# Draft Initial Environmental Examination (Main Report – Part 3 of 4)

Project Number: 52362-001 April 2019

# **BAN: Spectra Solar Power Project**

Prepared by ERM India Private Limited for Spectra Solar Park Limited and the Asian Development Bank.

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# 5.3.3 Ecological Sensitive Area

#### 5.3.3.1 Protected area

There is a Sanctuary namely Nogorbari-Mohongonj Dolphin Sanctuary situated from approximately 22.60 km far from the project location. Nazirganj Shushuk Sanctuary (Najirgonj Dolphin Sanctuary) is a wildlife sanctuary located in Pabna district of Bangladesh. It was established on 01 December 2013. This duck is made up of 146 hectares of wildlife sanctuary Map of the protected areas is shown in the **Figure 5.27**.



Figure 5.27 Nearest Protected Area Map

#### 5.3.3.2 Bird staging sites

According to the Birdlife international database, they have identified about 20 important bird areas in Bangladesh. The proposed project area does not fall in any IBAs. A map of the migratory bird's staging sites is given in **Figure 5.28**.



# Figure 5.28 Migratory bird's staging sites Map

# 5.3.4 Terrestrial Ecosystem

The Primary data collection of different components of the study area conducted by using well established and accepted ecological methods in the different habitats. The field data collection was mainly included on biodiversity assessment of different life of floral elements such as trees, shrubs, climbers, herbs and grasses. A total three quadrates study has been carried out in and around the study area of different floral aspects. The ecology team has identified the different floral species in the study area. The Quadrates study sites have been provided in the **Table 5.17** and images on **Figure 5.29**.

Table 5.17	Sampling site details for terrestrial flora
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Area	Quadrates	GPS coordinates
378.33 m from the project location in the Northern direction (Tree)	Q1	23°46'58.86"N; 89°49'1.92"E
358.61 m from the project location in the Southern direction (Shrub)	Q2	23°47'12.15"N; 89°49'43.91"E
811.57 km from the project location in the North West direction(Herb)	Q3	23°47'36.89"N; 89°49'21.45"E

# Figure 5.29 Photographs of Quadrant sampling



Sampling for Trees

Sampling for shrubs

Sampling for Herbs

#### 5.3.4.1 Flora

In the study area, terrestrial flora covers most of the vegetation. Inside the project site and around the adjoining area's (study area) terrestrial floral ecosystems were divided into divided into three categories.

- Homestead Plantation
- Agricultural or crop field vegetation
- Roadside Plantation

#### Homestead plantation

A total of 41 homestead floral species of 23 Families were listed from the study area. Majority of the trees belongs to the family Fabaceae (7 spp.) followed by Arecaceae (4 spp.). However, Moraceae, Meliaceae and Myrtaceae contains 3 spp. each. Furthermore, there are 31 tree, 07 shrub, 02 herb and only 01 are grass species has been found within this area **Figure 5.30**.



#### Figure 5.30 Tree family found at the study area

The survey results shows that 76% are tree species, 17% shrubs, 5% herbs and 2% grass species in the targeted study area (Refer **Figure 5.31**).



Figure 5.31 Types of plant species of the study area

Common planted tree species are Aam (Mangifera indica), Lychee (Litchi chinensis), Shal (Bombax ceiba), Narikel (Cocos nucifera), Eucalyptus (Eucalyptus camaldulensis), Mehogani (Swietenia mahagoni), Banana (Musa sp) etc. Raintree (Samanea saman), Narikel (Cocos nucifera) and Supari (Areca catechu) occupied the top canopy. Homesteads are commonly founds near the plain land which favor good growth of. Among the shrubs Lemon (Citrus spp.) is the most common of all species. Homestead flora consists of both native and exotic species (Acacia auriculiformis) and some of them are naturalized.

In addition, among all plant species it has been found that 49% are fruits, 24% timbers and 15% are aesthetic type tree (Refer **Figure 5.33**). Fuel and Medicinal trees are almost same. Furthermore, only nine species are listed in the IUCN global list and among them two found as Endangered (Mehegoni and Taal) and one as Data Deficient (Pepe). The list of plant species is presented in **Appendix I**.

Figure 5.32 Photographs of different tree species recorded from the study area



Phoenix dactylifera

Artocarpus heterophyllus









# Floral diversity Index of study area

A diversity index is a mathematical measure of species diversity in a community. Diversity indices provide more information about community composition than simply species richness (i.e., the number of species present); they also take the relative abundances of different species into account. Diversity indices provide important information about rarity and commonness of species in a community. The ability to quantify diversity in this way is an important tool for biologists trying to understand community structure.

**Shannon Weiner Diversity:** The Shannon diversity index (H) is an index that is commonly used to characterize species diversity in a community. Shannon's index accounts for both abundance and evenness of the species present. The proportion of species i relative to the total number of species (p<sub>i</sub>) is calculated, and then multiplied by the natural logarithm of this proportion (Inp<sub>i</sub>). The resulting product is summed across species, and multiplied by -1:

$$H = -SUM [(pi) * ln(pi)]$$

Shannon's equitability ( $E_H$ ) can be calculated by dividing H by  $H_{max}$  (here  $H_{max} = InS$ ). Equitability assumes a value between 0 and 1 with 1 being complete evenness.

#### Evenness, E=H/Hmax

On the diversity scale, biologically realistic H' values range from 0 (only one species present with no uncertainty as to what species each individual will be) to about 4.5 (high uncertainty as species are relatively evenly distributed). In theory, the H' value can be much higher than 4.5, although most real world estimates of H' range from 1.5 to 3.5.

Parameter	Q 1	Q 2	Q 3
Shannon-Wiener Diversity Index(H)	1.57	1.47	1.54
Evenness (E)	0.93	0.91	0.96
Species Richness (S)	14	10	7
Total Abundance	97	44	83

Table 5.18 Biodiversity index of floral species at study area

Based on the results presented in **Table 5.18** and graphically represented in **Figure 5.34**, Quadrate Location 1 represents maximum species richness and diversity. However evenness is almost same in quadrate 1 and 3.



Figure 5.34 Species Richness, Species Diversity and Evenness

#### Agricultural or crop field vegetation

Crop field vegetation is a major type vegetation of the study area. There are 4 types of cultivated land in the studied area four crop land, three crop land, di-crop land, mono-crop land. The most common agricultural crops cultivated in the study area are Ropa Aman, Jute, Maze, Sugarcane, Egg Plant tree, Pumpkin, Cucumber, Mustard, Garlic, Mere Trifle (Kochu), Onion, Wheat, Lentil (Masur), Pea (Motor), Chili, Turmeric, Ginger, Coriander, Date-Palm, Cotton and so on. Photo view of some crop field floral species are given below in **Figure 5.35**. There are some grassland weeds found in the agricultural land presented in **Appendix J**.







# **Roadside Plantation**

A total 20 species from 12 family roadside tree species recorded during the field survey. Strip Plantation program of Social Forest Department mainly coordinate the Highway roadside plantation. Most common floral species were Dalbergia sissoo, Azadirachta indica, Swietenia mahagoni, Shorea robusta, Mangifera indica, Artocarpus heterophyllus. Furthermore, only eight species are listed in the IUCN global list and among them one found as Endangered and one as Vulnerable. A details of the species are listed in the **Appendix K** and photographs of roadside plantation is given in **Figure 5.36**.

# Figure 5.36 Roadside vegetation in adjacent study site



# 5.3.4.2 Fauna

The terrestrial faunal diversity of an area mainly covers the following classes

- Mammals
- Avifauna
- Amphibians and Reptiles (Herpetofauna)

# **Diversity of Terrestrial Mammals**

Six species of mammals belonging to the 5 families were reported within the study area and all of them are considered as Least Concern according to IUCN Bangladesh, 2015. Red List of Bangladesh Volume 2: Mammals. List of mammals and comparison of their family are given in **Appendix L**.

#### Diversity of Avifauna

During the survey tenure, avifaunal diversity recorded either direct observation or from the consultation with local people. A total of 42 species of birds were identified belongings to 26 families at the study area of proposed "Solar power Plant". The highest number of birds dominated in the study area belonging to the Sturnidae family. However Accipitridae, Picidae and Corvidae family consist three species each within the study area. Homestead forest, grassland and bush, and some aquatic habitat of this site have supported the wild birds for feeding and roosting.





All of the bird species found in this area are found as least concern (LC) both locally and globally according to IUCN Red List. A detail about the bird's species checklist has shown in **Appendix M**. and the picture of the birds has been provided in **Figure 5.38**.



# Figure 5.38 Pictorial view of different bird species found in study area.

Passer domesticus

Halcyon smyrnensis





Streptopelia chinensis

Acridotheres tristis



Chroicocephalus brunnicephalus





Alcedo atthis



Motacilla alba



Lanius schach

Sturnus contra



Phalacrocorax sulcirostris



Milvus migrans



Oriolus xanthornus



Ardea intermedia



Dicrurus macrocercus

Copsychus saularis



Ardeola grayii

Corvus splendens

# Diversity of Amphibians and Reptiles

10 species of reptiles and 04 species of amphibians were being reported from the study area. One venomous reptilian species Spectacled Cobra are found as Near Threatened and rest of all of species are Least Concern as per IUCN Bangladesh, 2015. Red List of Bangladesh Volume 4: Reptiles and Amphibians. A list of herpeto-fauna found in the studied area is presented in **Appendix N**. Associated photographic view of Amphibians and Reptiles are given below in **Figure 5.39**.



Figure 5.39 Photographs of some herpetofauna at the study area

## 5.3.5 Aquatic Ecosystem

Aquatic habitat in the study area includes the River (Padma and Ichamati) ponds, ponds, bills, low-lying area. These wetlands also support diverse birds and fish species. Following aquatic ecological groups has been studied.

#### 5.3.5.1 Macrophytes

Aquatic vegetation are observed in the banks of Padma and Ichamati River, ponds, tank/pond wetland types. The most dominant macrophytes are Azolla pinnata, Eichhornia crassipes, Ipomea aquatica, Lemna minor, Najas graminea, Pistia stratiotes, Salvinia natans, Trapa natans, Typha angustifolia, and Vallisneria spiralis.

#### 5.3.5.2 Plankton

#### Survey Methodology

**Phytoplankton:** For qualitative study, phytoplankton were collected by plankton net (No. 20 silk bottling cloth, mesh size: 75 Um). The net was lowered into the water and sample water was collected by pulling the net horizontally and vertically. For quantitative study, phytoplankton were collected by plankton net by passing 10 liters of water through it. After collection they were preserved in 3% formalin and few drops of Glycerine and by Lugols solution. After adding preservatives, they were brought to the laboratory for species identification and numerical abundance. Detailed analysis were done by Sedgewick-Rafter Counter Chamber and by drop method. Results will be expressed by unit/l.

**Zooplankton:** For qualitative study, Zooplankton were collected by a plankton net (No. 25 silk bottling cloth, mesh size: 67 Um). The net was lowered into the water and sample water was collected by pulling the net horizontally and vertically. For quantitative study, Zooplankton were collected by a plankton net by passing 10 liters of water through it. After collection they were preserved in 3% formalin and few drops of Glycerine and by Lugols solution. After adding preservatives they were brought to the laboratory for species identification and numerical abundance. Detailed analysis was done by Sedgewick-Rafter Counter Chamber and by drop method. Results will be expressed by unit/l.

**Bentohs (Microbenthos):** Sediment were collected by Ekman Grab Sampler. After collecting, sample were passed through a sieve (0.5 & 1 cm mesh size net). After that again the sample will be sieved by US sieve no. 30 and preserved the sample by 10% formalin or 70% Ethanol for better identification Rose Bengal (200 mg/l) color was added. Salt and sugar solution were also be used to separate the benthic animal from the sediment for better identification

Bio-monitoring (Plankton and benthos) samples were collected from three locations- upstream and downstream Ichamati River (confluence point of local drainage channel). Another sample was collected from a stream (Surface water body near project site) that meets joins with local drainage channel. The sampling location details is presented in **Table 5.19** and **Figure 5.40**.

Location Code	Location	Geographical Coordinates
BM-1	Surface Waterbody near project site	23°46'57.9"N; 89°49'41.3"E
BM -2	Upstream of Ichamati River	23°46'10.2"N; 89°49'47.5"E
BM -3	Downstream of Ichamati River	23°46'52.3"N; 89°49'56.5"E

 Table 5.19
 Details of Plankton & Benthos Monitoring Location



#### Figure 5.40 Bio-monitoring Location Map

#### **Plankton Diversity**

The planktonic diversity studies reveal that 30 species of phytoplankton and 13 species of zooplanktons were recorded from the fresh water bodies, which are commonly found in these types of water bodies.

The phytoplanktonic diversity index result shows that the highest diversity is recorded in the BM-3 (2.866); this is followed by BM-1 (2.862) and BM-2 (2.854).

The zooplanktonic diversity index result shows that the highest diversity is recorded in the BM-3 (2.516) and this followed by BM-1 (2.462), BM-2 (2.454),

#### **Benthos Diversity**

Nine (9) genera of benthos has been recorded from the study area. The diversity index result shows that the highest diversity is recorded in the BM-3 (1.994); this is followed by BM-2 (1.941) and BM-1 (1.793).

#### 5.3.6 Diversity of Fishes

A total of 55 species has been found in and around the river, ponds, and oxbow lakes. Species are identified with morphometric and meristic study. Species are collected from the local fishermen as well as local fish market. Paturia Ghat fish market that is significant which opens at 5.00 am and run until 7.30 am. Different fishermen as well as retailers buy and sell their fishes in the Ghat area. A Check list fishes recorded/reported in the study area is provided in **Appendix O**.



Awaous guamensis

Wallago attu and Eutropiichthys vacha





Gagata youssoufi



Macrobrachium lamerrai and Ailia coila



Macrobrachium rosenbergii



Rita rita and Mastacembelus armatus



Bagarius bagarius







#### 5.3.6.1 Diversity of Aquatic Mammals

Bangladesh supports rich cetacean diversity (Aquatic Mammals) in its fresh and marine waters. The early studies on cetaceans were on the Ganges River Dolphins (Platanista gangetica gangetica) in the 1970s. Under the Sustainable Environment Management Programme of the MoEF (1998-2005), IUCN and BCAS worked on dolphin of Chandar beel area.

In 13<sup>th</sup> of February 2019, one dolphin was reported in Paturia Ghat within 5 km in the Padma, and Jamuna River at Manikgonj. The Location was (23°46'30.62"N, and 89°47'41.43"E) and the sighting occurred in Morning (08:58 am). Study conducted through transect from the Paturia Ghat to Dauladia Ghat also Vise –Versa. Study Started from 5am to 9am and 5 pm to 7.30 pm in 4 consecutive day in Bangladesh Time.



#### Figure 5.42 Photographs for survey of Aquatic Mammals

Consultation with Fishermen

Consultation with Forest Dept.

#### 5.4 Socio-economic Environment

This section provides the socio-economic baseline information of the project area of influence. It helps in building an understanding of the -

- administrative set up of the project location,
- demographic profile of the villages, t
- social groups present,
- identification of vulnerability,
- livelihood profile of the community,
- land use patterns in the area,
- social and physical infrastructure available in terms of the education and health infrastructure,
- water supply for irrigation and drinking purposes, and
- sanitation facilities and connectivity.

This baseline data is based on the secondary information available on the district, upazila and union level as well as the primary consultations undertaken in the study area, by ERM, during the site visit.

# 5.4.1 Approach and Methodology for Socio-economic Study

The socio-economic baseline for this project has been developed on the basis of a combination of a secondary literature review, as well as the inferences drawn from the consultations with different stakeholders including the local community.

#### 5.4.1.1 Identification of potential E&S Sensitivities

E&S Compliance audit was undertaken to review past and current performance of the project implementation by the Company, to ascertain, environmental and social issues are identified and complied with as per ADB Safeguard Policy Statement (SPS) 2009. Reconnaissance survey for scoping was carried out in February 2019. The land procurement procedure was discussed with SSPL. Consultations, land sellers (who had sold land for the project), Union Parishad Chairman and legal person from the land procurement team of SSPL.

#### 5.4.1.2 Focused Group Discussions

Focused Group Discussion (FGD) were undertaken at 10 locations across the study area. The main objective of the discussion with the stakeholder groups was to understand their perception towards the project and their livelihood pattern, discussion with the land users/owners, women, traders in the study area also covered general expectation from the proposed project in light of the development of the local area.

#### 5.4.1.3 Key Informant Interview

Key stakeholders consulted during the study process were:

- Iand sellers;
- local community;
- Union Chairman;
- Government Department; and
- NGO at Arua and Ulail Union.

#### 5.4.1.4 Primary data collection through household survey

For collection of primary data, a 2 km radius of the study area of the proposed project location was considered. The assessment of socio-economic environment was carried out based on the primary survey with the help of a structured questionnaire. The sample household survey covered 114 families that included landowners of Arua Union and general population living in the study area. Forty-five landowners who sold their land for the project was covered (which is slightly above 25% of the total affected landowners, i.e. 161). The primary survey was conducted both at the power plant location and along the transmission line corridor. List of land owners is provided in **Appendix P and Appendix Q**.

The socio-economic household survey was undertaken from 13<sup>th</sup> to 17<sup>th</sup> February 2019 and covered a total of 9 villages at Arua Union Parishad. FGDs and consultations were conducted with key informants in study area. A total of 114 households were surveyed and the breakup of survey as per villages covered is provided in Table **5.20**.

Union	Village	Household
Arua	Baruria	16
	Dhaturabari	7
	Darikandi	29

#### Table 5.20 Coverage of Socio-Economic Survey

Union	Village	Household
	Kodalia	3
	Lakshimpur	13
	Nali	4
	Nayakandi	23
	Sorishabari	3
	Teghari	7
	Trilochan Patti	9
	Total	114

# 5.4.1.5 Review of secondary information

All secondary demographic data are compiled using the latest Census 2011. Demographic Characteristics namely distribution and density of population, age structure, sex ratio, social structure, literacy rates, and occupational structure of people are studied. Secondary data were also collected from government reports, academic institutes, websites, published literature, interactions with government department and stakeholders, etc. A review and assessment of the available secondary data and information for the study area was undertaken in order to substantiate and corroborate, the understanding gained, through stakeholder consultations, and primary data collected on the socioeconomic profile of the land sellers and the host community as well as allow for a comparative assessment of the project area vis-à-vis the Union, Upazila and District level socio economic baseline information.

#### 5.4.2 Area of Influence

The proposed solar project (35 MW) and transmission line falls under Arua, Ulail and Shivalaya Union Parishads under the jurisdiction of Shivalaya Upazila of Manikganj district. The project site is located on the left bank of river Padma. Nearest town is Shivalaya, which is 10 km from the proposed project site and Manikganj town or the district head quarter is about 28 km (road distance).

Initially, the social baseline has been assessed covering distance up to 5 km from project location which is designated as the study area. However, based on the initial observation it is deemed that magnitude of impact would be limited to 1km radius and likely to be more visible. Therefore, 1km study area has been considered as project impacted area; and rigorous study has been done during field visit to get the indepth knowledge regarding social baseline condition of 1km radius area. The 1.0 km radius study area is referred as Core Zone and 1 to 5 km radius study area is referred as Buffer Zone. The Buffer zone includes eight unions under three Upazillas. The core Zone have nine villages (Dhuturabari, Chhota Dhuturabari, Darikandi, Nali, Trilochan Patti, Teghari, Baruria, Nayakandi, and Lakshimpur) under Arua Union. The study area map for Buffer Zone and Core Zone is presented in **Figure 5.43** and **Figure 5.44**.

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Figure 5.43 5 km radius study area with Union



Figure 5.44 Villages under 1 km AOI

#### 5.4.3 Administrative structure

The project is located in Boruria Mouza of Arua Union of Shivalaya Upazila of Manikganj district. Manikganj was one of the sub-divisions of former Dhaka Zilla. It was up-graded to a Zilla in 1984. The Zilla is bounded on the north by Sirajganj and Tangail silos, on the east by Dhaka Zilla, on the south by Faridpur, Rajbari and Dhaka silos and on the west by Pabna and Rajbari silos. It comprises an area of 1,383.66 km2. Manikganj District has a population of 1,671,985; 52.02% male and 56.34% female; the population density is 3674.

The Padma, Jamuna, Dhaleshwari, Ichamati and Kaliganga. An extensive area of the Zilla especially riverine area of the Upazillas of Harirampur, Shibalaya and Daulatpur becomes victim to riverbank erosion every year.

Manikganj subdivision was established in 1845 and was turned into a Zilla in 1984. The Zilla consists of 7 Upazillas, 65 unions, 1176 mauzas, 1660 villages, 2 paurashavas, 18 wards and 64 mahallas. The Upazillas are Manikganj Sadar, Singair, Shibalaya, Saturia, Harirampur, Ghior and Daulatpur.

Shivalaya is an Upazila of Manikganj District in the Division of Dhaka, Bangladesh. Shivalaya has 7 Unions/Wards, 205 Mauzas/Mahallas, and 236 villages. As of the 2011 Bangladesh census, Shivalaya has a population of 171873. Males constitute 85216 (49.58%) of the population, and females 86657 (50.41%). Shivalaya has an average literacy rate of 53.30% where Male literacy rate is 57.40% and female literacy rate is 49.20%.

#### 5.4.3.1 Administrative set up of the Project Impacted Area

Arua Union consists of 9 administrative Wards and 22 villages. Administrative linkage of the villages under study areas are presented in **Figure 5.45** provided below.





Source: Bangladesh National Portal, 2019/Arua Union

# 5.4.3.2 Villages in Core Zone

The social baseline has been assessed covering distance up to 1 km from project boundary designated as project core area based on the observation that magnitude of impact in this area is likely to be more visible.. There are nine (9) Wards in Arua Union. Four (4) wards comes under 1 km radius of the project site is presented in following **Table 5.21**.

S. No.	Ward	Villages
1	Ward No 1	Dhuturabari, Chhota Dhuturabari
2	Ward No 2	Darikandi, Nali, Trilochan Patti
3	Ward No 3	Teghari, Baruria
4	Ward No 4	Nayakandi, Lakshimpur

#### Table 5.21 Project Affected villages

\*Source: Secondary Information and Stakeholder Consultations

#### 5.4.4 Demography Profile

This section provides a demographic overview of the study area and core area to provide a clear understanding of the socio-economic and cultural context within which the project is located. Table 5.18 provides broad demographic features of the region wherein project study area is located. Total population of the study area (5 km radius) is 177695 and total number of households (HH) are 41,211. The average sex ratio in the study area villages is 97 against the national figure of 100, which depicts less representation of male population than the female population. Average household size (4.0) of the study area is lower than that of National Household size. **Table 5.22** shows the Demography of the project study area.

Upazila	Union	Total population	Total HHs	Average HH size	Sex Ratio	Population density (Sq. Km)
Shibalaya	Arua	14025	3522	3.9	99	638
	Shibalaya	26573	6323	4.2	101	1001
	Shimulia	23478	5680	4.1	98	847
	Ulail	25812	6253	4.1	98	1238
Harirampur	Balla	20682	4901	4.2	96	1189
	Kanchanpur	5271	1284	4.1	92	168
Goalandaghat	Daulatdia	34138	7280	4.6	94	661
	Ujan Char	27716	5968	4.6	96	950
Project Study	Area	177695	41,211	4.0	97	837

### Table 5.22Demographic profile of 5km study area

Source: Population and Housing Census, 2011, Bangladesh Bureau of Statistics (BBS)

On the other hand, in the 1km core area, nine villages consist of 2330 households. The total population in these 9 villages are 9282 where male population is 4837 and female population is 4445. The average household size among all these nine villages is 4.0. **Table 5.23** shows the village wise demographic information of 1km study area.

#### Table 5.23Demographic profile of 1km study area

Village	Households	Male	Female	Total	Average Household Size

Nali	320	672	608	1280	4	
Darikandi	350	755	680	1435	4.1	
Trilochan Patti	150	317	305	622	4.1	
Teghari Village	280	587.0	508	1095	3.9	
Baruria Village	200	419	379	798	4.0	
Nayakandi Village	300	582	558	1140	3.8	
Lakshimpur Village	200	430	387	817	4.1	
Dhaturabari Village	280	579	541	1120	4	
Kodalia Village	250	496	479	975	3.9	
Primary Study Area Total	2330	4837	4445	9282	4.0	

#### 5.4.5 Ethnic Composition

According to population and housing census (2011), 22 ethnic households found within the 5km radius of the project site. Majority of the ethnic populations are Monda group.

		1		1	1
Upazila	Union	Ethnic Households	Both Sex	Male	Female
Shibalaya	Arua	20	74	43	31
	Shibalaya	0	0	0	0
	Shimulia	1	6	4	2
	Ulail	1	2	1	1
Harirampur	Balla	0	0	0	0
	Kanchanpur	0	0	0	0
Goalandaghat	Daulatdia	0	0	0	0
	Ujan Char	0	0	0	0
Project Study Area		22	82	48	34

Table 5.24Ethnic composition of 5km study area

Source: Population and Housing Census, 2011, Bangladesh Bureau of Statistics (BBS)

However, it is confirmed through consultations and document review that there are no ethnic families living within 1km core area.

# 5.4.6 Religion

**Table 5.25** presents the study area wise religious affiliation of the people. Approximately 1,62,185 people (91.3%) are Muslim and 12,330 people (8.7%) are Hindu. Very lesser percentage (0.01%) households comprise of Christian community.

Table 5.25Religion Profile between above 1km to 5km study area

Upazilla	Union	Total	tal Muslim		Hindu		Christia	n
		pop.	Pop.	%	Рор.	%	Pop.	%
Shibalaya	Arua	14025	10859	77.4	3153	22.5	0	0

Upazilla	Union	Total	Muslim		Hindu		Christian	
		pop.	Pop.	%	Pop.	%	Pop.	%
	Shibalaya	26573	23708	89.2	2864	10.8	0	0
	Shimulia	23478	21031	89.6	2447	10.4	0	0
	Ulail	25812	22237	86.1	3563	13.8	12	0.046
Harirampur	Balla	20682	18897	91.4	1784	8.6	1	0.005
	Kanchanpur	5271	4512	85.6	759	14.4	0	0
Goalandaghat	Daulatdia	34138	33748	98.9	390	1.1	0	0
	Ujan Char	27716	27193	98.1	523	1.9	0	0
Project Study Area		177695	162185	91.3	12330	8.7	13	0.01

Source: Population and Housing Census, 2011, Bangladesh Bureau of Statistics (BBS)

The core area, within 1km radius, consists of 79% Muslims and 21% Hindus. Majority of Hindu populations reside in Nali village (55%) and Trilochan Patti village (90%). Village wise population distribution by religion is shown in **Figure 5.46**.





Source: Primary Data, 2019

#### 5.4.7 Education Profile

As per population and housing census (2011), average literacy rate is 43.9% in the study area which is lower than the National average literacy rate 51.8%. **Figure 5.47** shows union wise literacy rate which comes under the study area.



Figure 5.47 Literacy ratio in study area

Within 1km core area, the average literacy rate of nine villages is 86%. **Table 5.26** shows the literacy rate of the villages within 1 km area.

Village	Literacy Rate (%)
Nali	88
Darikandi	90
Trilochan Patti	80
Teghari	85
Baruria	85
Nayakandi	90
Lakshimpur	85
Dhaturabari	85
Kodalia	90
Primary Study Area Total	86

#### Table 5.26 Literacy ratio in study area villages

Source: primary data, 2019

#### 5.4.8 Settlement and Housing

Most of the structures in the study area villages are Kutcha type (88.2%). 7.3% structures are Semi-Pucca. Only 1.2% structure is Pucca type. **Table 5.27** shows the type of structure in the project study area.

Upazilla	Union	Number of		Type of Structure (%)					
		Households	Pucca <sup>1</sup>	Semi- Pucca	Kutcha	Jhupri			
Shibalaya	Arua	3517	0.7	3.7	78.7	16.9			
	Shibalaya	6319	2.2	6.2	86.8	4.8			
	Shimulia	5676	0.7	6.9	91.6	0.7			
	Ulail	6229	2.6	6.7	82.7	8.1			
Harirampur	Balla	4900	0.5	3.8	95.7	0			
	Kanchanpur	1284	0.4	9.6	89.8	0.2			
Goalandaghat	Daulatdia	7041	1.7	13.3	82.7	2.3			
	Ujan Char	5968	0.9	7.9	87.8	3.4			
Т	otal	40934	1.2	7.3	87.0	4.6			

# Table 5.27 Type of Structure in 5 km Study Area

Source: Population and Housing Census, 2011, Bangladesh Bureau of Statistics (BBS)

Within 1km core area, most of the structures are Kutcha Type (79.2%) followed by 15.8% makeshift structures 0.9% structures are Pucca type (**Ref Table 5.28**).

#### Table 5.28 Type of Structure in 1 km Study Area

Villago		Type of Struct	ure (%)	
village	Pucca	Semi-pucca	Kutcha	Jhupri
Nali	1.3	4.2	93.3	1.3
Darikandi	0	2.2	96.2	1.6
Trilochan Patti	2.1	11.7	62.9	23.3
Teghari	0	3.9	60.7	35.4
Baruria	1.3	0.6	69.6	28.5
Nayakandi	0	0	67.1	32.9
Lakshimpur	0	2	98	0
Dhaturabari	3.3	8	71	17.8
Kodalia	0.5	4	94	1.5
Primary Study Area Total	0.9	4.1	79.2	15.8

Source: Population and Housing Census, 2011, Bangladesh Bureau of Statistics (BBS)

#### 5.4.9 Transport and Communication

As per Population and Housing Census, 2011, transportation facilities are available in the study area villages. Total metalled road is 25%. Most of the village roads are non-metalled (made with bricks) 71.5%. Local bus service, Rickshaw, Van, Easy Bike Tempo are the mode of transportation for the people of the study area villages. A total of 3652 different types of vehicles registered (1986) and non-registered (1666) are running within the project study area where the numbers of non-motorized vehicles

Kutcha House: Houses made from mud, thatch, or other low-quality materials.

<sup>&</sup>lt;sup>1</sup> Pucca House: Houses made with high quality materials throughout, including the floor, roof, and exterior walls.

Semi Pucca House: Houses made with tin or the roof made with tin and the wall and floor made with brick/cement.

number is higher than that of the motorized vehicles. Importantly, these vehicles run for inter Upazilla transportation service. (**Ref Table 5.29 & Table 5.30**).

Upazilla	Metalled Road	%	Semi Metalled Road	%	Non- metalled Road	%	Total	%	Bus Stand
Shibalaya	79	20.8	5	1.3	296	77.9	380	100.0	14
Harirampur	76	21.9	7	2.0	264	76.1	347	100.0	10
Goalandaghat	48.86	32.5	10.48	7.0	90.87	60.5	150.21	100.0	6
Total	203.86	25.1	22.48	3.4	650.87	71.5	877.21	100	30

#### Table 5.29 Roads Communication in the 5km Study Area

Source: District Statistics 2011, Bangladesh Bureau of Statistics (BBS)

#### Table 5.30 Transportation Facilities in the 5km Study Area

	Vehicle Types	Shibalaya	Harirampur	Goalandaghat	Total
Registered	Rickshaw	810	72	206	1088
	Van	307	20	396	723
	Easy bike and auto rickshaw	31	0	24	55
	Тетро	92	18	10	120
Not Registered	Rickshaw	380	60	215	655
	Van	210	38	342	590
	Easy bike and auto rickshaw	40	24	152	216
	Тетро	15	0	60	75
	Nochimon/Korimo/ Bhotbhoti	12	20	98	130
	Total	1897	252	1503	3652

Source: District Statistics 2011, Bangladesh Bureau of Statistics (BBS)

#### Table 5.31 Rail and Water Communication in the 5km Study Area

Upazilla	Total railway line (all broad gage, meter gage & duel gage)	Railway station	Water way in monsoon (river + canal)	Water way round the year (river + canal)	Steamer/launch station
Shibalaya	0	0	45	20	2
Harirampur	0	0	135	25	0
Goalandaghat	10	2	22	4	1
Total	10	2	202	49	3

Source: District Statistics 2011, Bangladesh Bureau of Statistics (BBS)

Total Railway (all broad gage, meter gage and duel gage) is 10 kilometer under Goalandaghat Upazilla. The only Railway station is Goalandaghat Ghat Railway Station. Waterway in monsoon (river + canal) is 202 Kilometer and Waterway round the year (river + canal) is 49 Kilometer. Moreover, within the study area, there are 3 numbers of Steamer and Launch stations i.e. at Paturia Launch Terminal, Aricha Ghat and Daulatdia Ferry Terminal. The Project site is well accessible by road from Dhaka at a distance of 65 km through Dhaka-Paturia Highway. (**Ref. Table 5.31**).

During consultation in the core area villages, it was observed that all the villages are connected through metalled road except Trilochan Patti village. Trilochan Patti village is partially connected to other villages through non-metalled road (brick road).

#### 5.4.10 Public infrastructure and access to amenities

#### Water supply

As per Population and Housing Census 2011, in the study area villages, drinking water is sourced from tap, tube-well and others sources which is presented in **Table 5.32**. It is found that hand pump is the major source of drinking water. 96% population in all the union as well as urban and rural area depends on hand pump water. The facilities of tap water are found basically confined to urban area only (0.4%). Remaining 3.1% people are mostly depended on other sources (river, canal or pond water).

#### Table 5.32 Sources of Drinking Water and Electricity Facility of the 5km Study Area

Upazilla	Union	Number of Households	Source of Drinking Water (%)			Electricity Connection (%)	
			Тар	Hand Pump	Other		
Shibalaya	Shibalaya	6319	0.5	98.1	1.3	57.2	
	Shimulia	5676	0.3	92.4	7.3	61.4	
	Ulail	6229	1.5	95.8	2.7	48.3	
Harirampur	Balla	4900	0.2	96.6	3.2	56	
	Kanchanpur	1284	0	99.8	0.2	30.2	
Goalandaghat	Daulatdia	7041	0	96.8	3.1	27.6	
	Ujan Char	5968	0.1	95.9	4	45.8	
Project Stu	udy Area	37417	0.4	96.5	3.1	46.6	

Source: Population and Housing Census, 2011, Bangladesh Bureau of Statistics (BBS)



#### Figure 5.48 Source of Drinking water

Source: Primary Consultation by ERM, February 2019

During consultation, it was observed that, in the core area, almost all households (99%) depend on hand pump (tubewell) for drinking water. (**Ref. Figure 5.48**). Rest 1% still depends on other sources (river, canal or pond water). Ground water depth in the core area villages around 80-100 feet. Drinking water is highly contaminated with iron. Therefore, 90 deep tube wells (depth more than 500 feet) have been setup by the DPHE (Department of Public Health Engineering) which is good source of drinking water and free from iron contamination. For bathing and cooking purposes people of this Arua Union use adjacent Ichamoti River's water.

#### Electricity

Electricity is an important indicator for measuring the quality of life in the study area. A tremendous progress has taken in place in case of electricity connection in the Zilla. General households reported to have electricity connection in Manikganj Zilla are 52.68% in 2011 compared to 28.48% in 2001 which shows a sharp increase of 24.20 percent point during the decade 2001-2011. A rapid progress is also observed in the urban and rural areas which reflects 16.11 and 24.26% point increase in urban and rural areas respectively during the decade. In the 5km study area, 46.6% of the households have electricity connection. **Figure 5.49** shows that the in the core area nine villages 84% households have electricity connection.



Figure 5.49 Percentage of Electricity Connection within 1km Study Area

#### 5.4.11 Sanitation

According to the Population and Housing Census, 2011, in the study area villages 61.4% of households have sanitation facility. 19.9% household have water sealed sanitation (pour-flush latrine) facility whereas 41.5% have non-water sealed sanitation (non-flush latrine) facility. 35.5% households use non-sanitary (unhygienic) facilities. 3.1% households don't have any sanitation facility and people defecate in open places. **Table 5.33** shows sanitation facility of the project area.

Table 5.33	Sanitation Facility	y of the 5km Stud	y Area
		,	,

Upazilla	Union	Number of	Type of Toilet Fa	cility (%)		
		nousenoius	Sanitary(water- sealed) <sup>1</sup>	Sanitary (non- water- sealed)	Non- sanitary	Open Defecation
Shibalaya	Shibalaya	6319	40	42.8	15.8	1.4

<sup>&</sup>lt;sup>1</sup> Sanitary (water-sealed) toilet: A pit latrine, also known as pit toilet or long drop, is a type of toilet that collects human feces in a hole in the ground. Pit latrines can be built to function without water (dry toilet) or they can have a water seal (pour-flush pit latrine).

Upazilla	Union	Number of	Type of Toilet Facility (%)					
		Households	Sanitary(water- sealed) <sup>1</sup>	Sanitary (non- water- sealed)	Non- sanitary	Open Defecation		
	Shimulia	5676	16.3	57.9	23.8	2		
	Ulail	6229	36.1	42.8	18.5	2.6		
Harirampur	Balla	4900	9.5	29.6	57.1	3.8		
	Kanchanpur	1284	16.9	46.8	32.9	3.3		
Goalandaghat	Daulatdia	7041	10.3	38.6	48	3		
	Ujan Char	5968	10.2	32.2	52.1	5.6		
Project S	tudy Area	37417	19.9	41.5	35.5	3.1		

Source: Population and Housing Census, 2011, Bangladesh Bureau of Statistics (BBS)

In the core area villages with in 1km radius, all the households have toilets facilities, 45% are non-water-sealed, 35% are water-sealed and 20% Non-sanitary toilets. (**Ref Figure 5.50**).





# 5.4.12 Healthcare Facility

As per BBS 2011 data, within the study area there are total 3 Government Health Centres, 5 Private hospitals, 6 Diagnostic centres and 20 union health centres. (Ref **Table 5.34**).

Table 5.34	<b>Health Facilities</b>	in the 5km	<b>Study Area</b>
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Location	Govt. Health Centre	Private Hospital	Diagnostic Centre	Number of Union Health Centre	
Shibalaya	1	1	3	7	
Harirampur	1	4	1	10	
Goalandaghat	1	0	2	3	
Total	3	5	6	20	

Source: District Statistics 2011, Bangladesh Bureau of Statistics (BBS)

During consultation with Union Parishad Chairman, it was observed that, there is only one satellite clinic available at Arua Union. There are two more health care facilities available in Arua Union (Mother and Child Welfare Center in Baulikanda and Community Clinic in Dakshin Saljana). Nearest hospital is located at Upazilla Health Complex situated in Shibalaya Upazila, which caters to the health care requirement in case of emergency. There is no private clinic in the core area villages.

# 5.4.13 Educational Institutions

As per Population and Housing Census, 2011, there are 67 primary schools, 45 secondary schools, 7 Colleges and 2 Technical/vocational Institutions situated in the study area. (Ref **Table 5.35**)

Upazila	Primary	Secondary	College	Technical/vocational Institution
Shibalaya	22	21	2	0
Harirampur	23	14	3	0
Goalandaghat	22	10	2	2
Total	67	45	7	2

 Table 5.35
 Educational Institutions in the 5km Study Area

Source: District Statistics 2011, Bangladesh Bureau of Statistics (BBS)

On the other hand, in the core area villages there are 3 Primary Schools, 1 Secondary School and 2 Madrasa available. Additionally, 6 Primary Schools, 1 Secondary School and 1 college are also available in Arua Union outside the 1km radius. (Ref **Table 5.36**).

Educational Institutions	Total Number	Villages within 1k	thin 1km study area			
		Nali	Dhaturabari	Nayakandi		
Primary School	3	<ol> <li>Nali Baruria Govt. Primary School</li> <li>Awlad Hussain Khan Academy (Pvt.)</li> <li>Morining Sun Kindergarten (Pvt)</li> </ol>				
Secondary School	1	1.Nali Baruria Krishnachandra High School				
College	0					
Madrasa	2		1.Sayeda Khanom Hafizia Madrasa	1.Noyakandi Etimkhana Madrasa		
Training/vocational Institute	0					

Table 5.36 Educational Institutions in the 1km Study Area

Source: Arua Union Parishad, February, 2019

# 5.4.14 Bank and NGOs

As per Population and Housing Census, 2011 there are 10 Banks in the study area. (Ref Table 5.37)

Upazila	National Bank	Private Bank	Specialized Bank <sup>1</sup>
Shibalaya	3	0	2
Harirampur	6	1	2
Goalandaghat	1	0	1
Total	10	1	5

#### Table 5.37 Number of Bank Study Area

Source: District Statistics 2011, Bangladesh Bureau of Statistics (BBS)

In the core area i.e. within 1 km radius area there are two agent banking services (Bank Asia Agent Banking and Bikash Agent Banking), as there is no bank available. There are some institutions and community development bank like ASA, BRAC and Grameen Bank in these villages. These institutions are mostly microfinance institutions and they provide loan for agriculture, micro credit, health program, sanitary program.

#### 5.4.15 Common Property Resources

In the study area there are total 589 Mosques and 168 Temples. The list is given below in Table 5.38.

Upazilla	Mosque	Eid-Gah	Temple	Church	Pagoda
Shibalaya	210	185	85	1	0
Harirampur	228	48	56	0	0
Goalandaghat	151	73	27	0	0
Total	589	306	168	1	0

 Table 5.38
 Common Property Resources in the 5km Study Area

Source: District Statistics 2011, Bangladesh Bureau of Statistics (BBS)

During consultation with union members and villagers at the core area, it was confirmed that, proposed project was not nearby to the any protected monuments. So far it was informed that there is no designated or non-designated heritage site in the core area villages. There are some Common Property Resources (CPR) like Temples, Mosque, and Graveyard within the core area. In terms of CPR, the likely impact from the project development was also discussed with the villagers. The list of the CPRs within core area are given in **Table 5.39**.

Table 5.39	Common Prop	erty Resources	in the	1km Study	/ Area
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Village	Mosque Name	Temple Name
Nali	<ul> <li>Nali Bazar Ruhani Jame Mosque</li> </ul>	
Darikandi	<ul> <li>Darikandi Maddhapara Jame Mosque,</li> <li>Darikandi Khalpar Jame Mosque</li> </ul>	<ul> <li>Nali Maddhayapara Sunil Senbari Durga Mandir,</li> <li>Nali Bazar Durga Mandir,</li> <li>Nali Purbapara Kali Mandir</li> </ul>
Trilochan Patti		<ul> <li>Trilochan Patti Horitokitola Buri Mandir</li> </ul>
Teghari		
Baruria	<ul> <li>Baruria Jame Mosque</li> </ul>	
Nayakandi	<ul> <li>Nayakandi Bazar Jame Mosque</li> </ul>	

<sup>&</sup>lt;sup>1</sup> Specialized Bank- Krishi Bank and Bangladesh Development Bank Limited; these two are state owned specialized bank for supporting in agriculture and industrialization.

Village	Mosque Name	Temple Name
Lakshimpur		
Dhaturabari	<ul> <li>Pashchim Dhaturabari Jame Mosque,</li> <li>Choto Dhaturabari Talukdarbari Jame Mosque</li> </ul>	<ul> <li>Dhaturabari Kor Bari Durga Mandir</li> </ul>
Kodalia		
Total	7 Mosque	5 Temples

Source: Primary Survey, February 2019

# 5.4.16 Rural Markets (Haat/Bazar)

There are 71 rural markets including village Hat and Growth Centres<sup>1</sup> in the study area shows in **Table 5.40**.

Table 5.40	Rural markets in the Study Area
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Upazilla	Rural Market (Hat and Growth Centre)
Shibalaya	28
Harirampur	31
Goalandaghat	12
Total	71

Source: District Statistics 2011, Bangladesh Bureau of Statistics (BBS)

In the core area, there are two main rural markets (Haat) i.e. Nali Bazar and another is Nayakandi Bazar. Additionally, Paturia Ghat, Maluchi and Mandrakhola bazars are also situated within this Arua union outside the 1km Core area.

# 5.4.17 Economic Activities

As per Population and Housing Census, 2011, major livelihood in the study area is related to agriculture. Majority of the population in the study area villages depends on agricultural activities and work as agricultural labourers. Among the working population in the study area villages 85.5% male and 43.4% female are engaged in agriculture activities. In the study area villages, an average of 48.6% female workers engaged in service sector. **Table 5.41** shows economic activity in the study area.

Upazilla	Unions	Field of Activity (%)						
		Agriculture		Industry		Service		
		Male	Female	Male	Female	Male	Female	
Shibalaya	Shibalaya	62.0	13.6	1.7	5.6	36.3	80.8	
	Shimulia	88.1	48.1	1.9	2.5	10.0	49.4	
	Ulail	71.5	34.3	3.0	5.9	25.5	59.8	
Harirampur	Balla	90.4	68.0	2.9	5.3	6.8	26.7	
	Kanchanpur	94.3	76.2	0.4	9.5	5.4	14.3	

 Table 5.41
 Economic Activities in the 5km Study Area

<sup>&</sup>lt;sup>1</sup> Growth Centre: Growth Centers (GC) are called provisionally the convenient well-communicated marketing places where agricultural products are brought from rural areas for selling. The economic activities of the growth centers developed and constructed by the Local Government and Engineering Department (LGED)

Upazilla	Unions						
		Agr	iculture	Inc	dustry	S	ervice
		Male	Female	Male	Female	Male	Female
Goalandaghat	Daulatdia	69.2	2.8	6.6	0.9	24.2	96.3
	Ujan Char	85.5	43.4	5.9	8.1	8.6	48.6

Source: Population and Housing Census, 2011, Bangladesh Bureau of Statistics (BBS)

During consultation it was found that, agricultural labour and non-agricultural labour are important means of livelihood for many in the adjoining villages within the 1 km area. Major livelihood in the core area villages is related to agriculture. 62% male population are engaged in agriculture activities followed by 33.3% in service sector. A large number of female population are engaged in service sector (74%) followed by 23.3% in agriculture activities. A large number of population are engaged with fish selling business. In Trilochan Patti village, most of the households are engaged with fishing activities. People catch fishes from river Padma, Ichamati, and sell at local markets. (Ref **Table 5.42**).

Village	Field of Activity (%)						
	Agriculture		Industry		Service, Bu	Service, Business and others	
	Male	Female	Male	Female	Male	Female	
Nali	34.6	25.0	6.4	25.0	59.0	50	
Darikandi	99.0	100.0	1.0	0	0.0	0	
Trilochan Patti	53.1	25.0	7.1	0	39.8	75	
Teghari	47.6	7.7	8.1	0	44.4	92	
Baruria	78.3	0.0	5.8	0	15.9	0	
Nayakandi	95.2	0.0	0.0	0	4.8	0	
Lakshimpur	71.9	0.0	0.0	0	28.1	0	
Dhaturabari	37.9	0.0	0.5	0	61.5	100	
Kodalia	76.5	100.0	12.7	0	10.8	0	
Total	62.1	23.3	4.5	2.3	33.3	74	

#### Table 5.42 Economic Activities within 1km Area

Source: Population and Housing Census, 2011, Bangladesh Bureau of Statistics (BBS)

#### 5.4.18 Agriculture and cropping pattern

Agriculture is the primary occupation in the study area villages. Among the cereals paddy and wheat are the main crops. Among pulses masoor dal, gram dal are important pulses grown. Oilseed like mustard, sesame seeds (Til), are also grown. Along with these commercial and horticulture crops like jute, sugarcane, vegetables like tomato, brinjal, chilly, lady finger etc. are also grown in the area (Refer **Table 5.43** & **Table 5.44**).

Upazilla	Current Fallow	Single	Double	Triple	Total
Shibalaya	700	11588	10738	3050	26076
Harirampur	303	14072	7664	3879	25918
Goalandaghat	49	2700	17475	3882	24106
Total	1052	28360	35877	10811	76100

 Table 5.43
 Land Utilization (in Acre) of 5km Study Area

Source: District Statistics 2011, Bangladesh Bureau of Statistics (BBS)

Upazilla	Wheat	Jute	Sugarcane	Mustard	Sesame Seeds
-	Area (Acre)				
Shibalaya	550	918	85	5410	2060
Harirampur	715	101	38	901	43
Goalandaghat	2408	7577	156	1110	286
Total	3673	8596	279	7421	2389

Table 5.44	Other Agriculture	Products in	the 5km	Study Area

Source: District Statistics 2011, Bangladesh Bureau of Statistics (BBS)

During consultation with local people, it was informed that the norm of this region is double crop and some multiple crop. In 1km area about 55% land is used for double cropping followed by 20% for single, 10% for multiple cropping and 15% current fallow land (Barren land). In the core area villages the major crop production are Mustard, Til, Pulses like Moong dal and Paddy. (Refer **Figure 5.51**).

Figure 5.51 Agricultural Land Utilization (in %) within 1km Study Area



# 5.4.19 Irrigation

Abundance of water during monsoon and its scarcity during rabi season severely restrict agricultural production in Bangladesh. Therefore, planned utilization and efficient management of water resources particularly through irrigation is considered as one of the most crucial elements for increasing area under cultivation and improving long term productivity. The average rainfall in the Manikganj and study area villages is around 2376 mm. more than 90 percent of which occurs in the South West monsoon season. Ground water is the principal and most widely distributed resources for irrigation. For irrigation purposes Bangladesh abstracts 86% water from underground sources. During consultation, it was observed that the major source of irrigation facilities are bore wells used for agriculture with the 1 km core area. Irrigation water is channelized to the field using both lined and unlined canals. As per BBS 2011, it has been reported that 27,489 acres land is irrigated. Irrigation is required only for paddy cultivation. (Refer **Table 5.45**).

Table 5.45 Covered Irridation Area in the 5km Study Area	able 5.45	Covered Irrigation	Area in the 5km	n Study Area
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Upazilla	Total Area	Irrigated Area
Shibalaya	16253	11908
Harirampur	15413	8129

Upazilla	Total Area	Irrigated Area
Goalandaghat	8529	7452
Total	40195	27489

Source: District Statistics 2011, Bangladesh Bureau of Statistics (BBS)

## 5.4.20 Fishing

According to the District Statistics 2011, BBS, in the study area there are 10939 listed fishermen engaged with fishing related activities. Moreover, the total fish production, as reported in 2011 was 4287 metric ton. (Refer **Table 5.46**).

Upazilla	Number of Fishermen	Total Production (MT)
Shibalaya	5900	2263
Harirampur	3821	2016
Goalandaghat	1218	8
Total	10939	4287

Table 5.46	Fisherman	in the	5km	Study	Area
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Source: District Statistics 2011, Bangladesh Bureau of Statistics (BBS)

During consultation, it was observed that only 12% households within the 1 km villages of project are involved with fishing activities. In Trilochan Patti village 95% households are involved with fishing activities. (Refer **Figure 5.52**).





# 5.4.21 Vulnerability households

According to Population and Housing Census, 2011, in rural area of Dhaka Division about 23.5% populations reside Below Poverty Line. During consultation with the Union Chairman, it was reported that within 1 km core area there are 170 vulnerable households. There are 66 women headed households and 104 BPL (i.e. as per BBS data having a monthly income less than BDT 8500 / USD 100) families have

been identified. These vulnerable households receive stipends under Social Safety Net Programs. (Refer **Table 5.47**).

Village	Total Households	Vulnerable Women	Households Below Poverty Line (BPL)	Total Vulnerable Households	%
Nali	320	4	12	16	5
Darikandi	350	3	16	19	5.4
Trilochan Patti	150	5	15	20	13.3
Teghari	280	12	19	31	11.1
Baruria	200	11	1	12	6
Nayakandi	300	10	19	29	10
Lakshimpur	200	7	7	14	7
Dhaturabari	280	14	15	29	10
Kodalia	250	0	0	0	0
1km Study Area Total	2330	66	104	170	7.3

Table 5.47	Vulnerability	Household
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Source: Arua Union Parishad, February, 2019

#### 5.5 Socio Economic Survey (Primary Survey)

This section discusses the findings of the socio economic and the census survey carried out for the ESIA Study of the SSPL Project. Census survey was conducted for 15% the Project Affected Households (PAHs).

#### 5.5.1 Project Affected Persons: Population and PAHs/PAPs

The total 114 PAHs constitutes 672 family members or Project Affected Persons (PAPs). Approximately 25.4% of the PAHs are from Darikandi village and 20.2% of PAHs are from Nayakandi village. Table 5.48 provides distribution of PAH and PAPs of 10 villages.

Villages	PAHs	% PAHs	PAPs	% PAPs
Baruria	16	14.0	98	14.6
Dhaturabari	7	6.1	35	5.2
Darikandi	29	25.4	173	25.7
Kodalia	3	2.6	15	2.2
Lakshimpur	13	11.4	72	10.7
Nali	4	3.5	22	3.3
Nayakandi	23	20.2	140	20.8
Sorishabari	3	2.6	11	1.6
Teghari	7	6.1	45	6.7
Trilochan Patti	9	7.9	61	9.1

#### Table 5.48 Project Affected Persons: Population and PAHs/PAPs

Villages	PAHs	% PAHs	PAPs	% PAPs
Total	114	100.0	672	100.0

Source: Socio Economic Survey by ERM, February 2019

# 5.5.2 PAHs and Population Age group, Sex Composition, family size and Religion

The age and sex composition of the PAPs is provided in **Table 5.49**. Of the total PAPs, 357 constitute males and 315 constitute female. Approximately 448 PAPs falls in the age group of 19 -65 years. Only 52 PAPs are elderly more than 65 years of age.

Villages	Se	x Compositi	on		Age o	compositi	on		Total
	Male	Female	Total	<=6	7-14	15-18	19-65	>65	
Baruria	53	45	98	7	6	8	68	9	98
Dhaturabari	19	16	35	3	4	1	23	4	35
Darikandi	91	82	173	18	24	10	110	11	173
Kodalia	7	8	15	0	1	0	14	0	15
Lakshimpur	37	35	72	4	4	4	56	4	72
Nali	13	9	22	2	3	2	13	2	22
Nayakandi	74	66	140	13	19	6	89	13	140
Sorishabari	8	3	11	1	0	1	8	1	11
Teghari	23	22	45	6	8	1	26	4	45
Trilochan Patti	32	29	61	2	9	5	41	4	61
Total	357	315	672	56	78	38	448	52	672

Table 5.49 Age and Sex wise population

Source: Socio Economic Survey by ERM, February 2019

# Family Size

Affected households under the project has been classified into four categories based on the number of family members. Out of total, 50 households are small families with less than 4 members and 31 have 5-6 members. **Table 5.50** provides details on the family size of the PAHs.

Villages	Family Size							
	<=4	5-6	7-8	>8				
Baruria	5	6	1	4	16			
Dhaturabari	5	1	0	1	7			
Darikandi	11	9	3	6	29			
Kodalia	2	0	1	0	3			
Lakshimpur	6	3	2	2	13			
Nali	1	2	1	0	4			

Table 5.50 Family Size of PAPs

Villages	Family Size							
	<=4	5-6	7-8	>8				
Nayakandi	9	8	0	6	23			
Sorishabari	3	0	0	0	3			
Teghari	4	1	0	2	7			
Trilochan Patti	4	1	2	2	9			
Total	50	31	10	23	114			

Source: Socio Economic Survey by ERM, February 2019

#### **Religious Affiliation**

**Table 5.51** presents village wise religion affiliation of the PAPs. Approximately 631 PAPs (93.89%) are Muslim and 41 PAPs (6.10%) are Hindu.

Villages			Religion		
	Hindu	Muslim	Christian	Others	Total
Baruria	2	96	0	0	98
Dhaturabari	0	35	0	0	35
Darikandi	3	170	0	0	173
Kodalia	0	15	0	0	15
Lakshimpur	0	72	0	0	72
Nali	3	19	0	0	22
Nayakandi	6	134	0	0	140
Sorishabari	0	11	0	0	11
Teghari	8	37	0	0	45
Trilochan Patti	19	42	0	0	61
Total	41	631	0	0	672

Table 5.51Religious Affiliation

Source: Socio Economic Survey by ERM, February 2019

#### 5.5.3 Literacy Levels, Occupation, Income and Expenditure of PAPs

#### Literacy levels of PAPs

Information was collected for 672 project affected people on the literacy levels. A total 121 (18%) of the PAPs are uneducated, additional 30.95% of the PAPs have education less than elementary class (VIII standard) and only 10.26% are graduate or have higher degrees. **Table 5.52** provides detail on educational status of PAPs.

Villages	Illiterate	Functionall y Literate	Primary	Upper Primary	Secondary	Higher Secondary	Graduation	Post- Graduation	Total
Baruria	12	2	29	13	16	9	16	1	98
Dhaturabari	9	2	4	5	3	4	7	1	35
Darikandi	39	5	50	36	28	8	6	1	173
Kodalia	1	0	3	4	4	2	1	0	15
Lakshimpur	11	1	14	17	12	4	8	5	72
Nali	5	3	4	4	2	2	2	0	22
Nayakandi	18	3	53	31	15	7	11	2	140
Sorishabari	2	0	4	0	2	1	1	1	11
Teghari	10	0	11	12	8	2	2	0	45
Trilochan Patti	14	1	19	12	7	4	3	1	61
Total	121	17	191	134	97	43	57	12	672

#### Table 5.52 Educational Status of PAPs

Source: Socio Economic Survey by ERM, February 2019

# **Primary Occupation**

Agriculture is the predominant occupation with approximately 39.13% of the PAPs are involved in agriculture, 7.44% people are involve in service sector, 10.41% people are involved in number of occupation which involves agriculture allied activities, dairy, household industry, business trader, unskilled daily labour, service etc. Of the non-working population, 43.01% PAPs are either too young, disabled or students and do not have any occupation. The occupation wise distributions for PAPs is provided in Table 5.53.

Sources of Income	Baruria	Dhaturabari	Darikandi	Kodalia	Lakshimpur	Nali	Nayakandi	Sorishabari	Teghari	Trilochan Patti	Total
Farmer	43	12	71	9	33	8	44	6	18	19	263
Service (Govt.)	1	2	3	0	3	1	8	0	0	3	21
Service (Pvt)	5	3	8	0	2	2	6	0	2	1	29
Agri Labour	1	0	1	0	0	0	0	0	0	0	2
Daily Labour	0	0	6	0	1	0	1	0	2	6	16
Commercial	5	7	8	0	2	2	12	1	4	2	43
Household Industry	0	0	3	0	3	1	2	0	0	0	9
unable to work	9	2	16	0	2	0	17	1	4	5	56

Table	5.53	Occupation
IUNIC	0.00	Cocapation

Sources of Income	Baruria	Dhaturabari	Darikandi	Kodalia	Lakshimpur	Nali	Nayakandi	Sorishabari	Teghari	Trilochan Patti	Total
Unpaid Family Work	34	9	57	6	26	8	50	3	15	25	233
Total	98	35	173	15	72	22	140	11	45	61	672

Source: Socio Economic Survey by ERM, February 2019

# Monthly Income

Census Survey on the monthly income levels of each PAHs indicates that 29.82% of PAHs has monthly income in the range of BDT 10,000 – 20,000, 36.84% PAHs has monthly income in the range of BDT 20,000 - 50,000, 14.04% in the range of BDT 5,000 - 10,000, 1.75% less than BDT 5,000, 9.64% in the range of BDT 50,000 – 1 lakh and only 7.89% has monthly income more than BDT 1 lakh. The monthly income status of the PAHs is provided in **Table 5.54**.

Villages	M	onthly	Income	e of PA	Hs (BD	T)		Num	pers of H	louseho	old Earne	er
	Less than 5000	5000-10000	10000-20000	20000-50000	50000- 1 lakh	more than 1 lakh	Total	One earner	Two earner	three earner	four earner	Total
Baruria	1	5	4	5	1		16	5	6	4	1	16
Dhaturabari	0	2	2	1	2	0	7	4	3	0	0	7
Darikandi	0	4	10	12	1	2	29	5	15	9	0	29
Kodalia		1	1	1			3	3	0	0	0	3
Lakshimpur	1	0	2	6	3	1	13	2	8	3		13
Nali			2	2			4	1	1	2		4
Nayakandi		2	8	5	3	5	23	10	6	5	2	23
Sorishabari			2	1			3	3				3
Teghari		1	3	3			7	3	2	2		7
Trilochan Patti		1		6	1	1	9	2	3	3	1	9
Total	2	16	34	42	11	9	114	38	44	28	4	114

Table 5.54 Monthly Income of Household

Source: Socio Economic Survey by ERM, February 2019

# Expenditure Pattern

Information collected during Census survey on expenditure pattern of PAHs indicates that monthly expenditure of most of the households (35.09%) lie in the range of BDT 10,000-20,000, followed by 28.07% in the range of BDT 5000- 10,000. 28 PAHs refused to provide information on the month expenditure of their households. Table 5.55 provides information on monthly expenditure of the households.

Villages		Mon	thly Exp	penditure of	f PAHs ( Taka)		Refused	Total
	Less than 5000	5000-10000	10000-20000	20000-50000	50000- 1 lakh	more than 1 lakh		
Baruria	1	5	5	0	0	0	5	16
Dhaturabari	0	1	0	1	0	0	5	7
Darikandi	0	5	15	2	1	0	6	29
Kodalia	0	1	1	0	0	0	1	3
Lakshimpur	0	7	3	3	0	0	0	13
Nali	0	0	1	0	0	0	3	4
Nayakandi	0	9	10	3	0	0	1	23
Sorishabari	0	0	3	0	0	0	0	3
Teghari	0	2	0	0	0	0	5	7
Trilochan Patti	0	2	2	3	0	0	2	9
Total	1	32	40	12	1	0	28	114

# Table 5.55 Household Expenses

Source: Socio Economic Survey by ERM, February 2019

#### 5.5.4 PAHs Access to Basic Social Infrastructure and Public Services

#### Source of Drinking Water

As per the information collected from the PAHs, few household have access to tap water for drinking water. Survey data indicates that only 5 PAHs (4.38%) have access to drinking water through tap water supply, 109 PAHs (95.61%) draw water from hand pump. **Table 5.56** provides details on source of drinking water for these 10 villages.

Villages	Source of dri	Source of drinking water					
	Tap water supply	Hand pump					
Baruria	0	16	16				
Dhaturabari	1	6	7				
Darikandi	1	28	29				
Kodalia	0	3	3				

#### Table 5.56 Source of Drinking Water

Villages	Source of dri	Total	
	Tap water supply	Hand pump	
Lakshimpur	0	13	13
Nali	0	4	4
Nayakandi	1	22	23
Sorishabari	0	3	3
Teghari	1	6	7
Trilochan Patti	1	8	9
Total	5	109	114

Source: Socio Economic Survey by ERM, February 2019

#### Source of Domestic Water

As per the information collected from the PAHs, 65 (57.02%) household drew water from Hand pump for domestic purposes like cooking, cleaning, bathing etc. 30 households i.e. 26.32% use river water for domestic purposes. Survey data indicates that only 5 PAHs (4.38%) have access to drinking water through tap water supply. **Table 5.57** provides details on source of drinking water for these 10 villages.

Villages	Source of Domestic water					Total
	Khal	Pond	River	Tap Water	Hand Pump	
Baruria	1	0	5	0	10	16
Dhaturabari	1	1	2	2	1	7
Darikandi	0	2	5	1	21	29
Kodalia	0	0	2	0	1	3
Lakshimpur	0	0	4	0	9	13
Nali	0	0	2	0	2	4
Nayakandi	2	2	7	1	11	23
Sorishabari	1	0	2	0	0	3
Teghari	1	0	1	0	5	7
Trilochan Patti	0	1	0	1	7	9
Total	6	6	30	5	65	114

 Table 5.57
 Source of Domestic water

Source: Socio Economic Survey by ERM, February 2019

#### Sanitation Status

Census survey indicated that only all the households have access to toilets. For PAHs with toilets, (68.42%) have non water sealed toilets within the households and 21.93% have water sealed toilets and only 6.14% use kutcha toilets. Detail status on access to sanitation facilities is provided various villages is provided in **Table 5.58**.

Villages	Sanitation Status			Total		
	Open defecation	Kutcha Pit	Sanitary Non water sealed	Sanitary with water sealed	Community Toilet	
Baruria		1	9	6	0	16
Dhaturabari		0	2	5	0	7
Darikandi		5	18	6	0	29
Kodalia		0	2	1	0	3
Lakshimpur		0	11	2	0	13
Nali		0	3	1	0	4
Nayakandi		0	23	0	0	23
Sorishabari		0	3	0	0	3
Teghari		0	2	5	0	7
Trilochan Patti		1	6	2	0	9
Total		7	78	25	0	114

#### Table 5.58Sanitation Status

Source: Socio Economic Survey by ERM, February 2019

#### Electricity and Source of lighting

Assessment on electricity and source of lighting during the Census survey indicated 100% PAHs have access to electricity. Table 5.59 provides details on source of light for PAHs.

# Table 5.59 Electricity and Source of lighting

Villages	Source o	Source of lighting		
	Electricity	Kerosene		
Baruria	16	0	16	
Dhaturabari	7	0	7	
Darikandi	29	0	29	
Kodalia	3	0	3	
Lakshimpur	13	0	13	
Nali	4	0	4	
Nayakandi	23	0	23	
Sorishabari	3	0	3	
Teghari	7	0	7	
Trilochan Patti	9	0	9	
Total	114	0	114	

Source: Socio Economic Survey by ERM, February 2019

#### Cooking medium used by the Households

Assessment on the Cooking medium used by the PAHs during the census survey indicated that majority households i.e. 78.07% use firewood, cow dung cake for cooking and only 21.92% households use LPG cylinder for cooking. **Table 5.60** provides details on the Cooking medium used by PAHs

Villages	Cooking medium used by the households			Total
	LPG	Firewood & Cow dung Cake	Kerosene	
Baruria	1	15		16
Dhaturabari	3	4		7
Darikandi	6	23		29
Kodalia	1	2		3
Lakshimpur	1	12		13
Nali	0	4		4
Nayakandi	10	13		23
Sorishabari	1	2		3
Teghari	1	6		7
Trilochan Patti	1	8		9
Total	25	89		114

#### Table 5.60 Cooking medium used by the Households

Source: Socio Economic Survey by ERM, February 2019

# Type of Structure

Category wise type of construction is provided in **Table 5.61**. Analysis of the type of construction for the structures of the PAHs indicated that 52.63% households structures are Semi-Pucca, 43.86% households structures are kutcha, and only 3.5% households have pucca structures.

Villages	Type of Construction			
	Pucca	Semi Pucca	Kutcha	Total
Baruria	0	6	10	16
Dhaturabari	1	4	2	7
Darikandi	1	16	12	29
Kodalia	1	2	0	3
Lakshimpur	0	10	3	13
Nali	0	1	3	4
Nayakandi	0	14	9	23
Sorishabari	0	2	1	3
Teghari	0	3	4	7
Trilochan Patti	1	2	6	9
Total	4	60	50	114

#### Table 5.61 Type of Construction for the structures

Source: Socio Economic Survey by ERM, February 2019

#### Mode of cultivation

Census survey indicates that 56% PAHs cultivate their land by their own family members. Only 16% PAHs informed that they have engaged agriculture labour for farming. The mode of cultivation is provided in **Table 5.62**.

Villages	Cultivation done by family (%)		Cultivation done by agri. Labour (%)		
	Yes	No	Yes	No	
Baruria	56	44	19	81	
Dhaturabari	14	86	14	86	
Darikandi	66	34	28	72	
Kodalia	67	33	0	100	
Lakshimpur	77	23	23	77	
Nali	25	75	0	100	
Nayakandi	70	30	13	87	
Sorishabari	100	0	33	67	
Teghari	29	71	14	86	
Trilochan Patti	56	44	11	89	
Total	56	44	16	84	

#### Table 5.62Mode of Cultivation

Source: Socio Economic Survey by ERM, February 2019

#### 5.5.5 Purchase of Land with the compensation amount

The census survey indicates that 22.2 percent PAPs have purchased plots with the compensation amount.

Villages	Additional land purchase with compensation amount			
	Yes %	No %		
Baruria	44	56		
Dhaturabari	29	71		
Darikandi	55	45		
Kodalia	0	100		
Lakshimpur	31	69		
Nali	0	100		
Nayakandi	30	70		
Sorishabari	33	67		
Teghari	0	100		
Trilochan Patti	0	100		
Total	22.2	77.8		

 Table 5.63
 Land Purchase Compensation Amount

Source: Socio Economic Survey by ERM, February 2019