Soil Resource Development Institute
SPSS	Statistical Package for Social Sciences
STW	Shallow Tube Well

T. Aman	Transplanted Aman
T. Aus	Transplanted Aus
ToT	Training of Trainers
UAO	Upazila Agricultural Officer
WARPO	Water Resources Planning Organization

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Appendixes

Chapter-01:
Introduction

1.1 Background of the Study

Land is an important resource for most human activities including agriculture, industry, forestry, energy production, settlement, recreation, and water catchment and storage. These diversified uses of land have been giving financial benefits in one hand but on the other creating many problems in respect of criteria based uses and conflicts among the users. Shibpur is located at 24.3750°N and 90.7375°E. The Upazila occupies an area of 21780.97 hectare and total area 206.89 km². The Shibpur Upazila is bounded on the north by Manohardi Upazila on the east by Raipura and Belabo Upazilas on the south by Narsighdi Sadar Upazilas and on the west by Palash Upazila and Kapasia and Kaliganj Upazilas of Gazipur District. It is under Narsingdi District. The Agro-ecological zones of the Upazila are: Young Brahmaputra and Jamuna Floodplain (AEZ 8), Old Brahmaputra Floodplain (AEZ-9) and Madhupur tract (AEZ-28). Narsingdi gas field is situated in the Upazila adjacent to the Dhaka-Sylhet highway about 45 km away from Dhaka capital city. Shibpur Upazilla consists of one Municipality and 9 Unions.

Most of the people of this Upazila are directly or indirectly dependent on agriculture. Increased population imposes high pressure on land resources for agricultural production. Additionally, rapid population growth causes conversion of agriculture land into settlement, industrial area and urban zone. It is reported that natural disasters like seasonal flood, drought, water logging, and hail-storm, tornado and land erosion damage crops of this Upazila. However shifting agricultural land to non-agricultural purposes is a common phenomenon in this Upazila. Improper land use causes various forms of land degradation resulting in a reduced agriculture production. Indiscriminate land conversion will impose threat to national food security. Furthermore, improper land uses affect flora and fauna habitat and thus impact ecosystem and biodiversity. To protect agricultural land, to minimize land degradation and introducing modern technology are the basic needs to cope-up with the increasing demand of food for the growing population of this Upazila.

In view of the above mentioned context, a comprehensive study was conducted in all the Unions of Shibpur Upazila to assess present situation of land uses, related problems and potentialities of land for different other uses, and to find out possible coping ways to solve the problems. Therefore, considering all available parameters and characteristics of the area a sustainable land management was considered to develop better crop production.

1.2 Objectives of the Study

The main objective of the study is to assess the present cropping pattern and cropping intensities (single, double and triple crop area), land utilization and flood level. The main study questions are to determine the growth or decline of agricultural land during last ten years (from 2005-2016), and their causes for growth or decline covering a possible quality of existing and future agricultural land for the project area. The study is to determine the present scenario in agriculture practices and assessment of potential sustainable future development of the sector.

1.3 Approach and Methodology

A multi-disciplinary, participatory and interactive method has been followed in carrying out the study. Both primary and secondary data were reviewed. The primary data were collected through KII (Key Informant Interview) and field visit.KII information was collected by used of questionnaire Annex-1.

The secondary data were collected and reviewed on land use from DAE Union and Upazila Office documents. KII information was collected from 34 Sub-Assistant Agriculture Officers under 1 Municipality and 9 Unions through interview. Structured and semi-structured questionnaire was used for data collection (Annex-2). Data collection and consolidation occurred simultaneously. Data consolidation activities, such as editing, coding, classifying and data entry into the computer software for analysis were carried out simultaneously. Frequency tables (one, two or multiple ways) were prepared for interpretations and analyses using SPSS, and d-Base for data analysis.

Chapter-02:
Agriculture Relevant Policy Framework

This Chapter presents a review of the national policy, legal, and regulatory framework relevant to the agriculture aspects of the Project.

2.1 National Agriculture Policy, 2013

The National Agriculture Policy, 2013 approved by the Government of Bangladesh focuses on agriculture production, alleviating poverty through generating jobs and ensuring food security. The Policy outlined nine specific objectives. Although the policy does not emphasize the coastal zone separately, all specific objectives are applicable to the development of coastal zone agriculture.

The GoB will pursue programme for agro-ecologically disadvantaged regions in the hilly area, drought-prone area, Barind tract, char land, haor-baor and coastal belt with appropriate technological support.

To increase water productivity and enhance irrigation efficiency through optimal use of available water resources the GoB will facilitate dissemination of water management technology. Modern irrigation, drainage and water application systems will be introduced for expanding irrigation coverage including difficult or disadvantaged areas i.e. in char, hilly areas, Barind Tract, drought-prone and saline areas.

The proposed Preparation of Development Plan for Fourteen Upazilas Package: 02 are expected to contribute to achieving the objectives of the agriculture policy.

2.2 National Water Management Plan, 2001 (Approved in 2004)

The National Water Management Plan (NWMP) 2001, approved by the National Water Resources Council in 2004, envisions establishing an integrated development, management and use of water resources in Bangladesh over a period of 25 years. WARPO has been assigned to monitor the national water management plan. The major programs in the Plan have been organized under eight sub-sectoral clusters: (i) Institutional Development,(ii) Enabling Environment, (iii) Main Rivers, (iv) Towns and Rural Areas, (v) Major Cities; (vi) Disaster Management; (vii) Agriculture and Water Management, and (viii) Environment and Aquatic Resources. Each cluster comprises of a number of individual programs, and a total of 84 sub-sectoral programs have been identified and presented in the investment portfolio. Most of the programs are likely to be implemented in coastal areas.

Preparation of Development Plan for Fourteen Upazilas Package: 02 has been designed in line with this Plan and addresses its key objectives for the water resource management in the Shibpur Upazila Narsingdi district areas.

2.3 The Ground Water Management Ordinance, 1985 (Ordinance No. Xxvit of 1985)

This is an Ordinance to manage ground water resources for agricultural production. This Act authorizes the Thana Parishad (Police Station) to grant license for installing tube wells under its

jurisdiction. The Thana Parishad may grant the license if the Parishad is satisfied that the installation of the tube well applied for complies with the following points;

- will be beneficial to the areas where it is to be installed, or
- will not have any adverse effect upon the surrounding areas, or is otherwise feasible.

Preparation of Development Plan for Fourteen Upazilas Package 02 has been designed in line with this Plan and addresses its key objectives for the ground water management ordinance for Shibpur Upazila.

2.4 National Land Use Policy (MoL, 2001)

The National Land Use Policy enacted in 2001, aims at managing land use effectively to support trends in accelerated urbanization, industrialization and diversification of development activities. The NLUP urges that increasing the land area of the country may not be possible through artificial land reclamation process, which is cost-effective only in the long run. Therefore, land use planning should be based on the existing and available land resources. The policy suggests establishing land data-banks where, among others, information on accreted reverie and coastal chars will be maintained. Among the 28 policy statements of NLUP, the following are relevant to the Shibpur Upazila under coastal area:

- forests declared by the Ministry of Environment and Forests will remain
- as forest lands;
- reclassification of forest lands will be prevented; and
- effective green belts will be created all along the coast.

Preparation of Development Plan for Fourteen Upazilas Package 02 is designed in accordance with this Policy and will comply with the above listed requirements.

2.5 National Water Policy, 1999

Endorsed by the GoB in 1999, the National Water Policy (NWP) aims to provide guidance to the major players in the water sector for ensuring optimal development and management of water. According to the policy, all agencies and departments entrusted with water resource management responsibilities (regulation, planning, construction, operation, and maintenance) are required to enhance environmental amenities and ensure that environmental resources are protected and restored in executing their tasks.

The proposed Preparation of Development Plan for Fourteen Upazilas Package: 02 are expected to contribute to achieving the objectives of the national water policy.

2.6 National Integrated Pest Management (NIPM) Policy

IPM Action Plan supports a strategy that promotes use of biological or environmental pest control methods and reduces reliance on synthetic chemical pesticides. Agriculture, rural development and health sector projects have to avoid using harmful pesticides. Other pesticides can be used, but only as an element of an Integrated Pest Management Plan (IPMP) that emphasizes environmental and biological controls.

The proposed Preparation of Development Plan for Fourteen Upazilas Package 02 is expected to contribute to achieving the reduces pesticides used in agriculture sector and increases use of other pest control methods under National IPM policy.

Chapter-03:
Present Land Used

3.1 Description of the Present Situation

The land of Shibpur Upazila is intensively used for vegetables & fruits and other agriculture crops, housing and settlement, fisheries, poultry and other infrastructural development.

Shibpur Upazila falls into 3 Agro-ecological zones of the Upazila are: (i) Young Brahmaputra and Jamuna Floodplain (AEZ 8), (ii) Old Brahmaputra Floodplain (AEZ-9) and (iii) Madhupur tract (AEZ-28). Narsingdi gas field is situated in the Upazila adjacent to the Dhaka-Sylhet highway about 45 km away from Dhaka capital city. Shibpur Upazilla consists of 9 Unions and 1 Paurashava. Most of the people of this Upazila are directly or indirectly dependent on agriculture. General soil color of Shibpur Upazila is grey to brownish. The top soil is occupied by non-calcareous, permeable loamy soils and some parts are clayey. In Shibpur organic matter contents are low in the high land but moderate in the lower parts. Moisture holding capacity of soil is low to medium. General fertility is relatively poor. The top soil pH level ranges from 4.5-6.7 (SRDI 2003 and UAO 2016).

3.2 Shibpur Upazila and Union Wise Farm Families

Farmers in Shibpur Upazila lead their livelihood from agricultural activities. It is the main source of their employment and income. Shibpur Upazila has 9 Unions. It has 41 agricultural blocks under DAE. Union and category wise farm family under Shibpur Upazila is shown in Table 1. Farm family is categorized according to farmer holding own land. There are five categories of farm family in Bangladesh. These are: landless (0.05-0.50 acre land), marginal (0.51-1.50 acre land), and small (1.51-2.50 acre land), and medium (2.51-7.50 acre land) and larger (above 7.50 acre land). On an average about land less 9534, marginal 22957, small 12303, medium large 4336 farm families and remaining 291 are larger farmers under Shibpur Upazila. The highest percentage of farm families are marginal farmers (46%) followed by Small (25.00%), landless (19%), medium farmers (9%) and remaining are larger farmers (Fig-1).

Table1: Union and Category Wise Farm Family under Shibpur Upazila

Name of Union	Landless (%)	Marginal (%)	Small (%)	Medium (%)	Larger (%)	Total
	(.05-.50 acre)	(.51-1.50 acre)	(1.51-2.50 acre)	(2.51-7.50 acre)	(above 7.50 acre)	
Ayubpur Union	742 (15.27)	2536(52.19)	600(12.35)	971(19.98)	10(0.21)	4859
Baghaba Union	630(13.06)	2126(44.07)	1528(31.67)	511(10.59)	29(0.61)	4824
Chakradha	1185(16.10)	2413(32.78)	3247(44.10)	457(6.21)	60(0.81)	7362
Dulalpur Union	2143(35.52)	2253(37.34)	952(15.78)	661(10.96)	24(0.40)	6033
Josar Union	261(5.29)	2310(46.84)	1718(34.83)	574(11.64)	69 (1.40)	4932
Joynagar Union	469(7.74)	3277(54.05)	1783(29.40)	500(8.25)	34(0.25)	6063
Masimpur Union	869(21.04)	2313(55.99)	772(18.69)	152(3,69)	25(0.60)	4131
Putia Union	2065(29.73)	3357(48.34)	1217(17.52)	286(4.12)	20(0.29)	6945
Sadhar Char Union	1170(27.39)	2372(55.52)	486(11.38)	224(5.24)	20(0.47)	4272
Total	9534(19.29)	22957 (46.45)	12303(24.89)	4336 (8.77)	291 (0.59)	49421

Source: Sub-Assistant Agriculture Officers under ---------- Upazia, DAE 2016

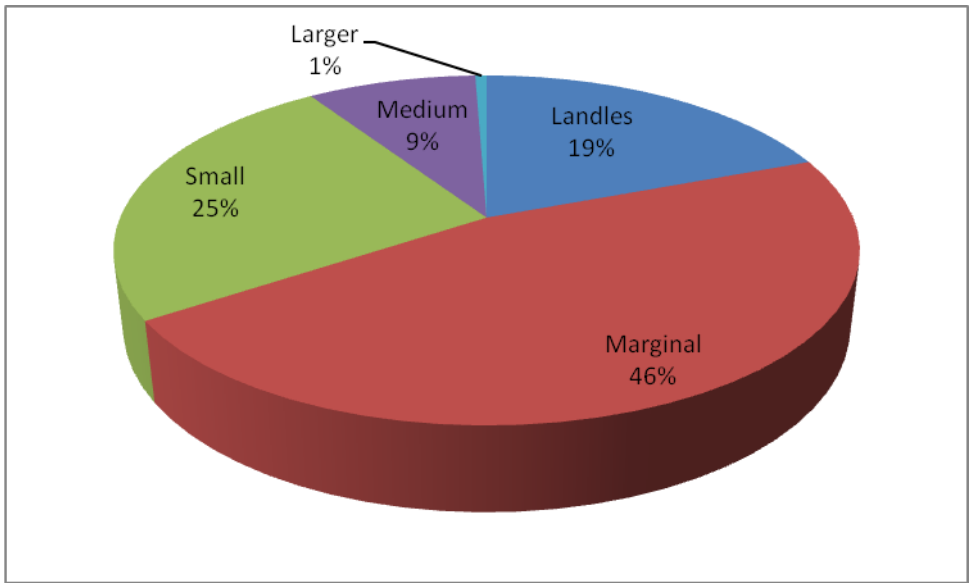


Figure 1: Percentage of Category wise Farm family under Shibpur Upazila

3.3 Present Agricultural Land Use

3.3.1 Present Upazila Land Use

The land of shibpur Upazila is dominant in agriculture and also intensively used for poultry, fish culture, settlements with homestead forest and other infrastructural activities. Shibpur Upazila gets high potentials for its land and agricultural production. This Upazila holds an important arena in Narsingdi District with her natural resources and ecosystem. The scenario of Shibpur Upazila present different land utilized is shown in Table 2 Types of lands are 6382 ha high land, 7617 ha medium high land, 5145 ha medium low land and 1440ha low land respectively. Shibpur Upazila covers 16500 ha of net cropped area of which about cultivated area is 37105 ha. The highest land area is 9445 ha is used as double crop and followed by triple crop of 5220 ha and remaining 1595 ha is used as single crops and 240 ha also used as more than three crops under Shibpur Upazila. Other land use: Permanent Fruit Garden 2544ha, Forest 40ha and Fish cultivation 165 ha. Percentage of single, double, triple and more than three cropped area used in Shibpur Upazila is shown in Fig 2. The highest percentage is double cropped area (57%) followed by triple cropped area (32%), single crop area (10%) and More than three cropped area 1% under Shibpur Upazila. The cropping intensity of Shibpur Upazila is 208%. Union-wise Present Agriculture Land Use Information and Identified land Zoning of Ishwarganj Upazila are shown in Table 3 and Table 4 and Fig 1.

Table-2: Shibpur Upazila Present Land Use

Sl. No	Upazila Land use	Total Area (ha)
1.	Total Agricultural land	20586
2.	Single cropped area	1595
3.	Double cropped area	9445
4.	Triple cropped area	5220
5.	More than three cropped area	240

6.	Net cropped area	16500
7.	Total crops land	37105
8.	Cropping Intensity	208%
9.	Water land (River, Ponds and others)	165
10.	Forest land	40
11.	Household area	6670
12.	High land	6382
13.	Medium high land	7617
14.	Medium low land	5145
15	Low land	1440
16.	Permanent Fruit Garden	2544
17.	Road	1623

Source Upazila Agriculture Office Ishwarganj, DAE 2016

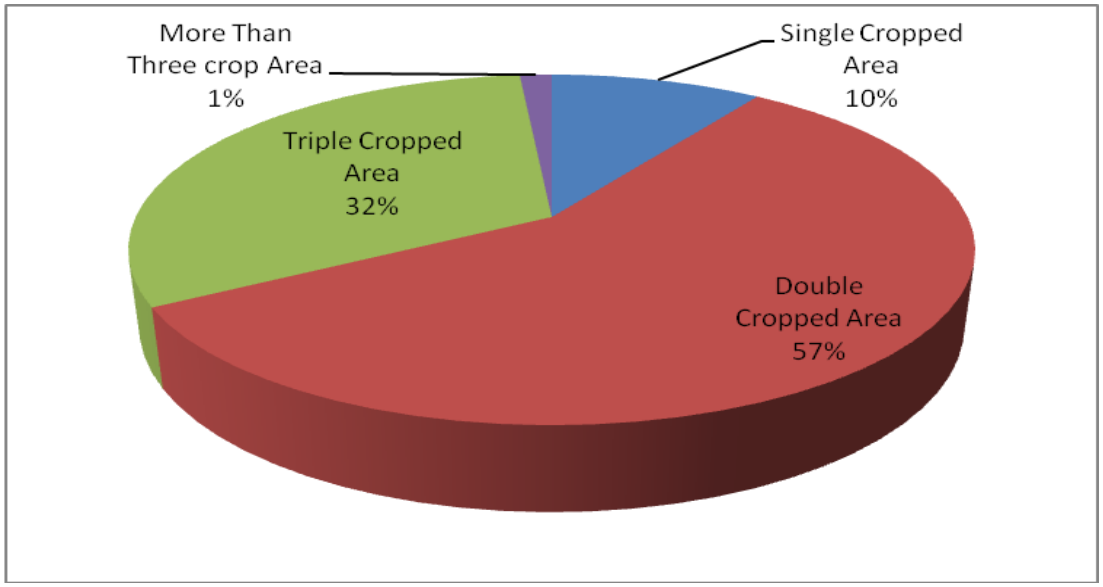


Figure 2. Percentage of single, double, triple and more than three cropped land used in Shibpur Upazila

Table 3: Union-wise Present Agriculture Land Use Information and Identified land of adjoining Shibpur Upazila

Name of Union	Total Area (HA)	NCA (ha)	Land Type (%) NCA	Soil P^H	Soil Texture	Present land Used (%)	Identified Land Zoning
Ayubpur Union	2588	1211	HL=20 MHL=29 MLL=34 LL =16 VLL =1	5.5-6,0	Loam clay	Agriculture =62.24 Industrial Area=0.04 Road = 1.31 Rural Settlement & & HV = 33.56 Water bodies=2 .86	Agriculture Zone

Name of Union	Total Area (HA)	NCA (ha)	Land Type (%) NCA	Soil P^H	Soil Texture	Present land Used (%)	Identified Land Zoning
Baghaba Union	4065	1850	HL=32 MHL=39 MLL=24 LL = 5	5.5-6.5	Clay Loam/ Clay	Agriculture=50.91 Forest =15.25 Industrial Area=0.05 Fruit garden=1.11 Road= 0.78 Rural Settlement &HV = 29.67 Urban Built-up Area =0.05 Water bodies=2.18	Agro-Forest& Fruit Garden Zone
Chakradha	4855	2325	HL=29 MHL=28 MLL=22 LL=21	4.0-6.0	Loam / clay loam	Agriculture=58.53 Road=0.86 Rural Settlement &HV =36.79 Urban Built-up Area =0.03 Water bodies=3.81	Agriculture Zone
Dulalpur Union	4535	2195	HL=15 MHL=50 MLL=23 LL=10 VLL=2	5.0-7.0	Clay loam/Clay	Agriculture =59.01 Road=1.14 Rural Settlement &HV =34.78 Water bodies=5.07	Agro-Fisheries Zone
Josar Union	2855	1395	HL=37 MHL=63	4.5-6.0	Loam / clay loam	Agriculture=24.34 Forest =26.65 Industrial Area=0.08 Fruit Garden=19.04 Road=0.93 Rural Settlement & HV =27.30 Water bodies=1.65	Gas Field-Agro-Forest& Fruit Garden Zone
Joynagar Union	5220	2800	HL=24 MHL=40 MLL=21 LL=15	5.0-7.0	Clay loam/Clay	Agriculture=40.78 Forest =22.40 Industrial Area=0.03 Fruit Garden=4.84 Road=0.43	Agro-Forest& Fruit Garden Zone Zone

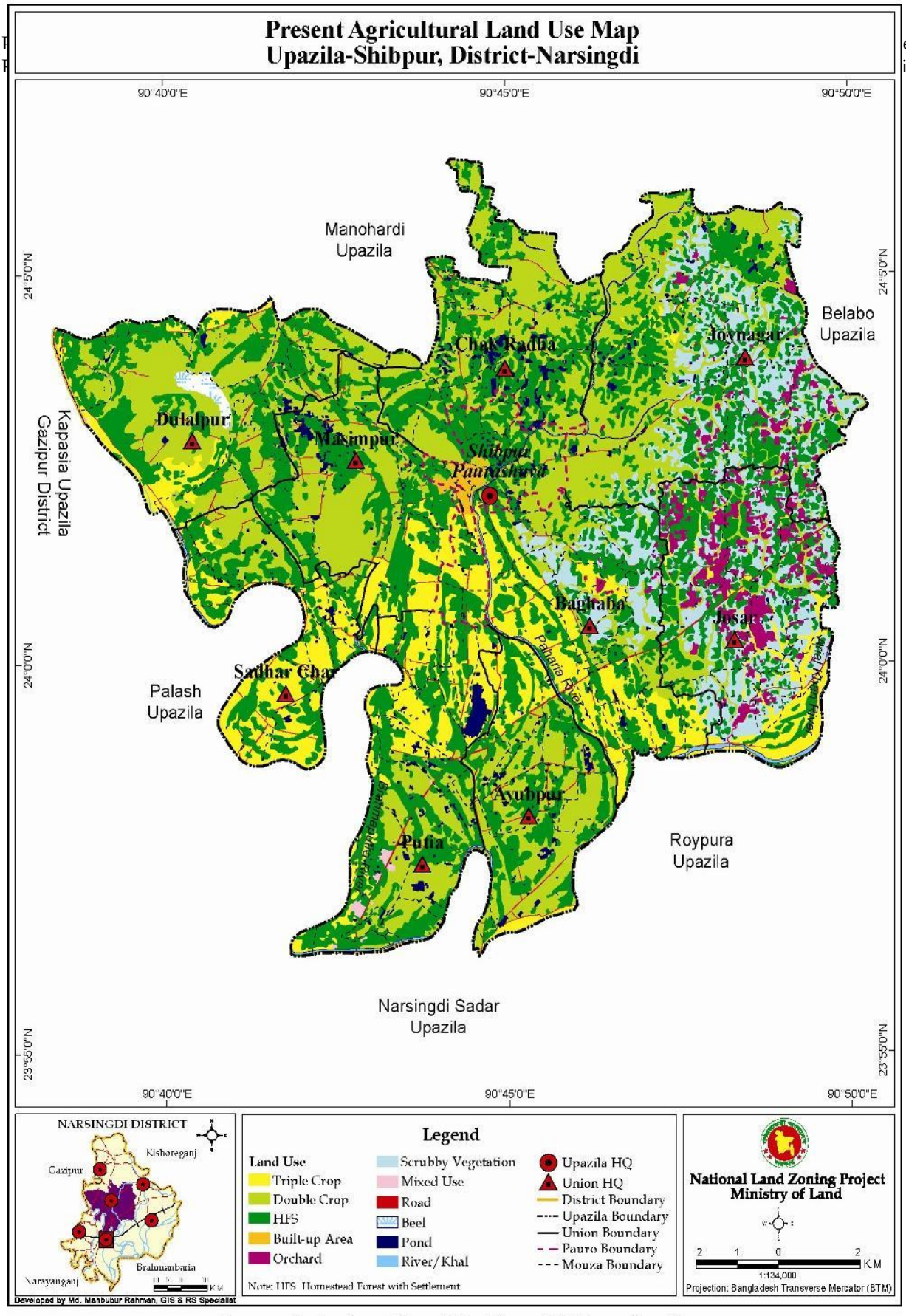
Name of Union	Total Area (HA)	NCA (ha)	Land Type (%) NCA	Soil P^H	Soil Texture	Present land Used (%)	Identified Land Zoning
						Rural Settlement & HV =29.86 Water bodies=1.66	
Masimpur Union	2106	1038	HL=17 MHL=67 MLL=11 LL=5	5.5-7.5	Clay loam/ loam	Agriculture=59.70 Road=1.07 Rural Settlement& HV =36.29 Urban Built-up Area =0.41 Water bodies=2.54	Agriculture Zone
Putia Union	4239	1968	HL=5 MHL=30 MLL=38 L L=21 VLL=6	5.0-7.5	Loam / clay loam	Agriculture=52.04 Industrial Area=1.39 Road=1.41 Rural Settlement & HV =39.34 Urban Built-up Area =0.35 Water bodies=5.47	Agriculture Zone
Sadhar Char Union	2630	1210	HL=25 MHL=49 MLL=16 LL=7	5.6-7.3	Loam / clay	Agriculture=60.64 Road=1.43 Rural Settlement & HV =35.21 Water bodies=2.72	Agro-Fisheries Zone
Shibpur Paurashava		878.54	HL=9 MHL=40 MLL=21 LL=29 VLL=1	5.0-7.0	Clay loam/Clay	Agriculture=45.27 Road=1.85 Rural Settlement &HV =42.21 Urban Built-up Area =7.44 Water bodies=3.23	Paurashava area

Source: National Land Zoning Report January 2015 of Shibpur Upazila under Narsingdi district

Table 4: Unions Identified Land Zoning under Shibpur Upazila

Name of Zone	Union	Remarks
1. Agriculture Zone	Ayubpur , Chakradha, Masimpur & Putia	Considering the present agricultural land use, land suitability analysis and as per opinion of local peoples these Unions are identified as agricultural Zone
2. Agro-Fisheries Zone	Dulalpur & Sadhar Char	Some of the area is potential for capture and culture fisheries and high production of fisheries
3. Agro-Forest & Fruits Garden Zone	Baghaba & Joynagar	This Union lies in Agro-Ecological Zone of Modhupur tract and suitable for forest and various fruit garden
4. Narsingdi Gas Field-Agro-Forest and Fruits Garden Zone	Joysar	Narsingdi Gas field is situated in the Upazila adjacent to Dhaka-Sylhet highway
5. Paurashava Area	Shibpur Paurashava	Urban development of plan should be implemented without degrading fertile agricultural land.

Source: National Land Zoning Report January 2015 of Shibpur Upazila under Narsingdi District



Present Agricultural Land Use Map of Shibpur Upazila

Fig 3: Agricultural Land-use Map of Shibpur Upazila

Source: National Land Zoning Report, December, 2014

3.4 Union-Wise Present Agriculture Land Use

Shibpur Upazila has 9 Unions and lands used of all the 9 unions are given below.

3.4.1 Ayubpur Union Land Use

General Description

Land type is the dominant factor guiding choice of crops and cropping patterns of area. Selection of crop largely depends on topographic position of land. Union falls into 3 Agro-ecological zones of the Union are: (i) Young Brahmaputra and Jamuna Floodplain (AEZ 8), (ii) Old Brahmaputra Floodplain (AEZ-9) and (iii) Madhupur tract (AEZ-28). The soil P^H is 5.5-6.0. The agricultural potentiality of these soils is high for field crops and Agro-forestry species (Land Zoning Report, January 2015). Ayubpur Union is comprised of 10 mauzas having an area of 2588ha of land of which cultivable area is 1211 ha. The land types of this union are highland (20%), medium high land (29%), Medium low land (34%) , Low land (16%) and very low land (1%) which indicates lands are free from monsoon flood and suitable for different Rabi crops and Kharif crops Cultivation(SAAO,2016).

Present Agriculture Land Use: Boro(HYV) is the main irrigated crops cultivated by using ground water . There are Seven cropping pattern are practiced in Ayubpur Union which is shown in Table 5. The cropping intensity of this union is 213%. Major crops cultivated in this union are: paddy, Jute, Lemon, Dhaincha and Rabi & Kharif different vegetables.

Table-5: Present Cropping Patterns of Ayubpur Union

Name of Union	Net Cultivable Area (ha)	Major Cropping Patterns	Cropping Intensity(%)	% of NCA	Area (ha)
Ayubpur	1211	Boro(HYV)→Fallow→T.Aman(HYV)	213	77.87	943
		Vegetables→Boro----Fallow		3.80	46
		RC→ Dhaincha→T.Aman(HYV)		4.13	50
		Mustard→Boro→ T.Aman		2.89	35
		Vegetable→Vegetable→Vegetable		6.52	79
		Vegetables→Fallow→T.Aman(HYV)		2.31	28
		Wheat/Maize→Jute→T.Aman		2.48	30
		Total		100	1211

Source: SAAOs of Ayubpur Union 2016

Major Problems on Crop Cultivation

Agriculture is the backbone of Shibpur Upazila and is synonymous to the food security. The major problems in Ayubpur Union crop cultivation are: (i) Flood (ii) Drought (iii) Water logging (iv) Lack of quality seed (v) Decrease of agricultural land (vi) Erosion (vii) Climate change (viii) Changes in rainfall pattern (ix) Temperature fluctuation (x) Adverse weather condition (xi) Power failure (xii) Inadequate drainage facilities (xiii) Increase insect and pest infestation and (xiv) Change in rivers and canals morphology.

Measures to Improve Crop Cultivation

The remedial measures are given below:

(a)Adapt modern farming techniques, (b) Choose high yields and drought tolerant varieties.

(c) Information on quality seed, (d) Observe weather conditions and follow weather forecast,

(e)Follow fertilizer recommendation by soil testing,(f) Select best available seeds from market,(g) Integrated effort for industrial effluents and waste management,(h) Incorporating organic manure in the soil by changing cropping pattern /crop rotation system (i) Grow one leguminous crop (Dhaincha / Pulses/Fodder etc.) between two cereal crops (j)Re-excavation of canals,(k) Reconstruction of damaged water management infrastructures,(l) Develop market infrastructures and road communication at local level and(m) Uninterrupted power supply to irrigation pumps.

3.4.2 Baghaba Union Land Use

General Description

Crops and cropping pattern depends on flood depth and lands which above normal inundation level, can provides wide range of opportunities for growing various crops round the year. This union land is suitable for crop cultivation round the year. Baghaba Union is comprised of 19 mauzas and 21 villages having an area of 4065 ha of land of which cultivable area is 1850 ha. The land types of this union are highland (32%), medium high land (39%), Medium low land (24%) , Low land (5%) which indicates lands are free from monsoon flood and suitable for different Rabi crops and Kharif crops Cultivation(SAAO,2016). Union falls into 3 Agro-ecological zones of the Union are: (i) Young Brahmaputra and Jamuna Floodplain (AEZ 8), (ii) Old Brahmaputra Floodplain (AEZ-9) and (iii) Madhupur tract (AEZ-28). Most of the areas of this Union are developed from transformed alluvial deposit by the Brahmaputra and Jamuna rivers. The soil P^H is 5.5-6.5. The agricultural potentiality of these soils is high for field crops and Agro-forestry species (Land Zoning Report, January 2015).

Present Agriculture Land Use: There are six cropping pattern is practiced in Baghaba Union which is shown in Table 6. The cropping intensity of this union is 219%. Baghaba Union dominant land use is agriculture followed by homestead garden. Boro(HYV) is the main irrigated crops cultivated by using ground water. Major crops cultivated in this union are: paddy, Potato, Jute, Lemon, Mustard and different Rabi & Kharif vegetables.

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Table-6: Present Cropping Patterns of Baghaba Union

Name of Union	Net Cultivable Area (ha)	Major Cropping Patterns	Cropping Intensity(%)	% of NCA	Area (ha)
Baghaba	1850	Boro(HYV)→Fallow→T.Aman(HYV)	219	47.03	870
		Boro(HYV/Hybrid) → Fallow→Fallow		5.14	95
		Spices→ Falllow→T. Aman(HYV)		11.35	210
		Vegetables → Jute→ T.Aman		6.76	125
		Vegetable→Vegetable→Vegetable		27.03	500
		Banana/Lemon→ Banana/Lemon		2.70	50
		Total		100	1850

Source: SAAOs of Baghaba Union 2016

Major Problems on Crop Cultivation

The major problems in Baghaba Union crop cultivation are: (i) Flood (ii) Drought (iii) Water logging (iv) Lack of quality seed (v) Decrease of agricultural land (vi) Erosion (vii) Climate change (viii) Changes in rainfall pattern (ix) Temperature fluctuation (x) Adverse weather condition (xi) Power failure (xii) Inadequate drainage facilities (xiii) Increase insect and pest infestation and (xiv) Change in rivers and canals morphology.

Measures to Improve Crop Cultivation

The remedial measures are given below:

(a)Adapt modern farming techniques, (b) Choose high yields and drought tolerant varieties.

(c) Information on quality seed,(d) Observe weather conditions and follow weather forecast,

(e)Follow fertilizer recommendation by soil testing,(f) Select best available seeds from market,(g) Integrated effort for industrial effluents and waste management,(h) Incorporating organic manure in the soil by changing cropping pattern /crop rotation system (i) Grow one leguminous crop (Dhaincha / Pulses/Fodder etc.) between two cereal crops (j)Re-excavation of canals,(k) Reconstruction of damaged water management infrastructures,(l) Develop market infrastructures and road communication at local level and(m) Uninterrupted power supply to irrigation pumps.

3.4.3 Chakradha Union Land Use

General Description

This union land is suitable for all types crops round the year. Natural and man-made hazards like flood, heavy rain, and drainage congestion damaging agricultural crops. Union falls into 3 Agro-ecological zones of the Union are: (i) Young Brahmaputra and Jamuna Floodplain (AEZ 8), (ii) Old Brahmaputra Floodplain (AEZ-9) and (iii) Madhupur tract (AEZ-28). The soil P^H is 4.0-6.0. The agricultural potentiality of these soils is high for field crops and Agro-forestry species (Land Zoning Report, January 2015). Chakradha Union is comprised of 12 mauzas and 18 villages having an area of 4855 ha of land of which cultivable area is 2325 ha. The land types of this union are highland (29%), medium high land (28%), Medium low land (22%) , Low land (21%) which indicates lands are free from monsoon flood and suitable for different Rabi crops and Kharif crops Cultivation(SAAO,2016).

Present Agriculture Land Use: Major crops cultivated in this union are: paddy, Potato, Jute, Lemon, Banana, Mustard and different Rabi & Kharif vegetables. Chakradha Boro (HYV) is the main irrigated crops cultivated by using ground water.There are six cropping pattern are practiced in Chakradha Union which is shown in Table 7. The cropping intensity of this union is 209%.

Table-7: Present Cropping Patterns of Chakradha Union

Name of Union	Net Cultivable Area (ha)	Major Cropping Patterns	Cropping Intensity (%)	% of NCA	Area (ha)
Chakradha	2325	Boro(HYV)→Fallow→T.Aman(HYV)	209	57.20	1330
		Boro(HYV/Hybrid) → Fallow→Fallow		18.28	425
		Mustard→ →T. Aman(HYV)		1.51	35
		Pulses → Fallow→ T.Aman		1.08	25
		Vegetable→Vegetable→Vegetable		19.57	455
		Banana/Lemon→ Banana/Lemon		2.37	55
		Total		100	2325

Source: SAAOs of Chakradha Union 2016

Major Problems on Crop Cultivation

The major problems in Chakradha Union crop cultivation are: (i) Flood (ii) Drought (iii) Water logging (iv) Lack of quality seed (v) Decrease of agricultural land (vi) Erosion (vii) Climate change (viii) Changes in rainfall pattern (ix) Temperature fluctuation (x) Adverse weather condition (xi) Power failure (xii) Inadequate drainage facilities (xiii) Increase insect and pest infestation and (xiv) Change in rivers and canals morphology.

Measures to Improve Crop Cultivation

The remedial measures are given below:

(a)Adapt modern farming techniques, (b) Choose high yields and drought tolerant varieties.

(c) Information on quality seed,(d) Observe weather conditions and follow weather forecast,

(e)Follow fertilizer recommendation by soil testing,(f) Select best available seeds from market,(g) Integrated effort for industrial effluents and waste management,(h) Incorporating organic manure in the soil by changing cropping pattern /crop rotation system (i) Grow one leguminous crop (Dhaincha / Pulses/Fodder etc.) between two cereal crops (j)Re-excavation of canals,(k) Reconstruction of damaged water management infrastructures,(l) Develop market infrastructures and road communication at local level and(m) Uninterrupted power supply to irrigation pumps.

3.4.4 Dulalpur Union Land Use

General Description

This Union dominant land use is agriculture followed by fisheries and fruits garden. A considerable number of farmers commercially were cultivated vegetables and fruits crops under this Union. Dulalpur Union is comprised of 12 mauzas and 20 villages having an area of 4535 ha of land of which cultivable area is 2195 ha. The land types of this union are highland (15%), medium high land (50%), Medium low land (23%) , Low land (10%) and very low land (2%) which indicates lands are free from monsoon flood and suitable for different Rabi crops and Kharif crops Cultivation(SAAO,2016). Union falls into 3 Agro-ecological zones of the Union are: (i) Young Brahmaputra and Jamuna Floodplain (AEZ 8), (ii) Old Brahmaputra Floodplain (AEZ-9) and (iii)

Madhupur tract (AEZ-28). The soil P^H is 5.0-7.5. The agricultural potentiality of these soils is high for field crops and Agro-forestry species (Land Zoning Report, January 2015).

Present Agriculture Land Use: There are five cropping pattern is practiced in Dulalpur Union which is shown in Table 8. The cropping intensity of this union is 206%. Boro(HYV) is the main irrigated crops cultivated by using ground water. Major crops cultivated in this union are: paddy, Potato, Jute, Lemon, Banana, Mustard and different Rabi & Kharif vegetables.

Table-8: Present Cropping Patterns of Dulalpur Union

Name of Union	Net Cultivable Area (ha)	Major Cropping Patterns	Cropping Intensity (%)	% of NCA	Area (ha)
Dulalpur	2195	Boro(HYV)→Fallow→T.Aman(HYV)	206	79.73	1750
		Boro(HYV/Hybrid) → Fallow→Fallow		3.42	75
		Boro →B. Aman(HYV)→T.Aman		9.52	209
		Vegetable→Vegetable→Vegetable		4.60	101
		Banana/Lemon→ Banana/Lemon		2.73	60
		Total		100	2195

Source: SAAOs of Dulalpur Union 2016

Major Problems on Crop Cultivation

The major problems in Dulalpur Union crop cultivation are: (i) Flood (ii) Drought (iii) Water logging (iv) Lack of quality seed (v) Decrease of agricultural land (vi) Erosion (vii) Climate change (viii) Changes in rainfall pattern (ix) Temperature fluctuation (x) Adverse weather condition (xi) Power failure (xii) Inadequate drainage facilities (xiii) Increase insect and pest infestation and (xiv) Change in rivers and canals morphology.

Measures to Improve Crop Cultivation

The remedial measures are given below:

(a)Adapt modern farming techniques,
(b) Choose high yields and drought tolerant varieties.
(c) Information on quality seed,
(d) Observe weather conditions and follow weather forecast,
(e)Follow fertilizer recommendation by soil testing,
(f) Select best available seeds from market,
(g) Integrated effort for industrial effluents and waste management,
(h) Incorporating organic manure in the soil by changing cropping pattern /crop rotation system
(i) Grow one leguminous crop (Dhaincha / Pulses/Fodder etc.) between two cereal crops
(j)Re-excavation of canals
(k) Reconstruction of damaged water management infrastructures,
(l) Develop market infrastructures and road communication at local level and
(m) Uninterrupted power supply to irrigation pumps.

3.4.5 Josar Union Land Use

General Description

This Union dominant land use is agriculture followed by agro-forest and fruits garden. Union falls into 3 Agro-ecological zones of the Union are: (i) Young Brahmaputra and Jamuna Floodplain (AEZ 8), (ii) Old Brahmaputra Floodplain (AEZ-9) and (iii) Madhupur tract (AEZ-28). Most of the areas of this Union are developed from transformed alluvial deposit by the Brahmaputra and Jamuna rivers. The soil P^H is 4.5-6.0. The agricultural potentiality of these soils is high for field crops and Agro-forestry species (Land Zoning Report, January 2015). Josar Union is comprised of 16 mauzas and 32 villages having an area of 2855ha of land of which cultivable area is 1395 ha. The land types of this union are highland (37%) and medium high land (63%) which indicates lands are free from monsoon flood and suitable for different Rabi crops and Kharif crops cultivation(SAAO,2016).

Present Agriculture Land Use: Major crops cultivated in this union are: paddy, Potato, Jute, Lemon, Banana and different Rabi & Kharif vegetables. Boro (HYV) is the main irrigated crops cultivated by using ground water. There are five cropping pattern are practiced in Josar Union which is shown in Table 9. The cropping intensity of this union is 204%.

Table-9: Present Cropping Patterns of Josar Union

Name of Union	Net Cultivable Area (ha)	Major Cropping Patterns	Cropping Intensity (%)	% of NCA	Area (ha)
Josar	1395	Boro(HYV)→Fallow→T.Aman(HYV)	204	46.59	650
		Vegetable→Vegetable→Vegetable		22.22	310
		Fallow → Vegetables→T.Aman		16.49	230
		Spices→Fallow-----T.Aman		5.73	80
		Banana/Lemon→Orchard-→Orchard		8.96	125
		Total		100	1395

Source: SAAOs of Josar Union 2016

Major Problems on Crop Cultivation

The major problems in Josar Union crop cultivation are: (i) Flood (ii) Drought (iii) Water logging (iv) Lack of quality seed (v) Decrease of agricultural land (vi) Erosion (vii) Climate change (viii) Changes in rainfall pattern (ix) Temperature fluctuation (x) Adverse weather condition (xi) Power failure (xii) Inadequate drainage facilities (xiii) Increase insect and pest infestation and (xiv) Change in rivers and canals morphology.

Measures to Improve Crop Cultivation

The remedial measures are given below:

(a)Adapt modern farming techniques, (b) Choose high yields and drought tolerant varieties.
(c) Information on quality seed,(d) Observe weather conditions and follow weather forecast,
(e)Follow fertilizer recommendation by soil testing,(f) Select best available seeds from market,(g) Integrated effort for industrial effluents and waste management,(h) Incorporating organic manure in

the soil by changing cropping pattern /crop rotation system (i) Grow one leguminous crop (Dhaincha / Pulses/Fodder etc.) between two cereal crops (j)Re-excavation of canals,(k) Reconstruction of damaged water management infrastructures,(l) Develop market infrastructures and road communication at local level and(m) Uninterrupted power supply to irrigation pumps.

3.4.6 Joynagar Union Land Use

General Description

Land types are the dominant factor for crop selection and cropping pattern of any area. Land, which above normal inundation level, can provide wide range of opportunities for growing round the year. This facility is available for farmers under Joynagar union. Union falls into 3 Agro-ecological zones of the Union are: (i) Young Brahmaputra and Jamuna Floodplain (AEZ 8), (ii) Old Brahmaputra Floodplain (AEZ-9) and (iii) Madhupur tract (AEZ-28). The soil P^H is 5.0-7.0. The agricultural potentiality of these soils is high for field crops and Agro-forestry species (Land Zoning Report, January 2015).

Joynagar Union is comprised of 7 mauzas and 32 villages having an area of 5220ha of land of which cultivable area is 2800 ha. The land types of this union are highland (24%) and medium high land (40%), Medium low land (21%) , Low land (15%) which indicates lands are free from monsoon flood and suitable for different Rabi crops and Kharif crops cultivation(SAAO,2016).

Present Agriculture Land Use: The cropping intensity of this union is 196%. Boro(HYV) is the main irrigated crops cultivated by using ground water . There are five cropping pattern are practiced in Joynagar Union which is shown in Table 10. Major crops cultivated in this union are: paddy, Potato, Jute, Lemon, Banana, Mustard and different Rabi & Kharif vegetables.

Table-10: Present Cropping Patterns of Joynagar Union

Name of Union	Net Cultivable Area (ha)	Major Cropping Patterns	Cropping Intensity (%)	% of NCA	Area(ha)
Joynagar	2800	Boro(HYV)→Fallow→T.Aman(HYV)	186	37.68	1055
		Boro (HYV)→Fallow→Fallow		27.93	782
		Vegetable→Vegetable→Vegetable		12.64	354
		Vegetables → Fallow→T.Aman		14.71	412
		Fruit Garden→ Fruit Garden →		7.04	197
		Total		100	2800

Source: SAAOs of Joynagar Union 2016

Major Problems on Crop Cultivation

The major problems in Joynagar Union crop cultivation are: (i) Flood (ii) Drought (iii) Water logging (iv) Lack of quality seed (v) Decrease of agricultural land (vi) Erosion (vii) Climate change (viii) Changes in rainfall pattern (ix) Temperature fluctuation (x) Adverse weather condition (xi) Power failure (xii) Inadequate drainage facilities (xiii) Increase insect and pest infestation and (xiv) Change in rivers and canals morphology.

Measures to Improve Crop Cultivation

The remedial measures are given below:

(a)Adapt modern farming techniques, (b) Choose high yields and drought tolerant varieties. (c) Information on quality seed,(d) Observe weather conditions and follow weather forecast, (e)Follow fertilizer recommendation by soil testing,(f) Select best available seeds from market,(g) Integrated effort for industrial effluents and waste management,(h) Incorporating organic manure in the soil by changing cropping pattern /crop rotation system (i) Grow one leguminous crop (Dhaincha / Pulses/Fodder etc.) between two cereal crops (j)Re-excavation of canals,(k) Reconstruction of damaged water management infrastructures,(l) Develop market infrastructures and road communication at local level and(m) Uninterrupted power supply to irrigation pumps.

3.4.7 Masimpur Union Land Use

General Description

Most of the areas of this Union are developed from transformed alluvial deposit by the Brahmaputra and Jamuna rivers. Masimpur Union dominant land use is agriculture followed by homestead garden and vegetables production. This Union is comprised of 6 mauzas and 13 villages having an area of 2106 ha of Land of which cultivable area is 1038 ha. The land types of this union are highland (17%) and medium high land (67%), Medium low land (11%) , Low land (5%) which indicates lands are free from monsoon flood and suitable for different Rabi crops and Kharif crops cultivation(SAAO,2016). Union falls into 3 Agro-ecological zones of the Union are: (i) Young Brahmaputra and Jamuna Floodplain (AEZ 8), (ii) Old Brahmaputra Floodplain (AEZ-9) and (iii) Madhupur tract (AEZ-28). The soil P^H is 5.0-7.5. The agricultural potentiality of these soils is high for field crops and fruit garden species (Land Zoning Report, January 2015).

Present Agriculture Land Use: Major crops cultivated in this union are: paddy, Potato, Jute, Lemon, Banana, Mustard and different Rabi & Kharif vegetables. Boro(HYV) is the main irrigated crops cultivated by using ground water. There are four cropping pattern are practiced in Masimpur Union which is shown in Table 11. The cropping intensity of this union is 203%.

Table-11: Present Cropping Patterns of Masimpur Union

Name of Union	Net Cultivable Area (ha)	Major Cropping Patterns	Cropping Intensity (%)	% of NCA	Area (ha)
Masimpur	1038	Boro(HYV)→Fallow→T.Aman(HYV)	203	81.70	848
		Boro (HYV)→Fallow→Fallow		2.41	25
		Vegetable→Vegetable→Vegetable		12.04	125
		Fruit Garden→ Fruit Garden →		3.85	40
		Total		100	1038

Source: SAAOs of Masimpur Union 2016

Major Problems on Crop Cultivation

The major problems in Masimpur Union crop cultivation are: (i) Flood (ii) Drought (iii) Water logging (iv) Lack of quality seed (v) Decrease of agricultural land (vi) Erosion (vii) Climate change (viii) Changes in rainfall pattern (ix) Temperature fluctuation (x) Adverse weather condition (xi)

Power failure (xii) Inadequate drainage facilities (xiii) Increase insect and pest infestation and (xiv) Change in rivers and canals morphology.

Measures to Improve Crop Cultivation

The remedial measures are given below:

(a)Adapt modern farming techniques, (b) Choose high yields and drought tolerant varieties. (c) Information on quality seed,(d) Observe weather conditions and follow weather forecast, (e)Follow fertilizer recommendation by soil testing,(f) Select best available seeds from market,(g) Integrated effort for industrial effluents and waste management,(h) Incorporating organic manure in the soil by changing cropping pattern /crop rotation system (i) Grow one leguminous crop (Dhaincha / Pulses/Fodder etc.) between two cereal crops (j)Re-excavation of canals,(k) Reconstruction of damaged water management infrastructures,(l) Develop market infrastructures and road communication at local level and(m) Uninterrupted power supply to irrigation pumps.

3.4.8 Putia Union Land Use

General Description

Land of this union is intensively used for vegetables, Paddy and different fruits crops. Putia Union is comprised of 19 mauzas and 26 villages having an area of 4239 ha of land of which cultivable area is 1968 ha. The land types of this union are highland (5%) and medium high land (30%), Medium low land (38%) , Low land (21%) and very low land (6%) which indicates lands are free from monsoon flood and suitable for different Rabi crops and Kharif crops cultivation(SAAO,2016). Union falls into 3 Agro-ecological zones of the Union are: (i) Young Brahmaputra and Jamuna Floodplain (AEZ 8), (ii) Old Brahmaputra Floodplain (AEZ-9) and (iii) Madhupur tract (AEZ-28). The soil P^H is 5.6-7.3. The agricultural potentiality of these soils is high for field crops and fruit and vegetables production (Land Zoning Report, January 2015).

Present Agriculture Land Use: There are seven cropping pattern are practiced in Putia Union which is shown in Table 12. The cropping intensity of this union is 215%. Boro(HYV) is the main irrigated crops cultivated by using ground water. Major crops cultivated in this union are: paddy, Potato, Jute, Lemon, Banana, Mustard and different Rabi & Kharif vegetables.

Table-12: Present Cropping Patterns of Putia Union

Name of Union	Net Cultivable Area (ha)	Major Cropping Patterns	Cropping Intensity (%)	% of NCA	Area(ha)
Putia	1968	Boro(HYV)→Fallow→T.Aman(HYV)	215	73.93	1455
		Boro (HYV)→Fallow→Fallow		10.16	200
		Vegetable→Vegetable→Vegetable		9.96	196
		Mustard→ Jute→T. Aman (HYV)		1.17	23
		S.Potato→Fallow→T.Aman(HYV/LV)		1.93	38
		Spices→Fallow→ T.Aman		1.02	20
		Fruit Garden→ Fruit Garden →		1.83	36
		Total		100	1968

Source: SAAOs of Putia Union 2016

Major Problems on Crop Cultivation

The major problems in Putia Union crop cultivation are: (i) Flood (ii) Drought (iii) Water logging (iv) Lack of quality seed (v) Decrease of agricultural land (vi) Erosion (vii) Climate change (viii) Changes in rainfall pattern (ix) Temperature fluctuation (x) Adverse weather condition (xi) Power failure (xii) Inadequate drainage facilities (xiii) Increase insect and pest infestation and (xiv) Change in rivers and canals morphology.

Measures to Improve Crop Cultivation

The remedial measures are:

(a)Adapt modern farming techniques, (b) Choose high yields and drought tolerant varieties. (c) Information on quality seed,(d) Observe weather conditions and follow weather forecast, (e)Follow fertilizer recommendation by soil testing,(f) Select best available seeds from market,(g) Integrated effort for industrial effluents and waste management,(h) Incorporating organic manure in the soil by changing cropping pattern /crop rotation system (i) Grow one leguminous crop (Dhaincha / Pulses/Fodder etc.) between two cereal crops (j)Re-excavation of canals,(k) Reconstruction of damaged water management infrastructures,(l) Develop market infrastructures and road communication at local level and(m) Uninterrupted power supply to irrigation pumps.

3.4.9 Sadharchar Union Land Use

General Description

This Union dominant land use is agriculture followed by fisheries and vegetables production round the year. Some commercial fruits garden is available under this Union. Union falls into 3 Agro-ecological zones of the Union are: (i) Young Brahmaputra and Jamuna Floodplain (AEZ 8), (ii) Old Brahmaputra Floodplain (AEZ-9) and (iii) Madhupur tract (AEZ-28). Most of the areas of this Union are developed from transformed alluvial deposit by the Brahmaputra and Jamuna rivers. The soil P^H is 5.6-7.3. The agricultural potentiality of these soils is high for field crops and fruit and vegetables production (Land Zoning Report, January 2015).

Sadharchar Union is comprised of 14 mauzas and 15 villages having an area of 2630 ha of land of which cultivable area is 1210 ha. The land types of this union are highland (25%) and medium high land (49%), Medium low land (16%) , Low land (7%) and very low land (1%) which indicates lands are free from monsoon flood and suitable for different Rabi crops and Kharif crops and also fish cultivation(SAAO,2016).

Present Agriculture Land Use: The cropping intensity of this union is 217%. Boro (HYV) is the main irrigated crops cultivated by using ground water . There are eight cropping pattern are practiced in Sadharchar Union which is shown in Table 13. Major crops cultivated in this union are: paddy, Sweet Potato, Jute, Lemon, Banana, Mustard, Spices and different Rabi & Kharif vegetables.

Table-13: Present Cropping Patterns of Sadharchar Union

Name of Union	Net Cultivable Area (ha)	Major Cropping Patterns	Cropping Intensity (%)	% of NCA	Area (ha)
Sadharchar	1210	Boro(HYV)→Fallow→T.Aman(HYV)	217	53.55	648
		Boro (HYV)→Fallow→Fallow		19.83	240

		Boro (HYV)--→Fallow---→ B. Aman		4.13	50
		Vegetable→Vegetable→Vegetable		11.74	142
		Mustard→ Jute→T. Aman (HYV)		2.89	35
		S.Potato→Til→ Fallow		2.64	32
		Spices→Fallow→ T.Aman		3.72	45
		Fruit Garden→ Fruit Garden →		1.49	18
		Total		100	1210

Source: SAAOs of Sadharchar Union 2016

Major Problems on Crop Cultivation

The major problems in Sadharchar Union crop cultivation are: (i) Flood (ii) Drought (iii) Water logging (iv) Lack of quality seed (v) Decrease of agricultural land (vi) Erosion (vii) Climate change (viii) Changes in rainfall pattern (ix) Temperature fluctuation (x) Adverse weather condition (xi) Power failure (xii) Inadequate drainage facilities (xiii) Increase insect and pest infestation and (xiv) Change in rivers and canals morphology.

Measures to Improve Crop Cultivation

The remedial measures are:
(a)Adapt modern farming techniques, (b) Choose high yields and drought tolerant varieties. (c) Information on quality seed,(d) Observe weather conditions and follow weather forecast, (e)Follow fertilizer recommendation by soil testing,(f) Select best available seeds from market,(g) Integrated effort for industrial effluents and waste management,(h) Incorporating organic manure in the soil by changing cropping pattern /crop rotation system (i) Grow one leguminous crop (Dhaincha / Pulses/Fodder etc.) between two cereal crops (j)Re-excavation of canals,(k) Reconstruction of damaged water management infrastructures,(l) Develop market infrastructures and road communication at local level and(m) Uninterrupted power supply to irrigation pumps.
All 9 Unions land used for single, double and triple cropped under Shibpur Upazila are shown in Fig.4

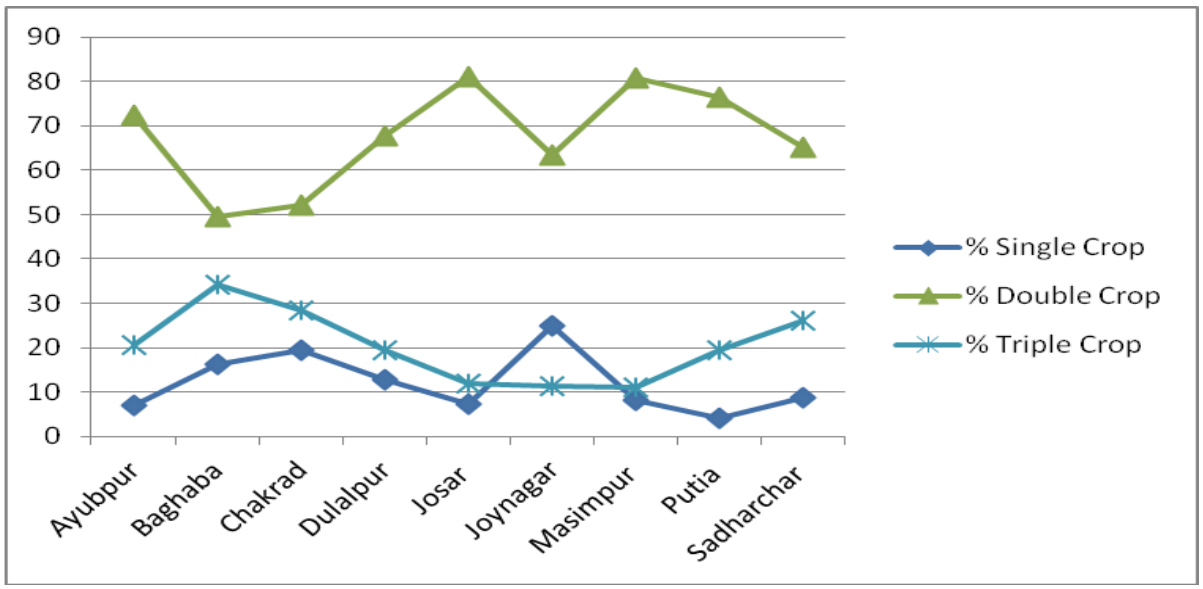

Fig 4 Percent of Union wise Single, Double & Triple cropped area under Shibpur Upazila

The present land use of Ayubpur , Baghaba, Chakradha & Dulalpur Unions under Shibpur Upazila obtained from the field survey is shown in Table 14. The Ayubpur Union covers cultivated cropped area 2588ha of which about net cropped area 1211 ha. The highest percentage is double cropped area (72%) and followed by triple (20%) and single cropped area (7%) under Ayubpur Union. Similarly, the Baghaba Union covers a net cropped area1850 ha of which about cultivated area 4065 ha. The highest percentage is double cropped area (50%) and followed by triple cropped area (34%) and single crop area (16%) under Baghaba Union. Further, the Chakradha Union covers a net cropped area 2325 ha of which about cultivated area 4855 ha. The highest percentage is double cropped area (52%) and followed by triple cropped area (28%) and single cropped area (20%) under Chakradha Union. Dulalpur Union covers a net cropped area 2195 ha of which about cultivated area 4535 ha. The highest percentage is double cropped area (68%) and followed by triple cropped area (19%) and single cropped area (13%) under Dulalpur Union (Concern Union SAAOs, DAE 2016).

Table-14: Present Land Use under Ayubpur , Baghaba, Chakradha & Dulalpur Unions

Sl. No.	Types of Land use	Present land used in ha (%)			
		Ayubpur	Baghaba	Chakradha	Dulalpur
1	Cultivated area	2588	4065	4855	4535
2	Single cropped area	85(7.02)	300(16.22)	455(!9.57)	282(12.85)
3	Double cropped area	875(72.25)	915 (49.46)	1210(52.04)	1485(67.65)
4	Triple Cropped area	251(20.73)	635(34.32)	660(28.39)	428(19.50)
5	Net cropped area	1211	1850	2325	2195
	Cropping Intensity (%)	213.71	219.73	208.8	206.65

Source: Concern 4 Union SAAOs, DAE 2016

The present land use of Joysar, Joynagar, Masimpur, Putia & Sadharchar Unions under Shibpur Upazila obtained from the field survey is shown in Table 15. The Joysar Union covers cultivated cropped area 2855ha of which about net cropped area 1395 ha. The highest percentage is double cropped area (81%) and followed by triple (12%) and single cropped area (7%) under Joysar Union. Similarly, the Joynagar Union covers a net cropped area 2800 ha of which about cultivated area 5220 ha. The highest percentage is double cropped area (64%) and followed by single cropped area (25%) and triple crop area (11%) under Joynagar Union. Further, the Masimpur Union covers a net cropped area 1038 ha of which about cultivated area 2106 ha. The highest percentage is double cropped area (81%) and followed by triple cropped area (11%) and single cropped area (8%) under Masimpur Union. Putia Union covers a net cropped area 1968 ha of which about cultivated area 4239 ha. The highest percentage is double cropped area (76%) and followed by triple cropped area (19%) and single cropped area (4%) under Putia Union. Sadharchar Union covers a net cropped area 1210 ha of which about cultivated area 2630 ha. The highest percentage is double cropped area (65%) and followed by triple cropped area (26%) and single cropped area (9%) under Sadharchar Union. (Concern Union SAAOs, DAE 2016).

Table-15: Present Land Use under Joysar, Joynagar, Masimpur, Putia & Sadharchar Unions

Sl. No.	Types of Land use	Present land used in ha (%)				
		Joysar	Joynagar	Masimpur	Putia	Sadharchar
1	Cultivated area	2855	5220	2106	4239	2630
2	Single cropped area	100(7.18)	700(25.00)	85(8.19)	80(4.07)	105(8.68)
3	Double cropped area	1130(81.00)	1780(63.57)	838(80.73)	1505(76.47)	790(65.29)
4	Triple Cropped area	165(11.82)	320(11.43)	115(11.08)	383(19.47)	315(26.03)
5	Net cropped area	1395	2800	1038	1968	1210
	Cropping Intensity (%)	204.66	186.43	203	215.40	217.36

Source: Concern 5 Union SAAOs, DAE 2016

Chapter-04:
Cropping Pattern and Cropping Intensities

4.1 Cropping Pattern

Land type and topographic is the dominant factor for crop selection and cropping patterns in any area. The term 'Cropping pattern' as it applies to the area of reclamation can be defined as the acreage distribution of different crops in any one year in a given farm area such as a water agency, or farm. Thus, a change in a cropping pattern from one year to the next can occur by changing the relative acreage of existing crops, and/or by introducing new crops, and/or by cropping existing crops'. Information that defines a cropping system consists of the number of crops on a given field per year including the accompanying cropping periods from sowing to maturity for each crop cycle and whether each crop is grown under rain fed or irrigated conditions.

Lands which are above normal inundation level can provide farmers wide range of crop cultivation round the year. The scenario of existing cropping pattern under Shibpur Upazila is complex and predominantly Boro and T. Aman Rice, Jute, Vegetables, Oilseeds, Pulses Spices, Fruits Garden and Orchard based. Detailed Upazila cropping patterns by season are presented in Table 16. Study finding shows that 13 different cropping pattern are practiced by Shibpur Upazila farmers. Shibpur Upazila present one main cropping pattern area is Boro (HYV/Hybrid) → Fallow→T. Aman (HYV) which is practiced 61.4% of the Net Cultivable Area (NCA). Boro(HYV/Hybrid)→-Dhaincha-→Fallow which is practiced 2% of the Net Cultivable Area (NCA). Similarly, winter vegetables→KHarif-1 vegetables→Kharif-2 summer vegetables which are practiced about 3% of the Net Cultivable Area (NCA). Mustard→Jute→T. Aman (HYV/LV) is covering about2 % of the NCA. Banana/Lemon/Zinger is the cropping pattern covering about 4% of the NCA. Fruits Garden is covered about 13% of the Net Cultivable Area. Spices→Jute→Fallow is practiced about 3% Net Cultivable Area (Table 14). This finding clearly indicated that. Shibpur Upazila soil is very fertile and farmers grown multiple crops such as vegetables, rice, Jute, Spices, Pulses and different fruits production.

Table-16: Present Cropping pattern under Shibpur Upazila

Major Cropping Pattern			Area (ha)	Contribution %
Rabi	**Kharif-1**	**Khari-2**		
Boro (HYV/Hybrid)	Fallow	T. Aman (HYV)	10130	61.4
Boro (HYV/Hybrid)	Fallow	Fallow	1030	6.25
Boro(HYV/Hybrid)	Dhaincha	Fallow	250	1.5
Vegetables	Vegetables	Vegetables	470	2.85
Mustard	Jute	T.Aman (HYV/LIV)	250	1.50
Fallow	Jute	T. Aman (HYV/LV)	450	2.72
Vegetables	Jute	T. Aman (HYV/LV)	240	1.45
Mustard	Boro(HYV/Hybrid)	Fallow	150	0.90
Banana/Lemon/Zinger	Banana/Lemon/Zinger	Banana/Lemon/Zinger	630	3.85
Fruits Garden	Fruits Garden	Fruits Garden	2180	13.25
Spices	Jute	Fallow	450	2.72
Vegetables	Jute	Vegetables	200	1.21
Pulses	Vegetables	Vegetables/T. Aman	70	0.4
Total			16500	100

Source: SAAOs and UAO Shibpur Upazila, DAE 2016

4.2 Cropping Intensity

Cropping intensity is an important index of utilization of land. Crop intensity index assesses farmers actual land use in area and time relationship for each crop or group of crops compared to the total available land area and time, including land that is temporarily available for cultivation. It is calculated by summing the product of area and duration of each crop divided by the product of farmers total available cultivated land area and time periods plus the sum of the temporarily available land area. For a specific crop, the cropping intensity is the number of times that crop is grown in one year on the same field. It is distinguish single, double and triple cropping systems respectively. Different cropping pattern are practiced in Shibpur Upazila. Union wise (9 Unions) present cropping intensity is shown in Figure-5. The average cropping intensity under Shibpur Upazila is 208% which is higher than cropping intensity of Unions of Joynagar (186%) & Masimpur (203%),Joysar (204%) and Dulalpur (206%) respectively. Further, Fig 5 shows the highest cropping intensity is under Baghaba Union (219%) which is followed by Sadharchar (217%),Putia(215%) and Ayubpur Unions(213%) respectively **.** The average cropping intensity under Shibpur Upazila is 208% which is higher than Narsingdi district (207%) and higher than national average cropping intensity (190%) (Krishi Diary 2016).

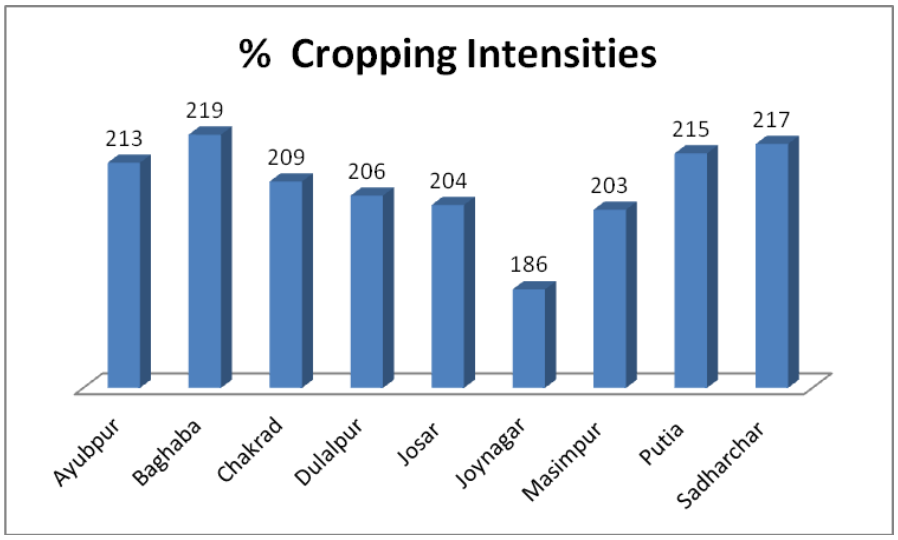

Figure 5: Union wise cropping Intensities under Shibpur Upazila

4.3 Present Cropped Area

Cultivated area depends on land types. High land is suitable for various Rabi, Kharif-1 & kharif-11 season crops cultivation. Rice, Jute, winter and summer vegetables, potato, mustard, groundnut and pulses, Banana, Lemon and various fruits crops are grown in 9 Unions under Shibpur Upazila. Shibpur Upazila present scenario of different cropped area, yield rate and production levels are shown in Table 17. The present total different cropped area is 27350 ha of which rice cropped area are 19750 ha and the rest 7600 ha is covered by non-rice crops (Jute, Potato, W & S. vegetables, pulses, and oilseeds, Banana, Lemon and Fruits etc.). The rice and non-rice cropped area are about 72% and 28% respectively of the total cropped area. The highest land area was used for Boro (HYV/Hybrid), T. Aman (HYV) rice and Jute cultivation.

4.4 Present Crop Production

Crop yield depends on crop variety, soil, fertilizer management and irrigation facilities. HYV/Hybrid rice or others crops gives higher yield in compared to local variety crops. Total crop production is 215408.6 metric tons of which rice production is 67428.5 metric tons and non-rice production is

147980.1 metric tons (Table-17). Among the rice crops the contributions of T. Aman (LV), T. Aman (HYV) and Boro (HYV & Hybrid) are about 6%, 31%, & 62% respectively. The highest contribution among the non-rice crops are Fruits Garden(33%), winter vegetables (24%) followed by Banana/ Lemon (18%),Jute (11%) and summer vegetables respectively (Table-17).

Table-17: Present Cultivated Area, Yield and Production under Shibpur

Crop Grown	Crop area(ha)	Yield/ha (mt)	Production (mt)	Contribution (%)
T. Aman(LV)	2100	1.84	3864	5.73
T. Aman(HYV)	7600	2.79	21204	31.45
Boro (HYV)	9950	4.21	41889.5	62.12
Boro (Hybrid)	100	4.71	471	0.70
Sub Total Rice	19750		67428.5	100.00
S. Vegetables	740	22.1	16354	11.05
W. vegetables	1380	25.9	35742	24.15
Jute	1590	10.25	16297.5	11.01
Potato	150	19.34	2901	1.96
Spices	450	2.58	1161	0.78
Sweet Potato	10	16.5	165	0.11
Oil seeds (Mustard, Til, Groundnut	400	1.55	620	0.42
Pulses	70	1.28	89.6	0.06
Fruits Garden	2180	22.25	48505	32.78
Banana/Lemon	630	41.5	26145	17.67
Sub-Total	7600		147980.1	100
Total	27350		215408.6	

Source : SAAOs and UAO Office Shibpur Upazila, DAE 2016

4.5 Irrigation Facilities under Different Unions

Irrigation is the lifeline of agriculture, because without irrigation facility crops diversification or HYV /Hybrid cultivation would be impossible. Irrigation facilities assured production of crops in the dry season as well as stabilized production through supplemental irrigation of the rain fed crops and ensured greater productivity. The main source of water is both surface and ground water. For Rabi crops cultivation ground water conservation and proper utilization in this Upazila is very important. This study are assessed the present scenario of irrigation facilities and problems. For irrigation purposes, generally, Deep Tube Wells (DTW), Shallow Tube Well (STW) and Low Lift Pump (LLP) are used. Union wise DTW, STW and LLP under Shibpur Upazila is shown in Table 18. A total of 3377 machine were used for irrigation under Unions in Shibpur Upazila. All 9 DTW has electricity facilities but 2054 STW and 4LLP has electricity. Different Unions 1296 STW and also 14 LLP has no electricity facilities for irrigation (Table 18). Electricity user's farmers reported that failed or disruption of electricity supply during Boro season were acute problems under Shibpur Upazila. Framers wanted nonstop electricity supply during Boro season. Majority of the Farmers (92-100%) reported irrigation drainage system is not pucca which is causes wastage of irrigation water. Farmers wanted pucca drainage system.

Table 18 Union Wise Irrigation Machine under Shibpur Upazila

Name of Union	DTW		STW		LLP		Remarks
	Electricity	Diesel	Electricity	Diesel	Electricity	Diesel	% kutcha drain
Ayubpur	0	0	305	55	0	4	100
Baghaba	4	0	335	145	0	0	98
Chakradha	3	0	248	112	3	10	100
Dulalpur	1	0	221	0	1	0	98
Joysar	0	0	114	130	0	0	100
Joynagar,	0	0	54	480	0	0	100
Masimpur	1	0	210	116	0	0	100
Putia	0	0	455	107	0	0	92
Sadharchar	0	0	112	151	0	0	100
Total	9	0	2054	1296	4	14	92-100

Source: SAAOs under Shibpur Upazila, DAE 2016

For crop cultivation ground water conservation and utilization in Shibpur upazila is important. In rabi season irrigation can help to increase agricultural production and crop diversification. Status of Union wise percent of irrigated and non- irrigated area and covered by irrigation water under LLP, STW and DTW are shown in Table 34. In rabi season 71-100% cultivated area are covered by irrigation water under different unions (Table 19). This indicates that farmers have access to irrigation water that facilitated ground water lifting cause an adverse impact both in agricultural production and surrounding environment. There is a need to regular monitoring ground water level.

Table 19: Union wise Irrigation and Ground water used under Shibpur Upazila

Union	Irrigated Area (%)	Non Irrigated Area (%)	Irrigated Area						Availability of Surface Water	Drought Prone Area (in ha)	Waterlogged Area (in ha)	Remarks
			Surface Water		Ground Water							
			LLP		STW		DTW					
			No	Area (%)	No	Area (%)	No	Area (%)				
Ayubpur	88	12	1	1	390	98	1	1	√	120	9	-Supplemental Irrigation -Industrial waste /pollution
Baghaba	93	7	3	2	500	93	3	5	√	130	2	
Chakradha	71	29	0	0	416	99	1	1	-	0	0	
Dulalpur	88	12	2	1	499	99	0	0	√	0	0	
Josar	71	29	2	1	280	99	0	0	√	0	0	
Joynagar	80	20	0	0	535	100	0	0	-	0	0	
Masimpur	100	0	0	0	390	100	0	0	-	0	0	
Putia	92	8	0	0	540	100	0	0	-	1000	50	
Sadharchar	90	10	0	0	340	990	0	0	-	0	0	
Shibpur Paurashava	99	1	5	8	137	85	2	7	√	286	20	

Source: National Land Zoning Project Report, January 2015

4.6 Cultivation Practices

All the Unions are dominated by agriculture crops are: Boro HYV/Hybrid variety of rice and Transplanted Aman rice, potato, Jute, and different kinds of winter and summer vegetables, spices, pulses which are cultivated under both rain fed and irrigation condition. Banana and Lemon cultivation are very famous in Shibpur Upazila. Farmers are cultivated different vegetables such as Brinjal, Potato, and Cabbage etc. All the SAAOs and UAO reported that about 98-100% farmers used power tiller and tractor during land preparation. Boro and T. Aman rice seedlings grown in seedbed are uprooted when they are about 30-45 days old and transplanted in the main fields. They transplanted Boro and T. Aman rice practiced line sowing. Generally in rice field weeding is done once, about a month after transplanting and this exercise is closely followed by top dressing with urea. Majority of the farmers did not use balance dose of chemical fertilizers due to lack of knowledge. Farmers reported pests are acute problems for crop production. Farmers used pesticides over and under dose as preventive and curative measures for controlling different pests because of lack of knowledge.

4.7 Major Types of Crops Cultivated

Main crops: Rice is a primary crop and a staple food of this area. Here the growth of rice production is much faster. Paddy (Boro rice (HYV/Hybrid), and T. Aman (HYV/LIV), Jute, Wheat, Maize, Vegetables, Mustard, Groundnut, Felon and Pulses etc. Jute is a primary and one of the main cash crops of this Upazila. It is an eco-friendly fiber. Jute cultivation requires less labor and less input. Despite the relative decline in importance of jute in agriculture, potential still exists for the fiber to increase its contribution to the economy through productivity increases and diversification. Yield increase, availability of better quality seeds, and improved provision of extension and credit support to grower's for this crop. Jute leaf is a common and favorable vegetable item to the farmer.

Mustard: Mustard is popularly cultivated in Shibpur. Mustard as an oilseed crops takes first place in respect of cultivated area in Bangladesh. Farmers of Shibpur generally cultivate mustard in between T. aman and Boro cultivation. Mustard oilcake is a nutritious food for cattle. This oilcake also used as organic fertilizer and the dry mustard plants can use as fuel.

Vegetables: Potato, Tomato, Sweet potato, Brinjal,, Radish, Cauliflower, Cabbage, Bean, Chili, Lalshakh, Loncho, Kolmi, Peas, Kochu, Bitter gourd, Pumpkins, Gourd, Rai Shakh, Ladies finger, Palong, Spinach, Cucumber etc. Potato is a tuber crop which cooked and eaten as a vegetable. Encouraging homestead level vegetables cultivation could be alternative source of household income generation It is widely cultivated in winter with huge potential in Shibpur area. The soil and climate conditions of this Shibpur area are favorable for multiple vegetables production. But unavailability of quality inputs (seeds, fertilizer and pesticide), lack of knowledge on proper cultivation techniques and finally low investment capacity of the farmers are some of the major challenges in vegetables farming.

Turmeric: Cultivation of turmeric, a kind of ground spice, has gained popularity in Shibpur and adjoining upazilas due to its high price. Farmers' cultivate turmeric on the abandoned land, surrounding their homesteads and paddy field. Besides, using as spice, turmeric are also useful for human health as medicine, according to herbal science.

Spices: Chili, Turmeric, Ginger, Onion & Garlic etc.
Fruits: Mango, Jackfruit, Litchi, Banana, Wood Apple, Coconut, Betel Nut, Country Goose Berry, GolapJum. Guava, Plum, Kul, Pineapple & Papaya etc.

Conversion of Agriculture Land to Non-Agriculture

Agricultural land is the main resource in agriculture. Many high value crop vegetables are grown in this Upazila. There is wide opportunity to lotkon and lemon, vegetables as commercial basis to export. The Upazila is considered as potential for agriculture. "Non-agricultural land" means such land which is used for different purposes and is not connected with agriculture. Such kind of land can be called non-agricultural land, if any developmental activity is carried over on the land and makes land unfit for crop production. In Shibpur a substantial amount of agricultural land had been shifted to a non-agricultural one viz construction of houses, brickfield, industries, sawmill, road, market and other infrastructures. Absence of proper planning and land zoning convert the arable land to other uses rapidly. The major component for agricultural land converted into non- agricultural are: (i) Non agricultural development on agricultural land. (ii) New or existing urban development and expansion (iii)Construction of industries and new settlements in agricultural land & (iv) Acquisition of agricultural land for non-agricultural purpose

Plate 1: Dhaincha Field (Green Manuring)

Plate2. Lemon Garden

Plate 3: Kakrul Vegetables Field

Plate 4. HYV Brinjal DAE Demonstration

Chapter 05:
Production Cost of Rice and Vegetables

5.1 Cost of Rice production

The production cost of paddy varies depending on crop season, variety (HYV/Hybrid/LV), land preparation (Power tiller/Tractor/Bullock), seeds and seedlings, manure and fertilizer, irrigation (complete irrigated (Boro Rice) and rain fed or provided supplementary irrigation), pesticide and labor. To assess farmers cost of rice production, Agriculture Economic Division of BRRI (2014-15) were conducted survey all over the country in three rice seasons (Boro, Aus and Aman paddy). BRRI study findings shows that Boro and Aus farmers per kg rice production cost is Tk 18.65 and Tk.18.64 and Aman rice production cost is Tk17.61 which is less than Boro and Aus (Table 20). Department of Agriculture Marketing was estimated production cost for Boro rice Tk.18.08per kg, Aman Rice Tk.18.20 per kg and Wheat Tk.23.50 per kg in the year 2015-16. On this basis Government has declared buying rate of Boro rice Tk.20.70, Aman rice Tk18.50 per kg and Wheat 27.02 per kg respectively. Shibpur upazila farmers and DAE SAAOs reported that Boro rice per kg or per ha production cost is higher than T. Aman rice because T. Aman rice is cultivated by natural water or rain water. There is no need for supplementary irrigation for Aman rice production. Fertilizers and pesticides are needed more in Boro rice production in compared to Aman rice.

Table-20: Cost of Rice Production (2014-15)

Name of Rice	Average per kg rice production cost (TK)	Crop season
Boro	18.65	Rabi
Aus	18.64	Kharif-1
Aman	17.61	Kharif-11

Source: Agriculture Economic Division, BRRI 2016

5.2 Cost of Vegetable Production

The production cost of vegetables varies depending on crop, variety, time, place, and season. During the survey, farmers were asked to identify the major types of production costs on which they usually spend. According to the respondents, the production cost of vegetables can be categorized into eight major categories: land preparation, seeds and seedlings, manure and fertilizer, irrigation, pesticide, labor, lease/rent of land, and other expenses like fencing, shedding, mulching etc.

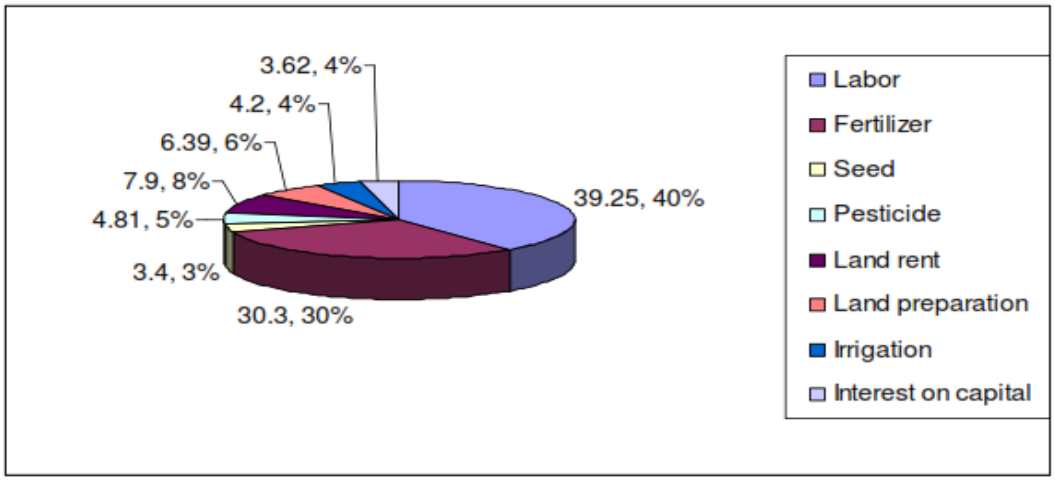

Fig 6: Percentage of Major Types of Production Costs for Vegetables
(Source: ASA University Review, Vol. 4 No. 1, January–June, 2010)

Monsura Zaman, Rokhsan-Ara-Hemel and Tahmina Ferdous (2010) assess the cost of production of four winter vegetables namely cauliflower, cabbage, tomato and brinjal in five villages under Dhaka district. The study finding shows that 39.2% of the total cost was devoted to labor, 30.3% to fertilizer, 3.4% to seed, 4.8% to pesticides, 7.9 % land rent, 6.3% to land preparation, 4.2% to irrigation and 3.6% to interest on capital, whereas, the result estimated by AVRDC (2001) shows that 48.4% of the total cost was devoted to labor, 24.2% to fertilizer, 6.1% to irrigation, pesticides and 3.7% to seeds. Fig.6) Cost of per kg and per 40kg was found approximately the highest for tomato and the lowest for cabbage and cauliflower.

Farmers of Shibpur Upazila reported that major cultivation occurred in land preparation (Power tiller/tractor cost), irrigation, pesticides, fertilizers and labor. Farmers reported that per ha cultivation cost is Tk. 8500-9000/- *(Upazila Agriculture Office, Shibpur).* Generally, supplementary irrigation provided potatoes, Chili and winter vegetables. Supplementary irrigation cost is 2000-3000 taka or more depends on crops and number of application. The highest supplementary irrigation provided in winter and summer vegetables crop field. Farmers did not practice supplementary irrigation T. Aman crops. The highest pesticides used in T. Aman and Boro rice fields (Tk.5000-6000/-) ana W & S. vegetables fields (Taka 2000-3500/ha). Labor cost day by day increased and per day labor cost more or less Tk. 450-500 depends on crop season.

Brinjal is one of the most popular and important vegetable in Shibpur Upazila. Farmers are cultivated this vegetables throughout year. Many farmers' brinjal vegetable is cultivated commercial basis in Shibpur Upazila. Compare the financial profitability of brinjal vegetable production in different region in Bangladesh. Several studies were done to estimate the financial profitability of brinjal vegetable production (Table 21). It is evident from the table that productions of brinjal vegetable were increased chronologically. This is due to adoption of farmers for different HYV varieties of brinjal. Price of brinjal vegetable was also increased through time change. Farmers were adjusted their vegetables price due to change the production cost. Now farmers used different insecticide, pesticide and fertilizer to increase production and protect vegetables from disease and pest. For this reason profitability of different vegetables also increased. It is true that total production cost of different vegetables increased but net margin also increased. Farmers were produce different vegetables because vegetables productions were profitable in the present study area which is reflected by high BCR for brinjal vegetable. The previous studies were done several years ago and we can interpret the different return by yield, price and place difference. The prices of brinjal vegetable are high in all over the country. Finally it is clear that productions of vegetables are more profitable in the study area like other vegetables growing areas.

The present study was assessed financial profitability of Brinjal, Tomato, Potato and Cabbage/cauliflower vegetables production under Shibpur Upazila which is shown in Table 22. Finding shows that Brinjal cultivation is more profitable (Tk655000/- per ha) followed by tomato (Tk300000/- per ha), Cabbage/Cauliflower (205000/- and potato (Tk180000/- per ha).

Table 21: Compare the Financial Profitability of Brinjal Vegetable Production in Different Region

Cultivation year	Study Area	Yield (kg/ha)	Price (Tk/kg)	Gross Return (Tk/ha)	Total Cost (Tk/ha)	Net Return (Tk/ha)	BCR	**Sources**
1997	Bangladesh	11730	6.0	70372	17,343	53,029	4.06	EPC, 1997
1998	Comilla	24,699	2.51	61,994	31,339	30,655	1.98	Miahet et al., 1998
2002	Jessore	43,899	7.09	3,10,293	1,77,457	1,32,836	1.75	Rashid et al. 2002
2014	Dhaka	55,691	18.00	10,02,438	269,627	732,811	3.72	Hasan et.al 2014
2016	Rangunia	61750	20.00	1235000	306492	9,28,508	4.03	UAO, DAE 2016

Table 22: Financial Profitability of 4 types of Vegetables Production in Shibpur Upazila

Vegetables	**Yield (Kg/kg)**	**Price (Tk/Kg)**	**Gross Return (Tk/ha)**	**Total Cost (Tk./ha)**	**Net Return (Tk/ha)**
Brinjal	40000	25	1000000	345000	655000
Tomato	20000	20	400000	100000	300000
Potato	22000	15	330000	150000	180000
Cabbag/Cauliflower	18000	20	360000	155000	205000

Source: SAAOs Shibpur Upazila, DAE 2016

Chapter 06:
Growth or Decline of Agricultural Land during Last Ten Years

Quantification of various parameters in relation to land use and farming is really a very difficult task, specially, in Bangladesh where record keeping is poor either by an organization or by individual. Beside this difficulty in mind a sincere attempt has been made to collect land use last ten year data (2005 to 2015) from Upazila Agriculture Office and discussion with 9 Unions and 1 Municipality all Sub-Assistan Agriculture Officers of Shibpur Upazila and review the other documents. The growth or decline of agricultural land use during last ten years under Shibpur Upazila is shown in Table 23. Table 22 finding shows 82% local variety rice was decreased during last ten years. The main reason for decreased local variety rice area due to yield is less in compared to HYV rice and farmers dictated to switchover cultivated HYV rice. The HYV paddy cultivation area 116% was increased. The reason for increased HYV rice cultivated area due to higher yield many farmers were cultivated HYV and Hybrid rice. Remarkable significant changed or increased during 10 years was occurred in Summer vegetables (77%), Winter vegetables (30%), oilseeds (106%), Spices (55%) and Banana/Lemon cultivation (103%) land use. The main reasons for increases are vegetables, fruits market demand and price is high. Table 22 shows, among the other purposes remarkable significant changed were occurred in poultry farm (742%) and Brick field (316%) and followed by gardening (85%) and Housing (79%) respectively. This finding clearly indicated crop land day by day has gradually decreased which will be reflected on crop production.

Table-23: Growth or Decline Agriculture Land Use during the Last 10 Year

Sl. No.	Agricultural land use	Land Use (2005) in ha	Land Use (2015) in ha	% Change
1	Paddy (local varieties)	11590	2100	-81.88
2	Paddy (HYV)	8160	17650	116.3
3	Vegetables (Summer)	568	740	30.28
4	Vegetables (Winter)	778	1380	77.38
5	Tuber crops	135	160	18.52
6	Pulse crops	50	70	40
7	Oilseed crops	194	400	106.19
8	Spice crops	290	450	55.17
10	Jute	1350	1590	17.78
11	Banana/Lemon	310	630	103.23
12	Other purposes			
	-Brick field	12(#5)	50(#23)	316.67
	-Poultry farm	4.05(#100)	34.1 (#842)	741.98
	-Fish/shrimp culture	834.8	1013.21	21.37
	-Gardening	1174	2180	85.69
	-Housing	1506.48	2700.4	79.25

Source: SAAOs, UAO, ULO, UFO and Upazila Statistic Office of Shibpur Upazila

Chapter-07:
Major Problems of Crop Production in Shibpur Upazila (9 Unions and 1 Municipality)

Agriculture survey findings and Participatory Rural Appraisal March 2016 study report findings show farmers some problems are common in different unions under shibpur Upazila such as drought, bad communication and wholesale market and infrastructure. Major problems are:

1. Natural disaster, such as heavy rain, flood, water logging, drought, and river erosion;
2. Electricity power failure during Boro crop season
3. Shortage of irrigation water and Ground water level declining
4. Inadequate drainage facilities
5. Conversion of agricultural land to non agricultural use
6. Bad communications due to many roads are damaged flood or rain.
7. About 100% irrigation canals are kutcha which is increase the wastage of irrigation water and crop area is not possible to increase.
5. There is no wholesale market and infrastructure for agriculture product under 9 Unions.
6. No cold storage and large vegetables selling center or market in Unions
7. Produce rice crops market price is less but production cost is high
8. Agricultural labor is not available in crop seasons.
9. Farmers did not interest to invest recommended doses of inputs (fertilizer and seeds) in crop production.
10. Lack of quality crop production inputs (seeds, fertilizers, pesticides, power tiller) and are partly available and price is high.
11. Insects, diseases, rodents and weeds are acute problem causes 30% damage every year. Farmers were applied pesticides over and under dose haphazardly for controlled pests due to lack of technological knowledge.
12. Farmer's lack of knowledge on modern crop production technology.
13. There is no agro processing center and industries under Unions.
14. Agriculture is very important to local communities in Shibpur Upazila. They are losing agricultural lands and farming opportunities at an alarming rate. This dramatically alters the traditional landscape. It is creating a growing dependence on imported food products. Fallow and grazing land has been converted into Banana, Papaya, orchard and vegetable cultivation.
15. Farmers are facing increasing pressures of infrastructural development that may encumber agricultural practices. Change in land morphology and Negative impact on food security.

Chapter-08:
Policy Framework and Conclusion

8.1 Policy Framework

As per Sub-Assistant Agriculture Officers, Farmers and District, Upazila level different organizational Officers opinions and field visit following recommendations are made which will help for proper planning and adoption of appropriate crop production measure in future to different Unions beneficiaries under Shibpur Upazila.

1. Developing Infrastructural Facilities: Road network at local level, agro-processing and marketing infrastructure development, Re-excavation of canals and irrigation facilities need to be improved for mitigating impacts of crop production related vulnerabilities and climate change. Reconstruction of damaged water management infrastructures need to be made. Each Union one wholesale market infrastructure need to be constructed.

2. To Reduce the Irrigation water Wastage, proper utilization and increase the irrigated command crop area the DTW, STW and, LLP kutcha drain need to be converted into pucca drainage system or introduce underground pipe irrigation system. Uninterrupted power supply to irrigation pumps.

3. Farming and Adaptation Practices: Adapt modern farming techniques and Choose high yields and drought tolerant varieties. There is need for conducting, strengthening and expanding crop demonstrations and block farming based on adaptation practices. Introduction of risk resistant crop varieties in agriculture with emphasis on crop diversification should be an integral part of the TOT, farmers training and demonstrations.

4. Vegetables Production: Different types of winter and summer vegetables are grown under 9 unions and Municipality area. All the Unions are excellent suitable for vegetables cultivation round the year. There is no cold storage and large vegetable selling center (market) under9 Unions. As results farmers could not get good price for their produced products. There is a need for establishment of cold storage each Union and development of market infrastructure.

5. Crop Production Inputs Availability: Ensure availability of quality HYV and Hybrid crop seeds, fertilizer, pesticides and cultivation equipments. Information on quality seed need to be provided up to block level.

6. Availability of Crop Seeds: Drought and submergence tolerant variety of different quality HYV/Hybrid crop seeds. BRRI, BARI, BSRI and BINA have recommended drought tolerant rice, wheat, maize, potato, pulses and oilseeds. These are BRRI Dhan-71,-72, 55, -57,-66,-67 and BINA Dhan -8, BARI Wheat-25, BARI-28,29,30 Muatard-11,14,17 BARI poato-21,22, 50, widely introduce and encouraged to cultivated farmers.

7. Fertilizer Management and Soil Health: Chemical fertilizers application in HYV varieties crops trend increasing but decreasing inorganic fertilizer (Green manure, cow dung). As a result, soil nutritional

health will be alarming situation which is in future serious affected on yield. There is a need for soil health improving program for Union farmers. DAE may arrange joint collaborative soil testing and recommendation and training program for beneficiaries. Financial support need to be provided to DAE from project. Grow one leguminous crop (Dhaincha / Pulses/Fodder etc.) between two cereal crops. Incorporating organic manure in the soil by changing cropping pattern /crop rotation system.

8. Pest Management: Insects, rats, weeds and diseases are a chronic problems which causes considerable damage of crops every season and increase the farmers cultivation cost. For control this pests farmers were applied pesticides under or over dose. Judicious use of pesticides needs to be developing and implement pest surveillance, monitoring and forecasting system. Farmers also need to increase knowledge on Integrated Pest Management (IPM) technology through practical oriented program and DAE joint collaborative crop production training. Farmers training budget need to be provided to DAE from project.

9. Agro-based Industries: Establishment of Agro-based processing center & industries in 9 unions and Municipality. There is a need for construction of infrastructure for some agro-base processing center. There is a need to integrated effort for industrial effluents and waste management.

10. Zoning of land: As per its present used and potentialities and the proper implementation of "preparation of Development Plan for Fourteen Upazilas" Package 02 (Ishwarganj, Shibpur and Raipura Upazila) as to ensure sustainable management of land resources in the area as well as improvement of agriculture sector.

11. The following additional systems may be adapted in an innovated way for Sustainable crop production and environmental conditions of Shibpur Upazila:

    - Biodynamic/eco-friendly agriculture.
    - Rice and non-rice crops integrated farming.
    - Grow vegetables predominantly.
    - Fruit tree based Agro-forestry system.
    - Integrated pest management.
    - Natural disasters adaptive, rain fed and resilience farming.
    - Minimize conversion of agricultural land to non agricultural use and increase awareness among the people and land users for conservation of land.

Ensuring planned and economic use of agriculture land, minimize agricultural land degradation and introducing regulatory measure like adopting land zoning law are necessary to protect the agriculture land.

8.2 Conclusion

Soil and weather conditions are suitable for different vegetables and other high value crops cultivation round the year in Shibpur Upazila. There is a need to develop vegetables wholesale market and improvement of communication system different Unions to Upazila. Farmers need modern crop production technological training which will be helpful for crop diversification and proper utilization land and increase crop production. For improvement of irrigation facilities kutcha drain are to be made lined channel which will reduced irrigation water wastage and increase crop production. Integrated pest management need to implement for Banana, Papaya, orchard and vegetable cultivation and reduce the pesticide use. Electricity power supply should be ensured during Boro crop season. Increase agriculture production through optimum use of land. Many high value crop vegetables are grown in this Upazila. There is wide opportunity to lotkon and lemon, vegetables as commercial basis to export.

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Annex-1
Questionnaire for KII

Name---------- Designation---------- Department------

Upazila----------District----------Mobile No.---------- Date------

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1. Category wise distribution of farm families

Sl No.	Category	No of farm family	%
1.	Land less (.05-.50 acre)		
2.	Marginal (.51-1.50 acre)		
3.	Small (1.51 -2.50 acre)		
4.	Medium (2.51-7.50 acre)		
5.	Larger (above 7.50 acre)		
	Total		

2. Present Land Use under Union

Sl No.	Type of Land use	Present land used	
		Area (ha)	%
1.	Cultivated Area		
	Single Cropped area		
	Double Cropped area		
	Triple Cropped area		
2.	Net cropped area		
3.	Cropping intensity		

3. Relationship of Land Type and Flood Depth with Area Cultivated

Sl No.	Land type and Flood Depth. (cm)	Present	
		NCA (ha)	%
1.	High land (0-30 cm) F0		
2.	Medium high land (30-90 cm) F1		
3.	Medium low land (90-180 cm) F2		
4.	Low land (180-360 cm) F3		
5.	Very low land above (360 cm) F4		
Total			

Source: CEIP field data and Upazila Agriculture Office, DAE

4. Major crops/cropping patterns (both improper/exhaustive and sustainable)

Season	Farming Practices
Rabi (Mid October-Mid March)	
Kharif-I (Mid March-Mid July)	
Kharif-II (Mid July-Mid October)	
Irrigated Farming Rabi (Mid-OctoberMid March)	
Kharif-I (Mid March-Mid July)	
Kharif-II (Mid July-Mid	

Season	Farming Practices
October)	
Name major cropping patterns	1. 2. 3. 4.

5. Crop cultivated and variety in polder area

Crop area	Name of crop	Name of variety
Cultivated crops under single crop area=		
Cultivated crops under double crop area=		
Cultivated crops under triple crop area=		
Cultivated crops under irrigated crop area=		
Cultivated crops under non crop area=		
Cultivated crops under homestead garden area=		
Orchard area=		
Seasonal Fallow land =		
How many commercial fruit garden within polder area? Yes ---------- No----------	Name of fruits garden Banana: Papaya: Coconuts: Mango: Others:	Number:
In future which crops will be profitable in your polder area:		

6. Present Crop Production and Area under polder/Upazila

Crop Area(ha)	Yield/ha	**Total Production(MT)**	**Crop Area(ha)**	Yield/ha	**Total Production(MT)**
Aus rice= LV = HYV =			Oilseeds=		
Aman rice= LV = HYV = Hybrid =			Mustard=		
Boro Rice= LV = HYV = Hybrid =			Sesame=		
Total Rice=			Sunflower=		
Wheat =			Groundnut=		
Maize =			Others=		
Pulses =			Winter vegetables=		
Khesari =			Summer vegetables=		
Mung bean =			Total vegetables=		
Soybean =			Fruits Watermelon=		
Cowpea =			Species=		
Chickpea=			Chili=		
Others =			Onion=		
Tuber crops=			Garlic=		
Potato=			Jute=		

Crop Area(ha)	Yield/ha	**Total Production(MT)**	**Crop Area(ha)**	Yield/ha	**Total Production(MT)**
Sweet potato=			Sugarcane=		
Bamboo =			Betel nut=		
Betel vine(Pan)=					

7. (a) Short term needs for better crop production under polder

1.----------2----------

3.----------4----------

5----------6----------

(b) Long term needs for better crop production under ploder

1.----------2----------

3.----------4----------

5.----------6----------

Appendix-2
Agriculture Questionnaire for Urban and Rural Economy Study

Name: _____ Designation: _____

Department: _____Name of Block: _____

Name of Union: _____ Upazila: _____

District: _____

Mobil No.: _____ Date: _____

1. Category wise distribution of Farm Families in Block

Sl. No.	Category	No. of farm family	%
6.	Land less (.05-.50 acre)		
7.	Marginal (.51-1.50 acre)		
8.	Small (1.51 -2.50 acre)		
9.	Medium (2.51-7.50 acre)		
10.	Larger (above 7.50 acre)		
	Total		

2. Agricultural land and land Use in Block

Sl. No.	Description of agricultural land	Area(ha)
1	Total agriculture land area	
	High land	
	Medium high land	
	Medium low land	
	Low land	
2	Permanent fallow land	
3	Current/seasonal fallow land(with fallow period) -Rabi fallow	
4	-Kharif-I fallow -Kharif-II fallow	
5	Net cropped area	
6	Single cropped area	
7	Double cropped area	
8	Triple cropped area	
9	Total cropped area	
10	Cropping intensity (%)	
11	Irrigated land area (%)	

3. Irrigation Facilities

Deep Tube Well (DTW) Yes---------- No---------- Number----------

Shallow Tube well (STW) Yes----------No---------- Number----------

Low Lift Pump (LLP) Yes----------No--------- Number----------

Others----------

4. Cultivation Practices

Power tiller----------% Used, Tractor ----------% Used

Bullock ----------% Used

5. Cropping Pattern

Sl. No.	Cropping Pattern			Area of Land	Percentage (%)
1|					
2|					
3|					
4|					
5|					
6|					
7|					
8|					
9|					
10|					
11|					

6. Cropping type and Present Crop Area & Production under Block

Crop Area (ha)	Area (ha)	Yield/ha	**Crop Area (ha)**	Area (ha)	Yield/ha
Aus rice LV HYV			Oilseeds		
Aman rice LV HYV Hybrid			Mustard		
Boro Rice LV HYV Hybrid			Sesame		
Total Rice			Sunflower		
Wheat			Groundnut		
Maize			Others		
Pulses			Winter vegetables		
Khesari			Summer vegetables		
Mung bean			Total vegetables		
Soybean			Fruits Watermelon		

Cowpea			Species		
Chickpea			Chilli		
Others			Onion		
Tuber crops			Garlic		
Potato			Jute		
Sweet potato			Sugarcane		
Bamboo			Betel nut		
Betelvine(Pan)			banana		
Other crops			Mango		
			Papaya		

7. Growth or Decline Agriculture Land During the Last 10 year.

SL No.	Agricultural land use	Land use (2005-06) in ha	Land use (2015-16) in ha	Causes of increase or decline
01	Paddy (local varieties)			
02	Paddy (HYV)			
03	Vegetables (Summer)			
04	Vegetables (Winter)			
05	Tuber crops			
06	Pulse crops			
07	Oilseed crops			
08	Spice crops			
09	Fruit crops			
10	Wheat			
11	Maize			
12	Sugarcane			
13	Jute			
14	**Other purposes** -Brick field			
	-Poultry farm			
	-Fish/shrimp culture			
	-Gardening/forestry			
	-Industries			
	-Housing			
	-Others			

9. Major problems to Crop Production in Block/Union

1. _____
2. _____
3. _____
4. _____
5. _____

10. Future Need for Sustainable Crop production.

a) _____
b) _____
c) _____
d) _____
e) _____

11. Major problems related to crop production system Under Union

1.
2.
3.
4.
5.

12. Future Need for Sustainable Crop production under Union

1.
2.
3.
4.
5.

13. Conclusion and Recommendation

1.
2.
3.
4.
5.

Appendix-3

Plate 1: Meeting with block supervisors of Shibpur Agriculture Office