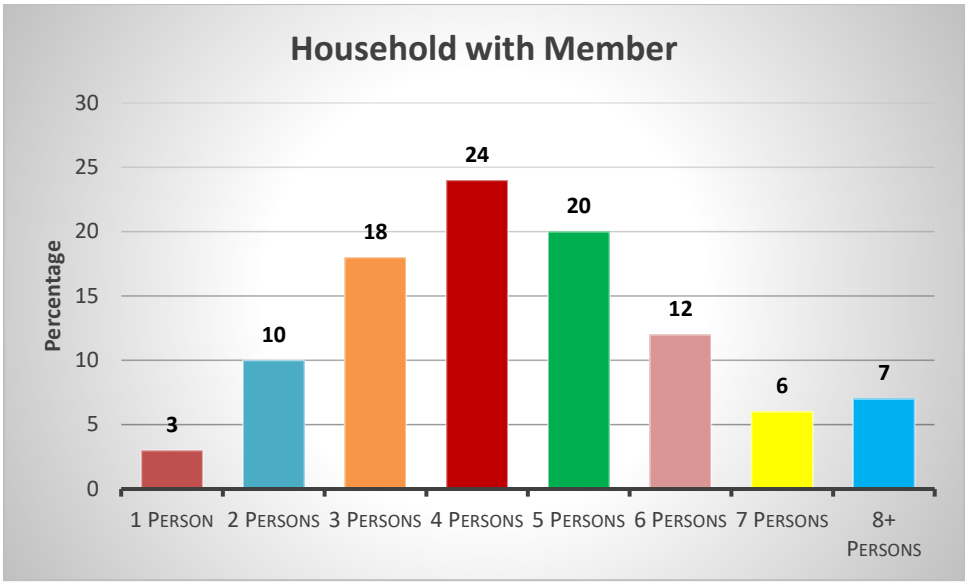


Source: BBS, 2012

Figure 6.37: Distribution of households by household members

Ethnic Community

520. In Bangladesh there are about 45 different indigenous communities living in the lowlands and hill areas. According to the BBS, 2012 six ethnic communities namely Bamon, Coach, Garo, Barmon, Chakma and Marma are living in the study area. A total of 395 households was found where 2,013 ethnic people are living. Each tribal group possesses separate identities, specific racial backgrounds, different languages, and distinct heritage and culture. The largest group in the study area is Barman. The ethnic groups differ in their social organization, marriage customs, birth and funeral rites, food and other social customs from the people of the rest of the country. The other ethnic communities are scattered in 5 upazilas. However, it is verified that there are no ethnic communities within the DIA (Direct Impact Area) of this project.

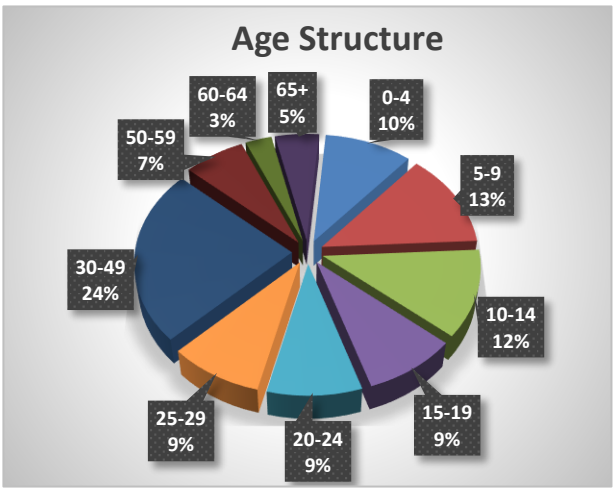
Age Structure

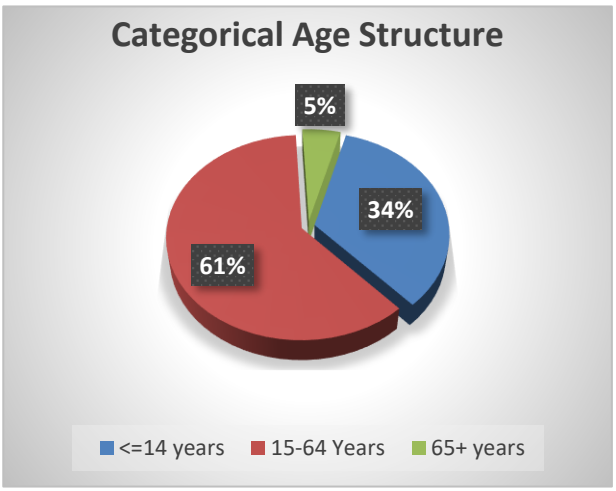
521. The highest number of population (24%) in the study area belong to the age category of 30 to 49 years old. Only 3% people are in 60 to 64 years category. The population data when analyzed to ascertain the size of (potentially) active and working population, shows that 61% population are in the age bracket of 15-64 and can be classified under this category. A small percentage (5%) is of 65 years and above. The categorization is made on the basis of International Labour Organization (ILO) reference for opting out potential labour force and dependent population (RaIf Hussmanns et. al, 1992[9]). Population of 15 to 64 years category is considered as labour force whereas, populations below 14 years and above 65 years are considered as dependents. Thus, the average dependency ratio[10] in the study area is 63% (BBS, 2012), or almost 63 persons are dependent on 100 working people. The national

[9]RaIf Hussmannset. al, 1992; *Surveys of economically active population, employment, unemployment and under employment;* International Labour Organization, Geneva.

10 Total dependency ratio= $\frac{number\ of\ people\ aged\ 0-14\ \&\ those\ 65\ and\ above}{number\ of\ people\ aged\ 15-64} \times 100$

dependency ratio (% of working-age population) is 52%, according to the World Bank[11]. Figure 6.38 and Figure 6.39 shows the age structure and categorical age structure of the local community.





Source: BBS, 2012

Figure 6.38: Age structure of the studied population

Figure 6.39: Categorical distribution of studied population

6.4.3 Land Holding Category

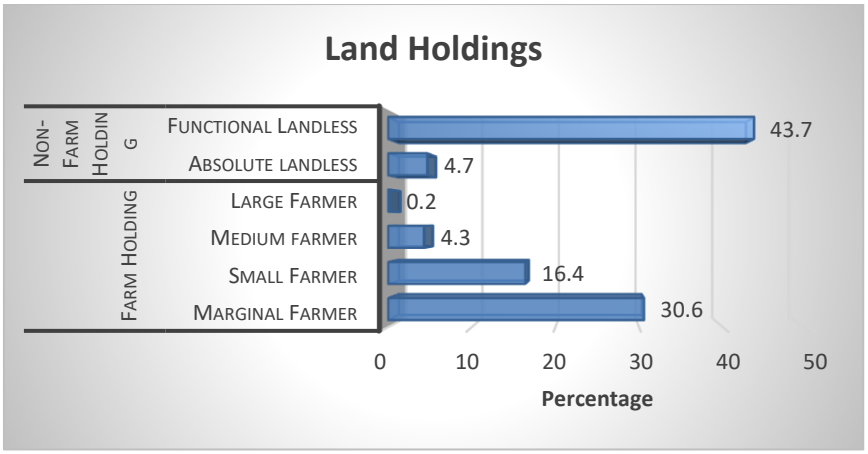
522. The Census of Agriculture, 2008 conducted by BBS classified land holdings into two broad categories- one is farm-holdings[12] and another is non-farm holdings[13]. The study area shows that out of total holdings 51.5% is farm-holder and the rest 48.5% is non-farm holders.

523. According to BBS 2008 data on land holding distributions in the study area 4.7% households are absolute landless i.e. they have no land either homesteads or cultivated. 43.7% households belong to functional landless category, who have land up to 0.04 acres. Among them 41.7% households have only homestead lands and 2% have homestead plus farm land within the limit of 0.04 acre. These households mainly own land adjacent to their homestead and these are used as kitchen garden that are primarily maintained by the female members for household consumption. Figure 6.40 shows the land holding category of the study area.

11http://data.worldbank.org/indicator/SP.POP.DPND?view=map

[12]A farm holding is defined as being an agricultural production unit having cultivated land equal to or more than 0.05 acre.

[13] Non-farm holding includes landless households and households having lands up to 0.04 acre.



Source: The Census of Agriculture, 2008, BBS

Figure 6.40: Households by land holdings

524. On the other hand, farm holding distribution shows that 30.6% households belong to marginal farmer (0.05 to 0.99 acre), 16.4% belong to small farmer (1.00 to 2.49 acre), 4.3% belong to medium farmer (2.5 to 7.49 acre) and 0.2% belong to large farmer (7.5+ acre) categories. It is evident that land fragmentation decreases the holding size; therefore large and medium farmers are gradually being converted to marginal farmers.

525. Field findings show that increasing industrial initiatives have purchased and/or acquired local lands which in turn, decreased the large and medium holdings and pushed many households into small and marginal categories. The same also contributed to marginalization of small landowners many leading to the status of landless. In the process of land acquisition by industrial houses the land losers often failed to purchase another parcel of land with the compensated money, as the value of land drastically went up with the as industries flourished in the region.

6.4.4 Land Price

526. The land prices of different types of lands have been collected from the local people. People of different areas, occupations, ages have provided indications about the land price. The areas are mostly in urban and industrial areas and as a result land price is higher. But, people living within the close vicinity of the northern and southern side of the fertilizer plant opined that, the land price is comparatively lower than the other two side (East and West) because, people are unwilling to buy land in these areas because of the unpleasant odor coming out of the open lagoon that spread over the adjacent locality following the wind direction. The average land prices in the different areas is presented below. It is seen that commercial and homestead land prices are highe. Table 6.33 presents the land price of the study area.

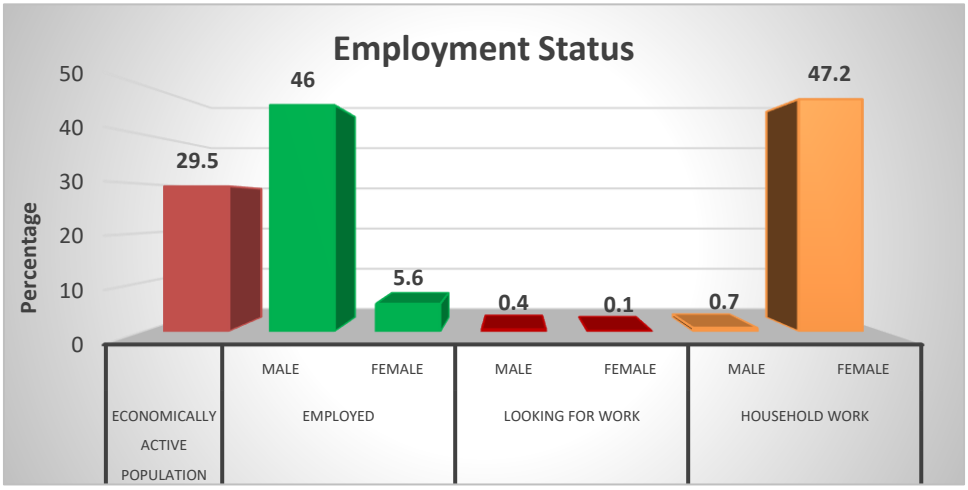
Table 6.33: Land Price of the study area

Land classes	Minimum - Maximum Land Price (Taka/Decimal)
Agricultural land	200,000 – 300,000
Homestead land	350,000 – 5000,000
Commercial land	1,000,000 – 1,200,000

Source: CEGIS field work, 2018

6.4.5 Occupations and livelihoods

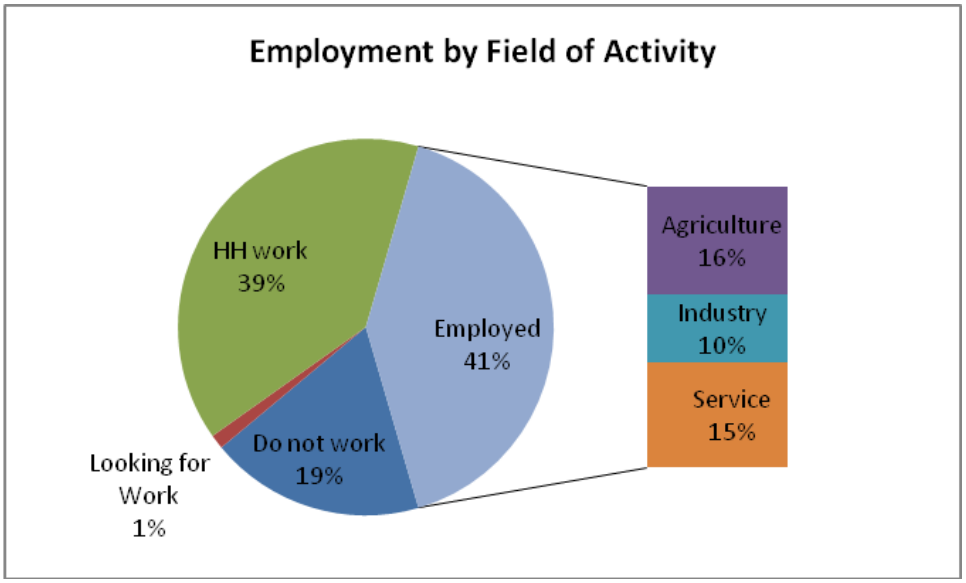
527. Out of a total of 526,463 population, 155,331 (29.5%) are economically active which include 80,139 (41.4%) employed, 836 (0.4%) are looking for work, and 74,356 (38.4%) engaged in household work. Here household work particularly for women participation is accounted in terms of household activities as well as alternative income generation such as livestock rearing, poultry farming etc. Therefore, women participation in direct income generating activities (employed category) is negligible. The employed category also includes child labour as it was accounted from 7 years old population. Therefore, non-attending children aged between 7 to 15 years were included in this category. Figure 6.41 shows the employment status of the area.



Source: BBS, 2012

Figure 6.41: Employment Status

528. Distribution of employed population at reference period of the 2011 census shows that 16% are engaged in agricultural activities, 10% in industry and 15% in service. Agricultural activities includes broadly crop farming, fishery and livestock and poultry farming. The scope of employment in agricultural sectors is gradually decreasing as urbanization and industrial initiatives are converting farm land into human settlements and industrial enterprises. Data confirms that land used for agriculture is about 49%, for settlement is about 39%, for industry is 10.38% and other. Field findings suggest that land use for settlements and industry is increasing. Employment in industrial sector (10%) is gradually increasing compared to the agriculture (16%) and service (15%) sectors. People stated that this contribution shall be increased if favorable assistances (infrastructure, power and gas supply) are ensured. Figure 6.42 shows the employment status by field of activities of the area.

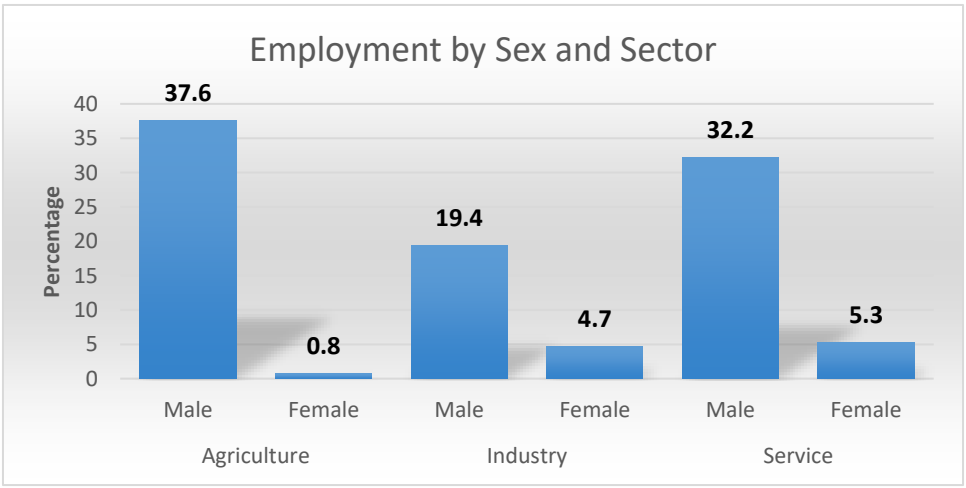


Source: BBS, 2012

Figure 6.42: Employment status by field of activities

6.4.6 Labor Market and Wage Rate

529. Data confirms that agriculture, industry and service are the primary sectors generating employment for the local people. Field findings also suggest that people who are not permanently employed tend to engage themselves in the above noted sectors in the forms of agricultural laborers, industrial worker, earth workers, cleaners and some as fishers. In agricultural and industrial sectors most of the laborers come from the local villages. There are a number of trained groups who are working contractually for fertilizer plant projects for instances, as plumber, mechanic, earth-worker etc. These trained laborers are organized and work under a group leader called “Sarder”.



Source: BBS, 2012

Figure 6.43: Distribution of population by sex and field of activity

530. The above Figure 6.43 demonstrates that female participation in industry and service sectors is higher (10%) than that of agriculture (0.8%). According to our field research women involved in the industrial sector mostly work in textile industries.

531. Wage level varies regarding type of work. In the agricultural sector, laborers get daily wages in the range of Taka 400-500, whereas in industrial sector mostly textiles workers receive per day/per production basis. However, the trained group working for fertilizer plant received comparatively higher wages. The following Table 6-34 shows the present wage rate in the study area.

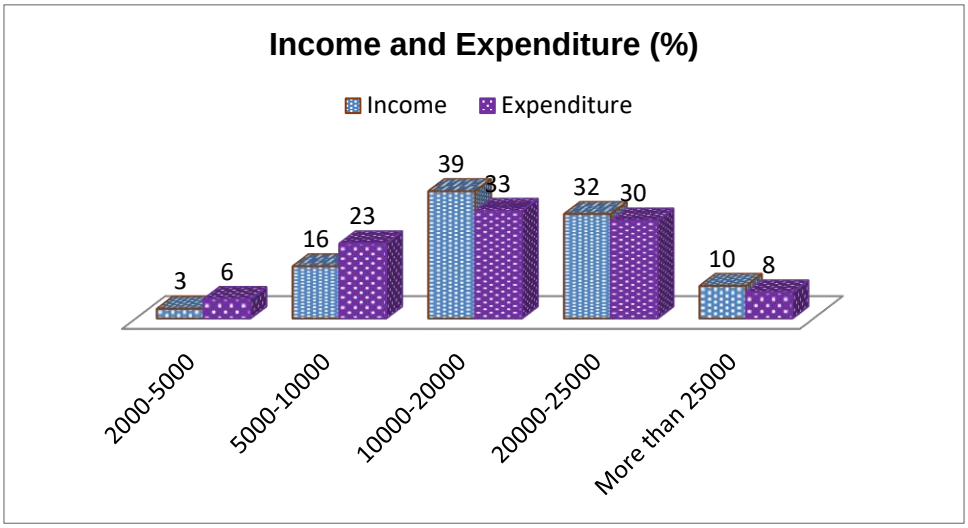
Table 6.34: Availability of Labour and Wage Rate of the Study Area

Type of Activities	Type of labor	Availability	Wage (Taka)	
			Max.	Mini.
Farming	Male	Medium	500	400
	Female	Low	350	300
Non farming	Male	High	600	400
	Female	Medium	400	350

Source: CEGIS field visit, 2018

Income and Expenditure

532. Household Primary data on income and expenditure suggests that households in the lower income groups are spending much more than their income, thus saving practically nothing and are potentially in a debt trap. Households with an income above Tk. 10,000 and above have indicated some savings. This trend increases with households in higher income brackets. The scenario of income and expenditure is shown in the following Figure 6.44.



Source: CEGIS field work, 2018

Figure 6.44: Distribution of Household by income and Expenditure

Self-Assessed Poverty

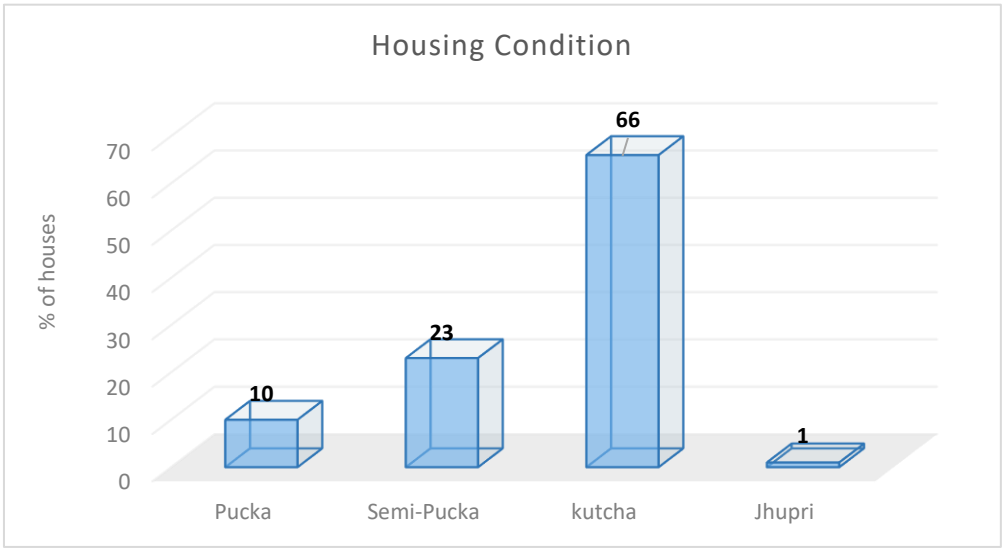
533. The poverty profile has been prepared by the participants of the RRA themselves through a self-assessment exercise. The assessment is based on the year-round income along with the food consumption by the inhabitants within three different categories namely deficit, balanced and surplus. It is observed that about 19% of the households on average are under the poverty line, 23% are above the poverty line and the remaining 59% in the “balanced” situation.

6.4.7 Status of Women

534. Field observation suggests that the whole study area is a highly male dominated area. Roles of women in both decisions making at household level and economic contribution to household income are inconsequential. Traditional belief is very strong here that generally males make all major household decisions and at the same time they contribute to household income more than females. Very few women work as day laborer but in that case wage discrimination is very common. Women's mobility in the rural area is mostly localized except when they go for medical treatments, fetching water, farming activities, and visiting relatives. (CEGIS field work, 2018).

6.4.8 Housing Condition

535. The study area shows the predominance of kutcha[14] houses (66%) compared to other three types of houses such pucka[15], semi-pucka[16] and jhupri[17]. 23% houses are semi-pucka, 10 pucka and one percent is still jhupri. Most of the pucka houses are located in municipal areas, whereas semi-pucka are predominant at the peripheral areas of municipality. Kutcha houses are predominant in the rural area (Figure 6.45).



Source: BBS, 2012

Figure 6.45: Housing condition in the study area

[14]Kutcha: Walls: Organic materials like jute stick, catkin grass, straw, and bamboo mats. Split are bamboo framing. In some areas wall are made by earth. Foundation: Earthen plinth with bamboo or timber posts. Roof: Thatch-rice or wheat or maize straw, and catkin grass, with split bamboo framing;

[15]Pucka: House which is made by fully concrete, cement, and iron.

[16]Semi-pucka: Walls: Bamboo mats, CI sheet, Timber or bamboo framing. In some areas wall are made by earth, sometimes part or full brick. Foundation: Earthen plinth; Brick perimeter wall with earth infill; Brick and concrete also use. Roof: CI sheet with timber or bamboo framing

[17]Jhupri: House which consist mud walls of 1.5 to 3.0 ft thickness, which carry the roof load. Earthen floor, thatch or CI sheets are used as roofing materials. There is no monolithic joint between the wall and the roof.

6.4.9 Traffic and Transport

536. The road network in the study area is developed. One of the main highways of Bangladesh Dhaka-Sylhet highway crosses over the study area. At the same time, two of the busiest railway lines (Dhaka-Chittogram and Dhaka-Sylhet) passes over the study area. There is also a railway station at Narshindi Sadar for carrying both passengers and goods. The Shitalakkha River also passes through the study area but no passenger vessel is navigating there except Cargo vessels which only carries and transports industrial goods.

537. During the field survey it was observed that roadway is the main mode of communication through the study area. People of the study area generally use Mini Bus, CNG, Auto Rickshaw and Rickshaw for their regular internal movement. There is no intercity bus terminal at Polash Upazila. As a result, people need to go to Narshingdi Sadar for availing intercity bus services.

6.4.10 Access to Health Service Facilities and Health Seeking Behavior

538. Access to health services and facilities refer to availability and adequacy of supply, affordability, physical accessibility and socio-cultural acceptability. Field data shows that each Upazila has a Health Complex (UHC) at the upazila level and one district hospital in Narshingdi Sadar. Besides, there are a few community clinics at the union level and several private health service providers also provide services to the local people. The Polash Upazila Health Complex is within half kilometer of the project area. People stated that now a days the existing services are accessible to rural poor people but, for common diseases still a substantial number of population tends to receive services from the local chemists and/or “village doctors” either self-educated or locally trained who have some basic knowledge about health and medicines. However, people complained that none of the hospitals have special unit for treating respiratory diseases although this disease is predominant in the Ghorasal Paurasava area; even the fertilizer industry has no such facility for the affected people. A tendency was found among the local people to go to Dhaka for better treatment for non-communicable diseases. There are two medical centres at UFFL and PUFFL respectively. The employees and their family members of these two factories have access into these two medical centres.

539. Field findings show that, the most prevailing disease at the direct impact area is skin disease. On the other hand, respiratory disease such as Asthma is alarming in Ghorasal Paurasava particularly in 1 no. ward. The disease became epidemic due to contaminated air with ammonia absorbent led by the fertilizer industry particularly at the time of releasing gas. This contamination infects mostly children and pregnant women. The local people mentioned a few cases of child deaths due to respiratory syndrome.

6.4.11 Utility Services

Sanitation Facility

540. In the study area about 32.9% households use non-sanitary latrines, 43.9% use non water-sealed sanitary latrines and 19.4% use sanitary water-sealed latrines (BBS, 2012). Field findings confirmed that non-sanitary latrines are predominant among kutcha houses and the non-water sealed sanitary latrines are seen across kutcha, semi-pucka and pucka households. Water-sealed sanitary latrines are available predominantly in pucka houses. However, there are 4% houses, which have no sanitation facilities but their members tend to use sanitary facilities on shared basis and in some cases use open spaces.

Drinking Water Facility

541. Collection of drinking water from tube-well is predominant (92%) throughout the study area. Supply of “tap water” is mainly used in municipal areas on rental basis. This supply system is dependent on abstraction of ground water. However, 3% households are still depending on open waterbodies as sources of drinking water. On the other hand, in the past the main source of water for drinking and other household uses for both fertilizer plants were their own treatment plant. About five years ago three deep tube wells were installed into the residential area of UFFL and one in the PUFFL. But till now at UFFL a limited amount of treated water is being used for household purpose for fulfilling the demand of water. People of the study area opined that for the last few years they have been facing problem to collect drinking water from hand set tube wells during the dry season. To get rid from this situation in recent years most of the households installed motorized water collection system which is locally called *Sama* and its average depth is 150 m. to 200 m.

Electricity

542. Data shows that about 84.5% households are under grid electricity coverage. Besides, there is a private power producer (quick rental) within the study area. The study area has access to both and benefited from generated power which in turn improved the standard of living for the people.

6.4.12 Population Migration

543. During the field visit, the local people stated that in recent years a trend of in-migration of laborers for agricultural sector is seen. In the industrial sector a number of in-migrant laborers are working, but this trend is gradually increasing. On the other hand, primary survey data revealed that there were small numbers of international out migrants (about 2%) that tends to go to Middle East.

6.4.13 Cultural and Archaeological Resources

544. The CEGIS study team has visited the project area and surrounding two km. area which is considered for assessing the direct impact of the proposed project. The proposed fertilizer plant will be constructed at the existing land of PUFFL. There are some cultural and community based organizations formed by the PUFFL officers and staffs like officers association, ladies club, employees club, PUFFL central monument and PUFFL freedom fighters association building are within the Project site. Beside these, no cultural resources and sensitive spaces are found in the area.

7. Environmental and Social Impacts

7.1 General

545. The existing UFFL and PUFFL are the age-old Urea Fertilizer Plants and have been in operation for more than 48 years and 32 years respectively. A new, modern, energy efficient and higher capacity Urea Fertilizer Plant has been planned in place of UFFL and PUFFL. The proposed Project will augment the current urea production with stipulated life time of 20 years. The proposed major activities will involve construction of labor-shed for labour accommodation in the project site or renting accommodation, site preparation, transportation of machinery and ancillaries, storage of equipment and materials for construction, civil works, erection of ammonia processing plant, ammonia tank, urea processing plant, steam turbine, GEG, jetty construction, civil structures demoloition (including removal of foundation), segregation of hazardous materials and their transportation to on-site disposal pit, construction of gas pipeline, etc. Land acquisition is not required for the construction of the Project and for the improvement of access road. These activities will have diversified impacts on the environment and socio-economy with different natures and magnitudes. Among the impacts from the proposed activities, some are temporary or short-term in nature and limited to pre-construction and construction period, and others are permanent in nature during the operation period.

546. Based on the experience of other similar types of projects like power plant, gas pipeline, many of the environmental issues are mainstreamed in the project design (e.g., energy efficient modern machinery, minimize NOx emission by installing GEG Power Plant, lower the relative water requirement for condenser cooling and minimize thermal effluent using open recirculation cooling, decrease specific-relative fuel requirement, etc.). Elevated noise level from the operation of heavy equipment, felling of trees during site preparation, and labor camp induced sanitation and social stress are the significant impacts of the construction works. A large number (about 3,750) of small to big trees will be cut down during site preparation which may hamper the dependent ecosystem and lead to loss of bird and other wildlife habitats. The overall positive impact of the project during operation is the augmentation of the production capacity of the urea fertilizer and improving the socio-economic condition and lifestyle of the country's population, reduction in effluent in the Shitalakhya River, which will facilitate in restoring habitats of fish species and easing habitat for others aquatic organisms along with benthic habitats.

7.2 Impact Assessment Methodology

547. Potential environmental and social impacts were identified on the basis of the review of feasibility reports, field visits, environmental quality baseline monitoring, ecological and fisheries surveys, and stakeholder consultations. The significance of potential impacts was assessed using the criteria and methodology given below.

7.2.1 Sensitivity of Receptor

548. The sensitivity of a receptor has been determined based on the review of the population (including proximity / numbers / vulnerability) and presence of features on the site or the surrounding areas. Each detailed assessment has defined sensitivity in relation to the

topic. Criteria for determining receptor sensitivity of the Project's potential impacts are outlined in Table 7-1.

Table 7.1: Criteria for determining sensitivity of the receptors

Sensitivity Level	Criteria for Sensitivity Determination of Receptors
Very High (4)	Vulnerable receptor with little or no capacity to absorb proposed changes or minimal opportunities for mitigation.
High (3)	Vulnerable receptor with little or no capacity to absorb proposed changes or limited opportunities for mitigation.
Medium (2)	Vulnerable receptor with some capacity to absorb proposed changes or moderate opportunities for mitigation
Low (1)	Vulnerable receptor with good capacity to absorb proposed changes and/or good opportunities for mitigation

7.2.2 Impact Magnitude

549. The potential impacts of the project have been categorized as major, moderate, minor or nominal based on consideration of the parameters such as: i) duration of the impact; ii) spatial extent of the impact; iii) reversibility; iv) likelihood; and v) Compliance to Legal Standards before Mitigation Measures.

550. The magnitude of potential impacts of the Project has generally been identified according to the categories outlined in Table 7-2.

Table 7.2: Parameters for determining magnitude of impact

Parameter	Major (4)	Moderate (3)	Minor (2)	Minimal (1)
Duration of potential impact	Long term (more than 15 years)	Medium Term (5 to 15 years)	Limited to construction period	Temporary with no detectable potential impact
Spatial extent of the potential impact	Widespread far beyond project boundaries	Beyond immediate project components, site boundaries or local area	Within project boundary	Specific location within project component or site boundaries with no detectable potential impact
Reversibility of potential impacts	Potential impact is effectively permanent, requiring considerable intervention to return to baseline	Potential impact requires a year or so for recovering with some interventions to return to baseline	Baseline returns naturally or with limited intervention within a few months	Baseline remains almost constant
Compliance to Legal Standards before Mitigation Measures	Breaches national standards and or international guidelines/ obligations	Complies with limits given in national standards but breaches international lender guidelines in one or more parameters	Meets minimum national standard limits or international guidelines	Not applicable
Likelihood of potential	Occurs under typical operating	Occurs under worst case	Occurs under abnormal,	Unlikely to occur

Parameter	Major (4)	Moderate (3)	Minor (2)	Minimal (1)
impacts occurring	or construction conditions (Certain)	(negative impact) or best case (positive impact) operating conditions (Likely)	exceptional or emergency conditions (occasional)	

7.2.3 Assigning Significance

551. Following the assessment of magnitude, the quality and sensitivity of the receiving environment or potential receptor has been determined and the significance of each potential impact established using the impact significance matrix shown in Table 7-3.

Table 7.3: Significance of Impact Criteria

Magnitude of Impact	Sensitivity of Receptors			
	Very High (4)	High (3)	Medium (2)	Low (1)
Major (4)	Critical (16)	Major (12)	Moderate (8)	Minor (4)
Moderate (3)	Major (12)	Major (9)	Moderate (6)	Minimal (3)
Minor (2)	Moderate (8)	Moderate (6)	Minor (4)	Minimal (2)
Minimal (1)	Minor (4)	Minimal (3)	Minimal (2)	Minimal (1)

Source: https://www.researchgate.net/.../222825624_Impact_significance_determination-Back_to_Basic

Color Legend:

Red (13-16)	≡ Catastrophic/ Critical	:Action with follow-up Verification & Validation by Authority needed before allowing work
Orange (9-12)	≡ Major	:Action needed under follow-up supervision before allowing work
Yellow (6-8)	≡ Moderate	: Need maintaining with routine monitoring and reporting
Blue (4)	≡ Minor	: Only for awareness
Green (1-3)	≡ Minimal	: No action needed to start work

7.2.4 Abatement Measures

552. The abatement or embedded control measures are those which are already considered by the Proponent in designing the project and selecting the equipment and machinery. The proposed Project has been designed with the state-of-art technology considering abatement measures against possible flue gas emission and discharge of different kinds of liquid wastes. The impact assessment has been done by considering the abatement measures for its authenticity. The major abatement measures are noted below:

- Desulphurization: Sulphur present in the natural gas feedstock will be desulphurized to a level less than 0.05 vol. ppm before used as feedstock.
- Reforming: The flue gas temperature in the primary reformer is about 1050^{o}C which is reduced to 190^{o}C in flue gas heat recovery section. The flue gas blower will take the flue gas to the stack.
- Secondary reformer: After cooling to 360^{o}C from 998^{o}C, the gas flows to the high temperature carbon monoxide (CO) converter.
- Carbon Monoxide Conversion: The heat content of the effluent from the high

temperature CO converter is recovered in the methanator trim heater, in the CG waste heat boiler and in the BFW heater not release in the ambient environment.

- After reforming, about 13.47% CO present in the gas (dry basis) will reduce to approx. 0.3 vol% and temperature will reduce to 228^{o}C.
- Carbon dioxide removal: After treating through carbon dioxide removal process it will come down to 0.05 vol. %.
- Methanation: The left over carbon dioxide and monoxide will be treated through mechanization process and it will form Methane. At this process the carbon dioxide and monoxide together will reduce to less than 5 ppm and the inlet temperature 300^{o}C will be reduced to 42^{o}C at the outlet point.
- Ammonia Synthesis: Compression and synthesis loop will protect poisoning against Water and carbon dioxide and in addition any risk of plugging the equipment in the loop with ammonium carbonate. The remaining ammonia in the purge gas will be sent to chiller and the liquid ammonia thus formed will be separated in the purge gas separator and returned to the bottom of the ammonia separator, the remaining ammonia in the purge gas will be water wash in the purge gas absorber. Washed gas will be send to the hydrogen recovery system. The recovered hydrogen rich gas will be sent to recycle loop. The off gas will be used as fuel.
- Ammonia convertor: Inert gases accumulating in the refrigeration system are vented from ammonia accumulator. Ammonia is condensed in the vent gas chiller and separated in the vent gas separator. The gas which still contains some ammonia is sent to ammonia recovery unit.
- Ammonia recovery: Inert and let down gas is introduced to the gas absorber and ammonia is washed out with water. The off gas from hydrogen recovery unit system and the gas absorber are mixed and send to fuel header.
- Steam System: The major part of waste heat available is utilized for production of high pressure steam.
- Flare and Vent System: Two separate headers in the Ammonia plant are provided. One is flammable blowout gases without ammonia, the other is blowout gases with ammonia. The flammable blow out gases without ammonia is sent to the vent Stack and it is vented to the atmosphere without burning. In addition to the flammable out gas from the Ammonia Plant, released flammable natural gas from the utility system is also sent to the Vent Stack in the Ammonia plant and discharged to the atmosphere without burning.
- The Main Flare Stack shall receive blowout gas only from header for blowout gases including Ammonia. The main Flare Stack shall include the seal drum, dry seal, pilot burner, ignition system, local ignition panel. In order to evaporate liquid ammonia and avoid the deposition of ammonium carbonate, the seal drum shall be equipped with the steam coil.
- During the normal operation, quantity of blow out gases is zero and very small. In case of upset condition, the quantity of blowout gases is zero or very smaller. In case of upset condition and or during start up and shut down operation of the plant, large quantity of blowout gases is released.
- Dust emission from Urea Plant: With the proven wet scrubbers, an efficiency of over 99.5% can be reached at all time, which means that the atmospheric emission

of urea dust from the granulator stack and from the cooler stack can meet the most stringent air pollution legislation.

- Process condensate: The urea solution plant having process condensate treatment section possesses hydrolyzer and distillation tower for recovering urea and ammonia contained in the process condensate avoiding any discharge of pollutants from the plant.
- Open drain system: The chemical contaminated water which is mainly mixed with ammonia and carbonate is collected from the following urea melt and granulation plant drain lines, such as sampling, pump seal and tank overflow which are connected to Process Condensate Treatment (PCT) system.
- Effluents: No liquid effluents are released by the plant into the sewers. It will be passed through the Effluent Treatment Plant (ETP).
- Solid disposal: No solid wastes are disposed off in the open environment, all material spills are internally collected and recovered into the process.

7.3 Selection of IECs

553. A list of Important Environmental and Social Components (IESCs) or Valued Environmental Components (VECs) has been selected for assessing the impacts of the proposed fertilizer factory. Table 7.4 presents a list of IESCs/VECs by resources considered under the study.

Table 7.4: IESCs/VECs for impact assessment

Sl. No.	IESCs/VECs
A. Physical Environment	
	A1. Land Resources/ Water Resources/ Hydrology/ Meteorology/ Air Quality/ Noise/ Waste Management
	• Land use
	• Hazardous and non-hazardous waste
	• Sewage/ Solid waste management facilities
	• Ambient air quality
	• Ambient noise
	• Surface water availability
	• Surface water quality
	• Ground water level
	• Ground water quality
	• Drainage congestion
	• Waterway traffic
B. Biological Environment (Ecology/Fisheries/Agriculture)	
	B1. Ecological Resources
	• Faunal habitat and biodiversity
	• Aquatic habitat
	• Aquatic resources mortality
	• Terrestrial vegetation cover
	• Food chain
	• Species of conservation significance
	a) Fisheries Resources
	• Fish habitat

Sl. No.	IESCs/VECs
	• Fish mortality
	• Heavy metal accumulation in fish
	• In-water noise level
	b) Agriculture Resources
	• Crop production
	• Soil quality
C. Socio-Economic Environment (Socio-economy)	
	• Employment generation
	• Land requirement and dispersion of dust
	• Economic activities
	• Community/Public health and safety
	• Occupational health and safety
	• Cultural conflicts
	• Burden on utility services
	• Communicable Health hazard and risk
	• Gender based violence
	• Transportation of urea fertilizer

7.4 Summary of Assessed Impacts

554. The potential impacts of the project and their significances have been assessed using the methodology described in Section 7.2 above. A summary of these impacts and their significance is presented in Table 7.5.

Table 7.5: Potential Impacts and their Significance

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	Mitigation and Enhancement Measure	Residual Significance
Pre-Construction Phase (A)								
Physical Environment (Land Resources/Hydrology/Meteorology/Air Quality/Noise/Waste Management)								
Demolition of civil structures	Hazardous and non-hazardous waste generation	A1. Approximately 27,400 tons of debris will be generated due to demolition of civil structures including 15 tons of asbestos cement sheet and spent catalysts [Para: 228] which would create burden on the ambient environment.	Waste management plan and precautionary measures have been taken in the Demolition Plan.	High (3) Sensitivity to the receptor (ambient environment) is considered 'High' as it has little capacity to absorb the burden of demolition generated hazardous and non hazardous waste.	Moderate (3) Impact Duration : Minr (2) Spatial Extent : Minr (2) Reversibility : Mod (3) Legal Comp. : Minr (2) [Hazardous Waste and Ship Breaking Waste Management rules 2011] Likelihood : Majr (4) As such the resultant impact magnitude is (13/5= 2.6~3) 'Moderate'.	Major Adverse (9) Sensitivity of the receptor is found 'High' while the magnitude is assessed as 'Moderate'. The resultant impact significance is 'Major Adverse'.	▪ Demolition waste (debris and rubbles) should be carried away by covered dump trucks to the landfill area. ▪ A confinement area should be developed for temporary storage of debris, spent catalysts and asbestos cement sheet along with scraps. For debris about about 0.5 acres of land may be required if it piles at the height of 2.5 m. ▪ Auction of asbestos cement sheet and scraps and carry away the sheets and	Minor Adverse (4) Changes in sensitivity and magnitude with implementation of suggested mitigation measures. Sensitivity: Medium (2) and Magnitude: Minor (2); the resultant significance is 'Minor Adverse'.

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	Mitigation and Enhancement Measure	Residual Significance
							rods by the Vendor. ▪ Water spraying for dust suppression during demolition and debris hauling. ▪ Asbestos containing waste material should be managed following Hazardous Waste and Ship Breaking Waste Management rules 2011 guideline and deposited with proper labeling and packaging. ▪ Asbestos washed water should be collected in a scientific pit and release in the openenvironment with due treatment. ▪ The labour contractor must follow the	

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	Mitigation and Enhancement Measure	Residual Significance
							OHSAS 18000/18001 guidelines.	
Demolition of civil structures and Materials Handling, Clearing of vegetation and transportation activities	Ambient air quality	A2. SPM and $PM_{2.5}$ levels in the base condition are already exceeded the standard (Para: 425]. Ambient air quality might be deteriorated further due to emission of exhaust gas and dust (SPM, PM_{10} and $PM_{2.5}$) resulting from the use of machinery and equipment for structure dismantling and demolition activities, as well as from circulation of vehicles on the area and cleaning activities.	Fencing of the project site.	Medium **(2)** Sensitivity of the receptor (ambient air quality) is considered as 'Medium' as Project site being located beside the river and having wide range of vegetation cover so it has some natural capacity of absorbing or assimilating dust and generous emission of exhaust gas.	Moderate (3) Impact Duration : Minr (2) Spatial Extent : Mod (3) Reversibility : Minr (2) Legal Comp. : Majr (4) [National Water Rules 2017] Likelihood : Majr (2) As such the resultant impact magnitude is (13/5= 2.6~3) 'Moderate'.	Moderate Adverse (6) Sensitivity of receptor is found 'Medium' while the magnitude is assessed as 'Moderate'. The resultant impact significance is 'Moderate Adverse'.	▪ Carry out regular dust suppression system at the work site and vehicle movement path; ▪ Introducing vehicular speed limit for controlling dust dispersion. ▪ Ensure using of modern and fuel efficient machinery to avoid incomplete combustion of fuel. ▪ Work site should be surrounded by the gunny sack/tarpaulin/net for safety issue as well as for controlling flying of dust.	Minimal Adverse (2) Changes in sensitivity and magnitude with implementation of suggested mitigation measures. Sensitivity: Low (1) and Magnitude: Minor (2); the resultant significance is 'Minimal Adverse'.
	Ambient Noise Level	A3. Noise levels at the UFFL and PUFFL colonies and in front of the TGTDCL's mosque	Limited during the day time	High (3) Sensitivity to the receptor	Minor (2) Impact Duration : Minr (2) Spatial Extent : Minr (2)	Moderate Adverse (6)	▪ Use of modern and low noise generating bulldozer for	Minimal Adverse (2)

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	Mitigation and Enhancement Measure	Residual Significance
		are already exceeded the standards [Para: 436]. Noise emissions resulting from the use of machinery and equipment, structure demolition and circulation of vehicles on the project area would further degrade the noise level.		(ambient noise level) is considered 'High' as the vulnerable receptor has little capacity to absorb proposed changed.	Reversibility : Mini (1) Legal Comp. : Mod (3) [National Water Rules 2017] Likelihood : Mod (3) As such the resultant impact magnitude is (11/5= 2.2~2) 'Minor'.	Sensitivity of receptor is found 'High' while the magnitude is assessed as 'Minor'. The resultant impact significance is 'Moderate Adverse'.	dismantling of civil structures. ▪ Construction of boundary wall around the Project site. ▪ Use low noise generating equipment and process in different activities. ▪ Reduce impulse noise and whistle of vehicles. ▪ Introduce speed limit within and around the Project site.	Changes in magnitude with implementation of suggested mitigation measures. Sensitivity: Medium (2) and Magnitude: Minimal (1); the resultant significance is 'Minimal Adverse'.
Site preparation	Landuse	A4. The Project site, which was mostly the leftover part of existing factory, possesses about 3,750 small to big trees (mostly sapling) [Para: 229]. Ecologically dominant existing industrial land use [Para: 384] would be changed to core industrial landuse.	Not available	High (3) Sensitivity to the receptor is considered 'High', as the remodeling of existing industrial fallow landuse to newer one with fewer vegetation.	Moderate (3) Impact Duration : Mod (3) Spatial Extent : Minr (2) Reversibility : Mod (3) Legal Comp. : N/A (1) [Social forestry Rules, 2004] Likelihood : Majr (4) As such the resultant impact magnitude is (13/5= 2.6~3) 'Moderate'.	Major Adverse (9) Sensitivity of receptor is found 'High' while the magnitude is assessed as 'Moderate'. The resultant	▪ Land optimization should be done during engineering design and vegetation clearance should be limited to as low as possible. ▪ Plantation program should be provisioned as per Forest Department and	Minimal Adverse (1) Changes in magnitude with implementation of suggested mitigation measures. Sensitivity: High (3) and Magnitude:

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	Mitigation and Enhancement Measure	Residual Significance
						impact significance is 'Major Adverse'.	DoE's Guidelines in the open spaces as per plot layout plan.	Minimal (1); the resultantsignificance is 'Minimal Adverse'.
Dredging activities for filling up of lagoon and ponds with dredged materials of the Shitalakhya River	Waterway traffic	A5. Dredging activities in the waterways [Para: 538] would cause conflict with other traffic operation, may create congestion or lead to accidents or disturbance to fishermen.	No abatement measure is considered.	Medium (2) Sensitivity to the receptor is considered 'Medium' as the vulnerable receptor has little capacity to absorb proposed changes.	Minor (2) Impact Duration : Minr (2) Spatial Extent : Mod (3) Reversibility : Minr (2) Legal Comp. : Minr (2) [Social forestry Rules, 2004] Likelihood : Mod (3) As such the resultant impact magnitude is (12/5= 2.4~2) 'Minor'.	Minor Adverse (4) Sensitivity of receptor is found 'Medium' while the magnitude is assessed as 'Minor'. The resultant impact significance is 'Minor Adverse'.	▪ Dredging should be started after obtaining permission from the competent authority. ▪ A complete Dredging Survey should be conducted. ▪ Notification to communities and river users prior to initiation of dredging. ▪ Installation of buoys in the area to alert river vessels passing the dredging site. ▪ A complete dredging plan should be disseminated to the river users.	Minimal Adverse (2) Changes in magnitude with implementation of suggested mitigation measures. Sensitivity: Moderate (2) and Magnitude: Minimal (1); the resultant significance is 'Minimal Adverse'.

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	Mitigation and Enhancement Measure	Residual Significance
Site preparation (vegetation clearing, top soil removal and lagoon fill up by dredged materials)	Surface water quality	Site preparation activities such as, vegetation clearing and top soil removal, may changes the water quality of Shitalakshya River and adjacent water bodies. High turbidity, low dissolved oxygen, and increase in nutrients (Nitrate, Silica, and Phosphate) are the probable impacts.	Temporary drainage system to collect the surface runoff and bring into the lagoon	Medium (2). Turbidity will be increased for a short period and the tidal influence will also minimize the impacts quickly	Minor (2) Impact Duration : Minr (2) Spatial Extent : Minr (2) Reversibility : Minr (2) Legal Comp. : Minr (2) [Social forestry Rules, 2004] Likelihood : Minr (2) As such the resultant impact magnitude is (10/5= 2) 'Minor'.	Minor (4)	▪ Enhance the drainage network and repairmen of the existing network; ▪ Debris collection from the land development site and the demolition of other constructions and dumping into the designated site.	Minimal Adverse (2) Properly debris collection and dumping will reduce the chance of water body pollution. In addition, drainage network development will enhance the minimization of top soils of the site. SO, changes in magnitude. Sensitivity: Moderate (2) and Magnitude: Minimal (1); the resultant significance is 'Minimal Adverse'.

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	Mitigation and Enhancement Measure	Residual Significance
Biological Environment (Ecology/Fisheries/Agriculture)								
Site preparation (vegetation clearance, filling up lagoon and pond with dredged materials)	Faunal habitat and biodiversity	A6. The Project site is a vegetated area, which facilitate the wildlife habitat particularly for Bengal Fox and a Near Threatened species, Large Indian Civet (*Viverra zibetha*) along with others [Para: 507]. These animals would be affected severely due to site preparation. A7. Roosting and nesting scope of birds would be reduced [Para: 512]. These specialized functions of birds would be hampered significantly.	Not available	Very High (4) Sensitivity to the receptor is considered 'Very High', as the wildlife habitat and flora and faunal biodiversity would be severely vulnerable. This issue has little capacity to absorb changes or minimal scope of mitigation.	Moderate (3) Impact Duration : Minr (2) Spatial Extent : Minr (2) Reversibility : Mod (3) Legal Comp. : Minr (2) [Social forestry Rules, 2004] Likelihood : Majr (4) As such the resultant impact magnitude is (13/5= 2.6~3) 'Moderate'.	Major Adverse (12) Sensitivity of receptor is found 'Very High' while the magnitude is assessed as 'Moderate'. The resultant impact significance is 'Major Adverse'.	▪ Avoid killing of wildlife during vegetation clearance. ▪ Wildlife pass should be created for their unscarred escaping to nearby similar habitat. ▪ Land optimization during engineering design and vegetation clearance should be limited to as low as possible. ▪ Bush cover should be created around the Project area and also outside the project site to create suitable habitat.	Moderate Adverse (6) Changes magnitude with implementation of suggested mitigation measures. Sensitivity: High (3) and Magnitude: Minor (2); the resultant significance is 'Moderate Adverse'.
Vegetation clearance	Terrestrial Vegetation Cover	A8. Loss of valuable timber plantations (about 3,750 no. of trees from sapling to adult) within the project	Not available	High (3) Sensitivity to the receptor is considered	Moderate (3) Impact Duration : Minr (2) Spatial Extent : Minr (2) Reversibility : Mod (3)	Major Adverse (9) Sensitivity of receptor	▪ Vegetation clearance should be limited to Project Layout area.	Moderate Adverse (6) Changes in magnitude

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	Mitigation and Enhancement Measure	Residual Significance
		area [Para: 229] would release carbon to the atmosphere.		'High', as the vulnerable receptor has little capacity to absorb changes or limited scope of mitigation.	Legal Comp. : Minr (2) [Social forestry Rules, 2004] Likelihood : Mod (4) As such the resultant impact magnitude is (13/5= 2.6~3) 'Moderate'.	is found 'High' while the magnitude is assessed as 'Moderate'. The resultant impact significance is 'Major Adverse'.	▪ Green belt should be developed with native plants for creating vegetation cover surrounding the Project area. ▪ Plantation should be done around the playground, dormitory, roadside, etc. outside the project site under Corporate Social Responsibility (CSR). This will also enhance the capacity to absorb more carbon from the atmosphere.	with implementation of suggested mitigation measures. Sensitivity: High (3) and Magnitude: Minor (2); the resultant significance is 'Moderate Adverse'.
Dredging activities for filling up of lagoon and ponds with dredged materials of the Shitalakhya River	Fish habitat	A9. Benthic fish habitat especially their nests during breeding period would be damaged due to removal of dredged materials of about 2,26,700 m^3 (Para: 234].	Not available	Medium (2) Sensitivity of the receptor is considered 'Medium' because nests of some benthic species would be wiped out but have	Moderate (3) Impact Duration : Minr (2) Spatial Extent : Mod (3) Reversibility : Mod (3) Legal Comp. : Minr (2) [National Water Rules 2017] Likelihood : Majr (4)	Moderate Adverse (6) Sensitivity of receptor is found 'Medium' while the magnitude is assessed as	▪ Dredging activity should avoid the breeding period (June to August) of fish; ▪ Survey should be done before selecting the dredging alignment for avoiding	Minimal Adverse (2) Changes in sensitivity and magnitude with implementation of suggested

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	Mitigation and Enhancement Measure	Residual Significance
				some capacity to absorb changes (take shelter in other places) or moderate scope of mitigation.	As such the resultant impact magnitude is (14/5= 2.8~3) 'Moderate'.	'Moderate'. The resultant impact significance is 'Moderate Adverse'.	important area of interest from fishery point of view. ▪ River users should be aware of dredging activity before starting dredging.	mitigation measures. Sensitivity: Low (1) and Magnitude: Minor (2); the resultant significance is 'Minimal Adverse'.
Dredging activities for filling up of lagoon and ponds with dredged materials of the Shitalakhya River	Food chain	A10. Loosened contaminated bed materials (sediment) [Para: 234] may pose threat to the intervened natural environment (e.g., release of heavy metals into aquatic environment and may enter into the food chain through bio magnification while absorption of heavy metals by fish through respiratory organs and uptake by skin and bio accumulates).	No abatement measure is considered.	High (3) Sensitivity to the receptor is considered 'High', as contaminated bed materials might affect aquatic environment including fish fauna. This issue has little capacity to absorb changes or limited scope of mitigation.	Minor (2) Impact Duration : Minr (2) Spatial Extent : Minr (2) Reversibility : Minr (2) Legal Comp. : Minr (2) Likelihood : Mod (3) As such the resultant impact magnitude is (11/5= 2.2~2) 'Minor'.	Moderate Adverse (6) Sensitivity of receptor is found 'High' while the magnitude is assessed as 'Minor'. The resultant impact significance is 'Moderate Adverse'.	▪ Bed materials should be tested in the laboratory to determine toxicity levels before dredging and disposal. ▪ If heavy metals are found in the dredged materials, dredging action in the concerned alignment and disposal in the wetland should be avoided for limiting contamination.	Minimal Adverse (2) Changes in sensitivity and magnitude with implementation of suggested mitigation measures. Sensitivity: Medium (2) and Magnitude: Minimal (1); the resultant significance is 'Minimal Adverse'.

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	Mitigation and Enhancement Measure	Residual Significance
Social Environment (Socio-economic)								
Demolition of infrastructures and scraping	Employment generation	A11. Generation of employment opportunity for about (400-60 exptraite= 340) local [Para: 379] and in-migrated people of different working levels and expertise during demolition of infrastructures and scraping, which would promote livelihood.	The proponent is committed to employ local people during demolition of infrastructures and scraping.	High (3) Sensitivity of the receptor is considered 'High' because livelihood of a large number (about 340) of people would be generated.	Moderate (3) Impact Duration : Minr (2) Spatial Extent : Majr (4) Reversibility : Mod (3) Legal Comp. : Minr (2) [Bangladesh Labour Act (BLA), 2006, ILO Declaration on Fundamental Rights and Principles (ILO, 1998), IFC PS-II, and Equator Principle-III] Likelihood : Majr (4) As such the resultant impact magnitude is (15/5= 3) 'Moderate'.	Major Beneficial (9) Sensitivity of receptor is found 'High' while the magnitude is assessed as 'Moderate'. The resultant impact significance is 'Major Beneficial'.	▪ Local people particularly the Project-affected Persons (PAPs) directly or indirectly should be given priority in employing workforces in different Project activities. ▪ Labour wage should be fixed based on the labour market and commodity prices of the area. ▪ Gender issue should be considered in employing labour. ▪ EPC Contractor should abide by the rules and regulations of BLA, 2006; ILO, 1998; EP-III and IFC PS-II.	Major Beneficial (12) Changes in magnitude with implementation of suggested enhancement measures. Sensitivity: High (3) and Magnitude: Major (4); the resultant significance is 'Major Beneficial'.
Demolition of infrastructures and scraping	Occupational health	A12. During demolition work there is a probability of	There is a bindings of maintaining	Medium (2)	Minor (2) Impact Duration : Minr (2)	Minor Adverse (4)	▪ Labours will undergo an initial medical test	Minimal Adverse (2)

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	Mitigation and Enhancement Measure	Residual Significance
	and safety	accidental risk for labors which will significantly impact the health of the working personnel. Besides, congested living in possible small spaces may cause the break out of contagious disease like diarrhea, dysentery, skin diseases, scabies, etc.	rules and regulations of BLA, 2006; ILO, 1998; EP-III and IFC PS-II from the lender part.	Sensitivity of the receptor is considered 'Medium' as even after maintaining abatement measures demolition activities have every chance of accidental events and have chance of break out of diseases.	Spatial Extent : Minr (2) Reversibility : Mod (3) Legal Comp. : Minr (2) [Bangladesh Labour Act (BLA), 2006, ILO Declaration on Fundamental Rights and Principles (ILO, 1998), IFC PS-II, and Equator Principle-III] Likelihood : Mod (3) As such the resultant impact magnitude is (12/5= 2.4~2) 'Minor'.	Sensitivity of receptor is found 'Medium' while the magnitude is assessed as 'Minor'. The resultant impact significance is 'Minor Adverse'.	where anyone identified as having any skin diseases will be segregated immediately and will undergo proper treatment ▪ Ensure rigorous standards for occupational health and safety are in place. ▪ Establish Occupational Health and Safety (OHS) procedures taking into account the inherent risks for this type of project. ▪ Occupational Health and Safety (OHS) Plan to be implemented based on ECP 13: Workers Health and Safety and World Bank Group's Environment, health and Safety	Changes in magnitude with implementation of suggested mitigation measures. Sensitivity: Medium (2) and Magnitude: Minimal (1); the resultant significance is 'Minimal Adverse'.

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	Mitigation and Enhancement Measure	Residual Significance
							(EHS) Guidelines. ▪ Contractor should establish a labor grievance mechanism and documenting its use for complaints. ▪ EPC Contractor should abide by the rules and regulations of BLA, 2006; ILO, 1998; EP-III and IFC PS-II. ▪ Contractor should also follow relevant IFC Performance Standard (PS) like PS-3 on Resource Efficiency and Pollution Prevention and PS-4 on Community Health, Safety, and Security. ▪ Safety training for all workers should be	

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	Mitigation and Enhancement Measure	Residual Significance
							ensured prior to commencing the work.	
Site preparation	Employment generation	A13. Generation of employment opportunity for about 600 local skilled, semi-skilled and unskilled people during site preparation [Para: 379], which would promote livelihood.	The proponent is committed to employ local people during demolition of infrastructures and scraping	High (3) Sensitivity of the receptor is considered 'High' because livelihood of a large number (about 600) of people would be generated.	Moderate (3) Impact Duration : Minr (2) Spatial Extent : Majr (4) Reversibility : Mod (3) Legal Comp. : Minr (2) [Bangladesh Labour Act (BLA), 2006, ILO Declaration on Fundamental Rights and Principles (ILO, 1998), IFC PS-II, and Equator Principle-III] Likelihood : Majr (4) As such the resultant impact magnitude is (15/5= 3) 'Moderate'.	Major Beneficial (9) Sensitivity of receptor is found 'High' while the magnitude is assessed as 'Moderate'. The resultant impact significance is 'Major Beneficial'.	▪ Local people particularly the Project-affected Persons (PAPs) directly or indirectly should be given priority in employing workforces in different Project activities. ▪ Labour wage should be fixed based on the labour market and commodity prices of the area. ▪ Gender issue should be considered in employing labour. ▪ EPC Contractor should abide by the rules and regulations of BLA, 2006; ILO, 1998; EP-III and IFC PS-II.	Major Beneficial (12) Changes in magnitude with implementation of suggested enhancement measures. Sensitivity: High (3) and Magnitude: Major (4); the resultant significance is 'Major Beneficial'.

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	Mitigation and Enhancement Measure	Residual Significance
Transportation with respect to equipment and materials procured and Site receiving, Handling and Warehousing	Occupational health and safety	A14. Transportation of construction materials may have different types of health and safety issues including safety from increased traffic, accidents and health hazard from flying of sand and dust from the carriers, etc.	Not available	Medium (2) Sensitivity of the receptor is considered 'Medium' because safety issue and health hazard of transport crews and labours have some capacity to absorb changes or moderate scope of mitigation.	Minor (2) Impact Duration : Minl (1) Spatial Extent : Majr (4) Reversibility : Minr (2) Legal Comp. : Minr (2) [Bangladesh Labour Act (BLA), 2006, ILO Declaration on Fundamental Rights and Principles (ILO, 1998), IFC PS-II, and Equator Principle-III] Likelihood : Mod (3) As such the resultant impact magnitude is (12/5= 2.4~2) 'Minor'.	Minor Adverse (4) Sensitivity of receptor is found 'Medium' while the magnitude is assessed as 'Minor'. The resultant impact significance is 'Minor Adverse'.	▪ Schedule of deliveries of material/ equipment should be fixed during off-peak hours. ▪ Depute flagman for traffic control. ▪ Arrange for signal light at night.	Minimal Adverse (2) Changes in magnitude with implementation of suggested mitigation measures. Sensitivity: Medium (2) and Magnitude: Minimal (1); the resultant significance is 'Minimal Adverse'.
Temporary Works (needed by the contractor) [Refer: Section 4.10]	Occupational health and safety	A15. During temporary work (i.e. warehouse construction, labor-shed construction, utility service development and fire safety work etc.) there is a probability of accidental risk for labors which will significantly affect the health of the working	No abatement measure is considered.	Medium (2) Sensitivity of the receptor is considered 'Medium' because safety issue and health hazard of temporary works having potential of	Minor (2) Impact Duration : Minr (2) Spatial Extent : Minr (2) Reversibility : Mod (3) Legal Comp. : Minr (2) [Bangladesh Labour Act (BLA), 2006, ILO Declaration on	Minor Adverse (4) Sensitivity of receptor is found 'Medium' while the magnitude is assessed as 'Minor'. The	▪ Ensure rigorous standards for occupational health and safety are in place. ▪ Establish Occupational Health and Safety (OHS) procedures taking into account the inherent risks for	Minimal Adverse (2) Changes in magnitude with implementation of suggested mitigation measures.

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	Mitigation and Enhancement Measure	Residual Significance
		personnel. Besides, congested living in possible small spaces may cause the break out of contagious disease like diarrhea, dysentery, skin diseases, scabies, etc.		accidental event and health hazard have some capacity to absorb changes or moderate scope of mitigation.	Fundamental Rights and Principles (ILO, 1998), IFC PS-II, and Equator Principle-III] Likelihood : Minr (2) As such the resultant impact magnitude is (11/5= 2.2~2) 'Minor'.	resultant impact significance is 'Minor Adverse'.	this type of project. ▪ Contractor should establish a labor grievance mechanism and documenting its use for complaints. ▪ EPC Contractor should abide by the rules and regulations of BLA, 2006; ILO, 1998; EP-III and IFC PS-II.	Sensitivity: Medium (2) and Magnitude: Minimal (1); the resultant significance is 'Minimal Adverse'.

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	▪ Mitigation and Enhancement Measure	Residual Significance
Construction Stage (B)								
Physical Environment (Land Resources/Hydrology/Meteorology/Air Quality/Noise)								
Construction of building, infrastructure, Utility, unit, NH_3 plant and Urea Plant along with Power Plant	Ambient air quality	B1. Ambient air quality might be deteriorated due to emission of particulate matter from construction works and material storage and transportation of construction vehicles.	Fencing of the project site.	Medium (2) Sensitivity of the receptor is considered as 'Medium' as the vulnerable receptors have some capacity to absorb the proposed changes or moderate opportunities for mitigation.	Minor (2) Impact Duration : Minr (2) Spatial Extent : Mod (3) Reversibility : Minr (2) Legal Comp. : Mod (3) [Bangladesh Labour Act (BLA), 2006, ILO Declaration on Fundamental Rights and Principles (ILO, 1998), IFC PS-II, and Equator Principle-III] Likelihood : Minr (2) As such the resultant impact magnitude is (12/5= 2.2~2) 'Minor'.	Minor Adverse (4) Sensitivity of receptor is found 'Medium' while the magnitude is assessed as 'Minor'. The resultant impact significance is 'Minor Adverse'.	▪ Carry out regular dust suppression system at the work site and vehicle movement path; ▪ Introducing vehicular speed limit for controlling dust dispersion. ▪ Ensure using of modern and fuel efficient machinery to avoid incomplete combustion of fuel. ▪ Work site should be surrounded by the gunny sack/tarpaulin/net for safety issue as well as for controlling flying of dust.	Minimal Adverse (1) Changes in magnitude with implementation of suggested mitigation measures. Sensitivity: Low (1) and Magnitude: Minimal (1); the resultantsignificance is 'Minimal Adverse'.
Do	Ambient Noise Level	B2. Noise emissions resulting from the use of machinery and	Use of low noise generating	High (3)	Minor (2) Impact Duration : Minr (2)	Moderate Adverse (6)	▪ Use modern, low noise generating equipment and process, reduce	Minimal Adverse (2)

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	▪ Mitigation and Enhancement Measure	Residual Significance
		equipment and vehicle circulation for piling and other construction activities.	equipment and process.	Sensitivity to the receptor is considered 'High', as the vulnerable receptor has little or no capacity to absorb propose changes or limited opportunities for mitigation.	Spatial Extent : Minr (2) Reversibility : Mini (1) Legal Comp. : Mod (3) [National Water Rules 2017] Likelihood : Mod (3) As such the resultant impact magnitude is (11/5= 2.2~2) 'Minor'.	Sensitivity of receptor is found 'High' while the magnitude is assessed as 'Moderate'.	impulse noise and whistle of vehicles ▪ Noise hood should be used where applicable. ▪ Noise generating equipment and machinery should be provided with silencer.	Changes in sensitivity and magnitude with implementation of suggested mitigation measures. Sensitivity: Medium (2) and Magnitude: Minimal (1); the resultant significance is 'Minimal Adverse'.
Extraction of Ground Water (GW) for construction work	Ground Water Level	B3. Drawdown induced lowering of ground water level may cause crisis of household level availability of groundwater through hand tube well [Para: 412].	The proponent is committed to use surface water for all construction purposes instead of ground water.	Very High (4) Sensitivity of the receptor is considered 'Very High' because extraction of ground water will be high only at construction phase have some limited	Minor (2) Impact Duration : Minr (2) Spatial Extent : Minr (2) Reversibility : Minr (2) Legal Comp. : Minr (2) [National Water Act, 2013]	Moderate Adverse (8) Sensitivity of receptor is found 'Very High' while the magnitude is assessed as 'Minor'. The resultant impact	▪ The EPC contractor should ensure use of surface water avoiding groundwater withdrawal. ▪ The proponent should encourage and facilitate introduction of Rainwater Harvesting System (RHS) as a substitute for	Minimal Adverse (2) Changes in magnitude with implementation of suggested mitigation measures. Sensitivity: Medium (2) and

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	▪ Mitigation and Enhancement Measure	Residual Significance
				capacity to absorb changes by recharge or moderate scope of mitigation.	Likelihood : Majr (4) As such the resultant impact magnitude is (12/5= 2.4~2) 'Minor'.	significance is 'Minor Adverse'.	other local users of GW as part of CSR. ▪ Monitoring should be considered as one of the important components during ground water extraction. ▪ Water supply system should be leakage proof.	Magnitude: Minimal (1); the resultant significance is 'Minimal Adverse'.
Project construction [Construction Period peak time local workforce is of about 4,000 and 1,530 officials]	Consumptive water requirement (for drinking, washing, bathing, etc.)	B4. Considering the water consumption of 50 litre/capita/day (IFC, 2007) for 4000 workers, 1530 EPC and BCIC officials will require about 275 m^3 of water per day. This may create extra pressure on the already depleted groundwater source and may lead to ground water mining.	The Proponent is committed to make available adequate consumptive water facilities for the official, personnel and workers to be involved in the Project activities through Reverse Osmosis (RO) of surface water from the Shitalakhya as the ground	High (3) Sensitivity is considered "High", as the drinkable and other consumptive water is scarcely available in the Project site except the ground water source. (Receptor is ground water)	Minor (2) Impact Duration : Minr (2) Spatial Extent : Minr (2) Reversibility : Minr (2) Legal Comp. : Minr (2) [ECR, 1997] Likelihood : Minr (2) As such the resultant impact magnitude is (10/5= 2) 'Minor'.	Moderate adverse (6) Sensitivity of receptor is found 'High' while the magnitude is assessed as 'Minor'. The resultant impact significance is 'Moderate Adverse'.	▪ Considering the poor quality of surface water and low availability of ground water, it is suggested to avoid abstraction of ground water for non-potable and other uses in the labor camp instead it is recommended to continue with Reverse Osmosis (RO) Plant throughout the Project period. Effective and efficient use of	Minimal Adverse (1) Changes in sensitivity and magnitude with implementation of suggested mitigation measures. Sensitivity: Low (1) Magnitude: Minimal (1); the resultant

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	▪ Mitigation and Enhancement Measure	Residual Significance
			water is scarce.		The required water for consumptive use will be distributed through pipeline system from the RO Plant. But the sludge of the RO Plant may be contaminant to the environment merits sludge management.		water should be ensured. ▪ Reuse of water with due treatment in suitable water use area. ▪ Sludge collection sump should be built.	significance is 'Minimal Adverse'.
Do	Sewage/ solid waste management facilities	B5. Considering sewage waste generation rate of 0.29 kg/person/ day (CCAC Municipal Solid Waste Initiative; www.unep.org/ ccac) for 4,000 labours in the camp and 1530 EPC and BCIC officials in the site for about three (03) years [Para: 379], about 2,400 m^3 of sewage/ organic solid waste would be generated which would require sound management. Failure of management may pollute the	EPC Contractor will appoint Labour Contractor, who maintains ILO Guidelines having international standard of sewage management expertise of the workers and others. Solid waste generated during construction will be segregated in following category:	Medium (2) Sensitivity is considered 'Medium', as the improper management of sewage may be the source of diseases to the officials, consultants and workers and to local inhabitants and messy outlook. (Receptor is office personnel, workers and local inhabitants).	Minor (2) Impact Duration : Minr (2) Spatial Extent : Minr (2) Reversibility : Minr (2) Legal Comp. : Minr (2) [ECR, 1997] Likelihood : Minr (2) As such the resultant impact magnitude is (10/5= 2) 'Minor'. The Proponent will build 3-year full scale capacity	Minor adverse (4) Sensitivity of receptor is found 'Medium' while the magnitude is assessed as 'Minor'. The resultant impact significance is 'Minor Adverse'.	▪ The tentatively required dimension of sewage/organic solid waste tank should be 1,750 m^3 capacity of organic solid waste in three years. ▪ The tank should be septic tank for better absorption of liquid by the soil. ▪ Maintain hygienic condition of the water closet (WC) for the next person's use. ▪ Dismantling of septic tank should be done	Minimal Adverse (1) Changes in sensitivity and magnitude with implementation of suggested mitigation measures. Sensitivity: Low (1) Magnitude: Minimal (1); the resultant significance

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	▪ Mitigation and Enhancement Measure	Residual Significance
		surrounding environment, lose aesthetic value and may cause diseases to labours and local inhabitants. Generation of solid waste (kitchen waste) of about 1,500 kg/day for about 4,000 workers and 1,530 Project officials) [Para: 379] from the official dorms and labour camp.	Compostable Re-cycleable Land fill Accordingly, three facilities will be developed for above categories, i.e., Composting facility, Re-cycle facility and landfill facility. No untreated liquid waste will be discharge to any waterbody. EPC contractor will develop Sweage treatment Plant.	Latrines and septic tanks are close (within 100 m) to the workforce accommodation facilities and about 2 km away from the community settlement.	septic sewage tank for the people involved in different Project activities.		with proper care and release gases arrested in the tank carefully for avoiding casualty. ▪ Proper sanitation should be maintained according to environmental standards.	is 'Minimal Adverse'.
Waste water and storm water management	Drainage congestion	B6. Drainage congestion may be happened due to blockage of temporary drainage	Temporary drainage system has been provisioned.	Low (1) Sensitivity of the receptor is	Moderate (3) Impact Duration : Minr (2)	Minimal adverse (3)	▪ A well engineering designed and modern drainage	Minimal adverse (1)

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	▪ Mitigation and Enhancement Measure	Residual Significance
		facilities by the construction debris and bore hole mud water along with lack of regular monitoring.		considered 'Low' as temporary drainage system will minimize the drainage problem.	Spatial Extent : Minr (2) Reversibility : Minr (2) Legal Comp. : Minr (2) [National Water Act, 2013] Likelihood : Mod (3) As such the resultant impact magnitude is (11/5= 2.2~2) 'Minor'.	Sensitivity of receptor is found 'Low' while the magnitude is assessed as 'Moderate'. The resultant impact significance is 'Moderate Adverse'.	system should be introduced. ▪ Regular Maintenance of the drainage network should be ensured. ▪ Clearing of drainage network should be done regularly.	Changes in magnitude with implementation of suggested mitigation measures. Sensitivity: Low (1) and Magnitude: Minimal (1); the resultant significance is 'Minimal Adverse'.
Disposal of construction waste during Project Component construction	Soil, air and water quality	B7. Indiscriminate and unplanned disposal of solid and liquid waste may affect local environment (soil, air and water) adversely.	Temporary storage and housekeeping of construction solid and liquid waste.	Medium (2) The sensitivity is considered 'Medium' as vulnerable receptor (environmental elements) has moderate opportunities for mitigation.	Minor (2) Impact Duration : Minr (2) Spatial Extent : Minr (2) Reversibility : Minr (2) Legal Comp. : Minr (2) [ECR, 1997] Likelihood : Minr (2) As such the resultant impact magnitude is	Minor adverse (4) Sensitivity of receptor is found 'Medium' while the magnitude is assessed as 'Minor'. The resultant impact significance is 'Minor Adverse'.	▪ Implement ECP 1 Waste Management. ▪ Siting of fuel and hazardous material storage sites, including refueling facilities, batching plants and construction yards are to be located inside the flood embankments. ▪ Hazardous waste will be disposed of following	Minimal Adverse (1) Changes in sensitivity and magnitude with implementation of suggested mitigation measures. Sensitivity: Low (1)

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	▪ Mitigation and Enhancement Measure	Residual Significance
					(10/5= 2) 'Minor'. Hazardous waste will be disposed of following environment friendly and ISM system by designated contractors. Good housekeeping will be adopted to reduce generation of construction wastes and the potential water pollution.		environment friendly manner by designated contractors. ▪ Good housekeeping will be adopted to reduce generation of construction wastes and the potential water pollution.	Magnitude: Minimal (1); the resultant significance is 'Minimal Adverse'.
Biological Environment (Ecology/Fisheries/Agriculture)								
Pile driving during Jetty construction	Species of conservation significance	B8. In case of pre-cast pile driving activities following concern may arise: Overpressure and sound from pile driving activities will harm riverine animals, including dolphins [Availability of Dolphins mentioned in Para: 515].	There is very little chance of using pre-cast driven piles. Jetty will be developed on cast in-situ type pile driving with vibratory hammer.	High (3) Sensitivity is considered High as vulnerable receptor (Species of conservation significance/dolphin) has little capacity to absorb proposed changes.	Minor (2) Impact Duration : Minr (2) Spatial Extent : Minr (2) Reversibility : Minr (2) Legal Comp. : Minr (2) [ECR, 1997] Likelihood : Mod (3) As such the resultant impact magnitude is (11/5= 2.2~2) 'Minor'. As Pile driving activity is envisaged minimum noise generation.	Moderate adverse (6) Sensitivity of receptor is found 'High' while the magnitude is assessed as 'Minor'. The resultant impact significance is 'Moderate Adverse'.	▪ Jetty should be constructed as such that it would not create any obstacle to the river flow and to avoid river conveyance. In that case, it would be constructed inside the land with keeping the provision of mooring of required no. of barges at a time. ▪ The excavated quantity of soil coming from the	Minimal Adverse (2) The reason for the change in residual significance is because of the change in magnitude with implementation of suggested mitigation measures. Sensitivity:

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	▪ Mitigation and Enhancement Measure	Residual Significance
							construction of jetty estimated to about 2,200 m^3. It is suggested to use to excavated soil in levelling the project site and filling up the lagoon. ▪ In case of pre-cast pile driving activities following measures will be applicable: ▪ Pile driving will be completed using Best Management Practices for Pile Driving and Related Operations. ▪ Conferring with appropriate organizations to determine the preferred timing and methods of the pile driving.	Medium (2) Magnitude: Minimal (1)
Pile driving during Jetty construction	In-water noise level	B9. Most of the piles will be cast in-situ type. So, underwater noise from piling activities	There is very little chance of using precast driven piles.	High (3) Sensitivity is considered	Minor (2) Impact Duration : Minr (2)	Moderate adverse (6)	▪ In case of pre-cast pile driving activities following	Minimal Adverse (2)

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	▪ Mitigation and Enhancement Measure	Residual Significance
		will be remote. In case of pre-cast pile driving activities following concern may arise: Noise from in-water construction along with pile driving generates intense underwater sound pressure waves that will adversely affect riverine organisms including vocalization and behavior of fish, dolphins and other animals [Para: 514-516].	Jetty will be developed on cast in-situ type pile driving.	'High' as vulnerable receptor (noise-sensitive aquatic animals and swim bladderless fishes) has little capacity to absorb proposed changes.	Spatial Extent : Minr (2) Reversibility : Minr (2) Legal Comp. : Minr (2) [ECR, 1997] Likelihood : Minr (2) As such the resultant impact magnitude is (10/5= 2) 'Minor'. As Pile driving activity is not envisaged generation of noise shall be minimal.	Sensitivity of receptor is found 'High' while the magnitude is assessed as 'Minor'. The resultant impact significance is 'Moderate Adverse'.	measures will be applicable: ▪ Use of vibratory hammers instead of impact hammers ▪ Monitoring of underwater noise levels and use of underwater air bubble curtains, metal or fabric sleeves to surround the piles to reduce noise levels if required. ▪ A large bubble curtain consists of a hose with drilled holes, supplied with compressed air. The hose is placed on the river bed and the air escaping from the holes forms the bubble screen. [Single bubble curtain reduce noise by: 12 dB (SEL), 14 dB (peak); Double bubble	The reason for the change in residual significance is because of the change in magnitude with implementation of suggested mitigation measures. Sensitivity: Medium (2) Magnitude: Minimal (1)

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	▪ Mitigation and Enhancement Measure	Residual Significance
							curtain by 17 dB (SEL), 21 dB (Peak)] ▪ Hydro Sound Damper consists of fishing nets with small balloon filled with gas and foam - tuned to resonant frequencies fixed to it. It can be applied in different ways. [Hydro Sound Damper reduce noise by 4 - 14 dB (SEL)] ▪ Setting up cofferdam which consists of a rigid steel tube surrounding the pile. Once the pile is stabbed into the cofferdam, the water is pumped out. [Cofferdam up to 22 dB (SEL) and 18 dB (Peak)] ▪ Conduct pile driving during low	

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	▪ Mitigation and Enhancement Measure	Residual Significance
							tides in intertidal and shallow subtidal areas. ▪ Implement seasonal restrictions when necessary to avoid construction-related impacts to habitat during species' critical life history stages (e.g., spawning and egg development periods). ▪ Reduce sound pressure impacts during pile installation by using wood or concrete piles, rather than hollow steel piles which produce intense, sharp spikes of sound that are more damaging to fish and dolphins having air cavities. ▪ Underwater noise during piling	

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	▪ Mitigation and Enhancement Measure	Residual Significance
							activities could be carried out with a hydrophone sensor which is normally placed in a water column at least 1 metre deep, with the sensor located at a depth of 0.5 metre above bottom of the water column. 'Reference sound levels from pile driving normally are reported at a fixed distance of 10 meters'.	
Movement of construction materials carrying vessels	Species of conservation significance	B10. Risk of dolphin collision with construction vessels in the river.	Construction vessels will follow Shitalakhya River (Navigation Route Class III) being used for the decades. Moreover, collision with dolphin by vessels plying in the river	High (3) Grazing of dolphin in and around the proposed jetty site is found nominal. Most congregations of dolphins are observed in the confluence of the pool areas. The sensitivity is considered	Minor (2) Impact Duration : Minr (2) Spatial Extent : Mod (3) Reversibility : Minr (2) Legal Comp. : Minr (2) [ECR, 1997] Likelihood : Mod (3)	Moderate adverse (6) Sensitivity of receptor is found 'High' while the magnitude is assessed as 'Minor'. The resultant impact significance	▪ Restrict the vessel speeds. ▪ Restrict boat movement within safe distance around the construction site if river width permits. Avoid areas where Dolphins are known to congregate (particularly the river pool areas	Minimal Adverse (2) The reason for the change in residual significance is because of the change in magnitude with implementation of suggested

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	▪ Mitigation and Enhancement Measure	Residual Significance
			has not been reported.	High as the receptor (endangered species/ dolphin) has little capacity to absorb proposed changes.	As such the resultant impact magnitude is (12/5= 2.4~2) 'Minor'.	is 'Moderate Adverse'.	and scouring sites).	mitigation measures. Sensitivity: Medium (2) Magnitude: Minimal (1)

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	▪ Mitigation and Enhancement Measure	Residual Significance
Social Environment (Socio-economic)								
Project construction	Employment generation	B11. Generation of employment will be maximum 4,000 people of different working levels and expertise during Project components construction [Para: 379], which will promote livelihood facilities in and around the study area.	The proponent is committed to employ local people of skilled, semi-skilled and unskilled people of over 18 years old.	Very High (4) Sensitivity of the receptor is considered 'Very High' as creation of new employment of about 4,000 local people temporarily.	Moderate (3) Impact Duration : Minr (2) Spatial Extent : Major (4) Reversibility : Minr (2) Legal Comp. : Mod (3) [Bangladesh Labour Act (BLA), 2006, ILO Declaration on Fundamental Rights and Principles (ILO, 1998), IFC PS-II, and Equator Principle-III] Likelihood : Mod (3) As such the resultant impact magnitude is (14/5= 2.8~3) 'Moderate'.	Major Beneficial (12) Sensitivity of receptor is found 'Very High' while the magnitude is assessed as 'Moderate'. The resultant impact significance is 'Major Beneficial'.	▪ Local people particularly the Project-affected Persons (PAPs) directly or indirectly should be given priority in employing workforces in different Project activities. ▪ Labour wage should be fixed based on the labour market and commodity prices of the area. ▪ Gender issue should be considered in employing labour. ▪ EPC Contractor should abide by the rules and regulations of BLA, 2006; ILO, 1998; EP-III and IFC PS-II.	Major Beneficial (9) Changes in magnitude with implementation of suggested enhancement measures. Sensitivity: Very High (4) and Magnitude: Moderate (3); the resultant significance is 'Major Beneficial'.
Project construction	Economic activity	B12. Increased economic activity due to involvement of about 4000	No abatement measure is considered.	Medium (2)	Moderate (3)	Moderate Beneficial (6)	▪ The Proponent should ensure accessibility of workforce in	Moderate Beneficial (8)

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	▪ Mitigation and Enhancement Measure	Residual Significance
		workers at peak time and about 1530 officials in the Project site, selling of local construction materials, traders, food supply, etc. This will improve the local socio-economic condition and life style.		Sensitivity is considered 'Medium', as local farmers, producers, traders and other services will involve more local people other than 4,000 people/workers involved in the Project component's construction. Considering the potential economic activities during Project construction, life style of the local people, thus the sensitivity for the receptors (Lifestyle) are kept medium.	Impact Duration : Minr (2) Spatial Extent : Majr (4) Reversibility : Minr (3) Legal Comp. : Mod (3) [IFC PS-II, and Equator Principle-III] Likelihood : Majr (4) As such the resultant impact magnitude is (16/5= 3.2~3) 'Moderate'.	Sensitivity of receptor is found 'Medium' while the magnitude is assessed as 'Moderate'. The resultant impact significance is 'Moderate Beneficial'.	shopping activities in the local market place. ▪ Ensuretimely payment of the labour for facilitating rolling of money. ▪ Emphasizing purchasing of commodities locally for giving benefit to local farmers, producers, traders including small shops within the project area. ▪	The change in magnitude with implementation of suggested enhancement measures. Sensitivity: Medium (2) Magnitude: Major (4)
Movement of heavy equipment and construction vehicle	Community health and safety	B13. Little increase of equipment carrying heavy vehicle movement of on the road may cause noise and vibration affecting workers, project	Most of the construction materials and plant equipment will be transported	High (3) Sensitivity is considered High as vulnerable receptor (community) has	Minor (2) Impact Duration : Minr (2) Spatial Extent : Mod (3)	Moderate adverse (6) Sensitivity of receptor is found 'High' while the	▪ Construction vehicle movement near settlements will be limited to day time mostly. ▪ High noise producing	Minimal Adverse (2) The reason for the change in residual

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	▪ Mitigation and Enhancement Measure	Residual Significance
		staff and the nearby community. Most of the construction materials and plant equipment will be transported using water vessels.	using water vessels. Movement of Heavy Vehicle shall be mostly confined to project area which is away from the local community.	little capacity to absorb proposed changes.	Reversibility : Minr (2) Legal Comp. : Minr (2) [ECR, 1997] Likelihood : Minr (2) As such the resultant impact magnitude is (11/5= 2.2~2) 'Minor'. Six (06) lane access road will be constructed [two (02) lane already constructed] which is passing mainly through non habitat area.	magnitude is assessed as 'Minor'. The resultant impact significance is 'Moderate Adverse'.	equipment will be provided with mufflers or acoustic hood/enclosures. ▪ Install acoustic enclosures around generators and install temporary noise control barriers where appropriate to reduce noise levels. ▪ Fit high efficiency mufflers to appropriate construction equipment. ▪ Notify affected communities in advance regarding major noisy operation. ▪ Implement Noise Management Plan.	significance is because of the change in magnitude with implementation of suggested mitigation measures. Sensitivity: Medium (2) Magnitude: Minimal (1)
Quarry/ burrowing activities for civil structure	Land requirement and dispersion of dust	B14. Quarry/ burrowing activities for river protection works and associated pilling up of extracted	A required quantity of area will be designated by the Proponent.	Medium (2) The sensitivity is considered 'Medium' as	Minor (2) Impact Duration : Minr (2)	Minor adverse (4) Sensitivity of receptor is found	▪ Burrow/quarry areas will be developed close to the project area for extraction of	Minimal Adverse (1) The reason for the

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	▪ Mitigation and Enhancement Measure	Residual Significance
		earth may require additional land and after being dried up dust particles may be dispersed.	Excavated earth may be be used for land filling.	vulnerable receptor (land and air quality) has moderate opportunities for mitigation.	Spatial Extent : Minr (2) Reversibility : Minr (2) Legal Comp. : Minr (2) [ECR, 1997] Likelihood : Minl (1) As such the resultant impact magnitude is (9/5= 1.8~2) 'Minol'.	'Medium' while the magnitude is assessed as 'Minor'. The resultant impact significance is 'Minor Adverse'.	earth material and aggregates for river protection works. ▪ No private lands or agriculture lands will be used for burrowing. ▪ Minimize volume of burrowing material by using dredged material generated from the associated component of the Project. ▪ Control of dust and associated air pollution by application of watering method.	change in residual significance is because of the change in magnitude with implementation of suggested mitigation measures. Sensitivity: Low(1) Magnitude: Minimal (1)
Project Construction	Occupational health and safety	B15. Injuries to the workers, even casualty or life loss in case of accident may be held during transportation of machinery and equipments from the ship to site and their installations.	MHI's own Safety Guidelines	Medium (2) Sensitivity is considered 'Medium', as during temporary works may cause accidents. As such the sensitivity for the receptors (workers) are kept medium.	Minor (2) Impact Duration : Minr (2) Spatial Extent : Minr (2) Reversibility : Mod (3) Legal Comp. : Minr (2) [Bangladesh Labour Act (BLA),	Minor Adverse (4) Sensitivity of receptor is found 'Medium' while the magnitude is assessed as 'Minor'. The resultant impact significance is	▪ Proper health and safety training on hazard identification and how to handle hazardous equipments must be provided to the workers before starting any construction activities. ▪ Ensure rigorous standards for	Minimal Adverse (2) Changes in magnitude with implementation of suggested mitigation measures.

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	▪ Mitigation and Enhancement Measure	Residual Significance
					2006, ILO Declaration on Fundamental Rights and Principles (ILO, 1998), IFC PS-II, and Equator Principle-III] Likelihood : Minr (2) As such the resultant impact magnitude is (11/5= 2.2~2) 'Minor'.	'Minor Adverse'.	occupational health and safety are in place. ▪ Establish Occupational Health and Safety (OHS) procedures taking into account the inherent risks for this type of project. ▪ An on-site medical team should be set up and emergency first-aid kit should be at hand in case of any accidental injuries (burns, cuts, broken bones etc.). ▪ The workers should use the appropriate PPEs. ▪ Ensure workers hygiene and health status. Conduct monthly health check-ups to monitor their health condition and provide	Sensitivity: Medium (2) and Magnitude: Minimal (1); the resultant significance is 'Minimal Adverse'.

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	▪ Mitigation and Enhancement Measure	Residual Significance
							appropriate treatment for any ailments. ▪ Need proper danger signs/ posters to prevent accident from occurring at the construction site. ▪ Contractor will establish a labor grievance mechanism and documenting its use for complaints about unfair treatment or unsafe living or working conditions without reprisal. ▪ Provide health insurance for employees for the duration of their contracts. ▪ Provide insurance for accidents resulting in disabilities or death of employees for the	

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	▪ Mitigation and Enhancement Measure	Residual Significance
							duration of their contracts ▪ EPC Contractor should abide by the rules and regulations of BLA, 2006; ILO, 1998; EP-III and IFC PS-II.	
Do	Cultural conflicts	B16. Migrant workers will come from different parts of the country and abroad having cultural diversity, so there will be possible cultural conflicts among workers, and between communities and workers.	Accommodation facility for the labours is provisioned for 1,700 (about 30%) persons out of 5,530 persons workers and EPC and Project officials [Para: 354].	Medium (2) Sensitivity is considered 'Medium', as conflicts may arise between the local community and the construction workers, which may be related to religious, cultural or ethnic differences, or based on competition for local resources. As such the sensitivity for the receptors (conflict) are kept medium.	Minor (2) Impact Duration : Minr (2) Spatial Extent : Mod (3) Reversibility : Minr (2) Legal Comp. : Mod (3) [Bangladesh Labour Act (BLA), 2006, ILO Declaration on Fundamental Rights and Principles (ILO, 1998), IFC PS-II, and Equator Principle-III] Likelihood : Minr (2) As such the resultant impact	Minor Adverse (4) Sensitivity of receptor is found 'Medium' while the magnitude is assessed as 'Minor'. The resultant impact significance is 'Minor Adverse'.	▪ To avoid the conflict the EPC contractor will have to develop following things: ▪ Project-level Grievance Redressal Mechanism (GRM). ▪ Worker Code of Conduct in local language(s). ▪ Provision of cultural sensitization training for workers regarding engagement with local community.	Minimal Adverse (2) Changes in magnitude with implementation of suggested mitigation measures. Sensitivity: Medium (2) and Magnitude: Minimal (1); the resultant significance is 'Minimal Adverse'.

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	▪ Mitigation and Enhancement Measure	Residual Significance
					magnitude is (12/5= 2.4~2) 'Minor'.			
Do	Increased burden on public service provision (utility services)	B17. The presence of construction workers and service providers can generate additional pressure on the provision of public (utility) services, such as water, electricity, medical services, education and social services [Para: 378].	The proponent will construct labor-shed for in-migrant and expatriate workers of about 1.700 persons and develop separate utility services for them during construction period.	Medium (2) Sensitivity is considered 'Medium', as labor influx will increase burden on public service during contraction phase, in the Project adjacent area. As such the sensitivity for the receptors (public utility services) are kept medium.	Minor (2) Impact Duration : Mini (1) Spatial Extent : Mod (3) Reversibility : Minr (2) Legal Comp. : Mod (3) [Remote Area Power Supply System (RAPSS) Guidelines, 2007] Likelihood : Minr (2) As such the resultant impact magnitude is (11/5= 2.2~2) 'Minor'.	Minor Adverse (4) Sensitivity of receptor is found 'Medium' while the magnitude is assessed as 'Minor'. The resultant impact significance is 'Minor Adverse'.	▪ Workers' camps to include wastewater disposal and septic tank system for managing human excreta. ▪ Identification of authorized water supply source and prohibition of use from other community sources. ▪ Separate service providers for community and workers' camp/ construction site. ▪ Worker Code of Conduct on water and electricity consumption. ▪ Contingency plan for temporary rise in demand for utilities and public service provision. ▪ The Proponent should widen the existing road	Minimal Adverse (2) Changes in magnitude with implementation of suggested mitigation measures. Sensitivity: Medium (2) and Magnitude: Minimal (1); the resultant significance is 'Minimal Adverse'.

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	▪ Mitigation and Enhancement Measure	Residual Significance
							passes beside the PUFFL Colony for easy communication of the local people. ▪ The Colony will be built in the present Ghorasal Fertilizer Factory Ltd. For the new plant. Through the Colony an access road up to the Shitalakhya River could be constructed.	
Do	Increased risk of communicable diseases	B18. Increased interactions between the incoming workforce and the local community may result in increasing rates of communicable diseases, including sexually transmitted diseases (STDs) and HIV/AIDS.	MHI's own Safety Guidelines	High (3) Sensitivity is considered 'High', as workforce has high susceptibility to the local community in terms of communicable diseases, in the Project adjacent area. As such the sensitivity for the receptors	Minor (2) Impact Duration : Mini (1) Spatial Extent : Mod (3) Reversibility : Majr (4) Legal Comp. : Mod (3) [EHS Guidelines of IFC, 2007] Likelihood : Minr (2)	Moderate Adverse (6) Sensitivity of receptor is found 'High' while the magnitude is assessed as 'Minor'. The resultant impact significance is 'Moderate Adverse'.	▪ To avoid the risk of communicable diseases, the EPC contractor will: ▪ Establish or upgrade health centers at camp and construction site. ▪ Ensure awareness raising programs like public health impacts from labor influx.	Minimal Adverse (2) Changes in sensitivity and magnitude with implementation of suggested mitigation measures. Sensitivity: Medium (2)

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	▪ Mitigation and Enhancement Measure	Residual Significance
				(communicable diseases) are kept 'High'.	As such the resultant impact magnitude is (11/5= 2.2~2) 'Minor'.		▪ Introduce community sensitization campaigns on STDs among the workers and local community. ▪ Implement HIV/AIDS education program. ▪ Develop worker Code of Conduct in local language(s).	and Magnitude: Minimal (1); the resultant significance is 'Minimal Adverse'.
Do	Gender based violence	B19. Construction workers are predominantly younger males. Those who are away from home on the construction job are typically separated from their family and their normal sphere of social control. This can result is inappropriate behavior, such as sexual harassment of women and girls and illicit sexual relations with	MHI's own Safety Guidelines	Medium (2) Sensitivity is considered 'Medium', as women workforce have moderate susceptibility to the abusement and stalking bythe male workforce.	Minor (2) Impact Duration : Minr (2) Spatial Extent : Minr (2) Reversibility : Mod (3) Legal Comp. : Mod (3) [EHS Guidelines of IFC, 2007] Likelihood : Minr (1) As such the resultant impact	Minor Adverse (4) Sensitivity of receptor is found 'Medium' while the magnitude is assessed as 'Minor'. The resultant impact significance is 'Minor Adverse'.	▪ To avoid the risk of abusement, the EPC contractor will: ▪ Ensure awareness raising programs like sexual harrasment impacts from male labor. ▪ Introduce community sensitization campaigns on STDs among the workers and local community.	Minimal Adverse (2) Changes in magnitude with implementation of suggested mitigation measures. Sensitivity: Medium (2) and Magnitude: Minimal (1); the resultant significance

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	▪ Mitigation and Enhancement Measure	Residual Significance
		minors from the local community.			magnitude is (11/5= 2.2~2) 'Minor'.		▪ Implement HIV/AIDS education program. ▪ Develop worker Code of Conduct in local language(s).	is 'Minimal Adverse'.
Do	Public safety	B20. Increased Traffic on local roads will affect access to the trading center and, houses close to the road, deteriorate safety (especially the school children), spillage of fuels and chemicals, and damage to infrastructures and properties due to vibration.	No abatement measure is considered.	Medium (2) Sensitivity is considered 'Medium', as the receptors have some capacity to absorb proposed change or moderate opportunities for mitigation.	Moderate (3) Impact Duration : Minr (2) Spatial Extent : Mod (3) Reversibility : Mini (1) Legal Comp. : Mod (3) [EHS Guidelines of IFC, 2007] Likelihood : Minr (2) As such the resultant impact magnitude is (11/5= 2.2~2) 'Minor'.	Moderate adverse (6) Sensitivity of receptor is found 'Medium' while the magnitude is assessed as 'Moderate'. The resultant impact significance is 'Moderate Adverse'.	▪ Contractor will implement traffic management plan to ensure uninterrupted traffic movement during construction. ▪ Restrict truck deliveries, where practicable, to day time working hours. ▪ Restrict the transport of oversize loads. ▪ Enforce on-site speed limit, especially close to the sensitive receptors, schools, health centres, etc.	Minimal Adverse (2) Changes in magnitude with implementation of suggested mitigation measures. Sensitivity: Medium (2) and Magnitude: Minimal (1); the resultant significance is 'Minimal Adverse'.

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	▪ Mitigation and Enhancement Measure	Residual Significance
							▪ Implement ECP 10: Traffic Management ▪ Inspect structures within the close proximity of construction site for damages.	
Do	Health safety	B21. Operation of heavy equipment and transport vehicles will cause noise and vibration affecting workers and the nearby population.	No abatement measure is considered.	**High** **(3)** Sensitivity is considered 'High', as the receptors have little capacity to absorb proposed change or limited opportunities for mitigation.	Moderate (3) Impact Duration : Minr (2) Spatial Extent : Mod (3) Reversibility : Mini (1) Legal Comp. : Mod (3) [EHS Guidelines of IFC, 2007] Likelihood : Mod (3) As such the resultant impact magnitude is (12/5= 2.4~2) 'Minor'.	Major Adverse (9) Sensitivity of receptor is found 'High' while the magnitude is assessed as 'Moderate'. The resultant impact significance is 'Major Adverse'.	▪ Construction activities near settlements will be limited to day time only (8AM – 6PM). ▪ High noise producing equipment will be provided with mufflers or acoustic hood/enclosures. ▪ Install acoustic enclosures around generators and install temporary noise control barriers where appropriate to reduce noise levels. ▪ Fit high efficiency mufflers to appropriate	Minor Adverse (4) Changes in magnitude with implementation of suggested mitigation measures. Sensitivity: Medium (2) and Magnitude: Minor (2); the resultant significance is 'Minor Adverse'.

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	▪ Mitigation and Enhancement Measure	Residual Significance
							construction equipment. ▪ Notify affected communities in advance regarding major noisy operation. ▪ Implement Noise Management Plan	
Operation Phase (C)								
Physical Environment (Land Resources/Hydrology/Meteorology/Air Quality/Noise)								
Operation of the total urea plant with occasional shutdown, Power Plant operation with other utilities operation	Ambient air quality	C1. Ambient air quality might be deteriorated due to emission of NH_3, NOx, PM_{10}, $PM_{2.5}$ SO_2 and CO.	Modern, energy and water efficient and leak-proof technology has been selected: Ammonia Plant: Haldor Topsoe A/S (HTAS), Denmark Urea Plant: Saipem S. p. A., Italy Granulation Plant: TKFT CO_2 Recovery from Primary Reformer:	Medium (2) Sensitivity is considered 'Medium', as the proponent has already considered environment friendly technologies for avaiding gaseous emission.	Minor (2) Impact Duration : Mjar (4) Spatial Extent : Minr (2) Reversibility : Minr (2) Legal Comp. : Minr (2) [EHS Guidelines of IFC, 2007] Likelihood : Mini (1) As such the resultant impact magnitude is (11/5= 2.2~2) 'Minor'.	Minor Adverse (4) Sensitivity of receptor is found 'Medium' while the magnitude is assessed as 'Minor'. The resultant impact significance is 'Minor Adverse'.	▪ Regular monitoring of emission should be conducted.	Minimal Adverse (2) Changes in magnitude with implementation of suggested mitigation measures. Sensitivity: Medium (2) and Magnitude: Minimal (1); the resultant significance is 'Minimal Adverse'.

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	▪ Mitigation and Enhancement Measure	Residual Significance
			MHI (Para: 236]					
Project operation	Ambient Noise Level	C2. Noise generation from cooling tower, boiler, ST, GEG, NH_3 Plant, Urea Plant and other utility services Hearing complexity and loss along with increase blood pressure, disturbances and discomfort to the technicians and workers and surrounding communities due to noise generated from rotator machineries at exceedance level.	Modern and efficient machinery will be used	Medium (2) Sensitivity is considered 'Medium', as the proponent has already considered environment friendly technologies for avoiding noise generation.	Minor (2) Impact Duration : Mjar (4) Spatial Extent : Minr (2) Reversibility : Minr (2) Legal Comp. : Minr (2) [Noise Control Rules, 2006 and ECR,EHS Guidelines of IFC, 2007] Likelihood : Mini (1) As such the resultant impact magnitude is (11/5= 2.2~2) 'Minor'.	Minor Adverse (4) Sensitivity of receptor is found 'Medium' while the magnitude is assessed as 'Minor'. The resultant impact significance is 'Minor Adverse'.	▪ Regular monitoring of noise should be conducted. ▪ Noise hood should be installed where applicable. ▪ Plantation program should be implemented for attenuating noise.	Minimal Adverse (2) Changes in magnitude with implementation of suggested mitigation measures. Sensitivity: Medium (2) and Magnitude: Minimal (1); the resultant significance is 'Minimal Adverse'.
Water intake from the Shitalakhya River	Surface water availibility	C3. Gross water intake would be about 0.567 m^3/s and net water intake for the operation of the Project would be about 0.283 m^3/s whereas lowest discharge of the	The specific relative consumption of water (0.583 m^3/s) is less with respect to production of urea in previous	Low (1) Sensitivity to the receptor is considered 'Low' as the design life of the factory is 20 years.	Moderate (3) Impact Duration : Majr (4) Spatial Extent : Majr (4) Reversibility : Mod (3)	Minimal Adverse (3) Sensitivity of receptor is found 'Low' while the magnitude is assessed as	▪ System loss during plant operation should be minimized as much as possible. ▪ Regular O&M should be conducted;	Minimal Adverse (2) Changes in magnitude with implementation of suggested

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	▪ Mitigation and Enhancement Measure	Residual Significance
		Shitalakhya River is about 83 m^3/s in dry season. This indicates that the impact of the project would be bare minimum on the surface water availability [Para: 401].	plants (UFFL and PUFFL) in the the selected technology for GPUFP.		Legal Comp. : Minr (2) [National Water Act, 2013] Likelihood : Majr (4) As such the resultant impact magnitude is (17/5= 3.4~3) 'Moderate'.	'Moderate'. The resultant impact significance is 'Minimal Adverse'.	▪ Regular monitoring of dry season water flow should be ensured. ▪ Cooling water should be reused with due treatment. ▪ Rainwater Harvesting System should be installed in the factory level.	mitigation measures. Sensitivity: Low (1) and Magnitude: Minor (2); the resultant significance is 'Minimal Adverse'.
Ground Water abstraction mainly for potable water of colony and Plant officials during emergency period	Ground Water Level	C4. Drawdown induced lowering of ground water level may cause crisis of household level availability of groundwater through hand tubewell.	The proponent has provisioned the use of surface water for the operation of the plant including potable water for the Plant officials.	Medium (2) Sensitivity of the receptor is considered 'Medium' because extraction of ground water will be very limited at operation phase have some capacity to absorb changes by recharge or moderate scope of mitigation.	Moderate (3) Impact Duration : Majr (4) Spatial Extent : Mod (3) Reversibility : Minr (2) Legal Comp. : Minr (2) [National Water Act, 2013] Likelihood : Minr (2) As such the resultant impact magnitude is (13/5= 2.6~3) 'Moderate'.	Moderate Adverse (6) Sensitivity of receptor is found 'Medium' while the magnitude is assessed as 'Moderate'. The resultant impact significance is 'Moderate Adverse'.	▪ The proponent should encourage and facilitate introduction of Rainwater Harvesting System (RHS) as a substitute for other local users of GW as part of CSR. ▪ Monitoring should be considered as one of the important components during ground water extraction.	Minimal Adverse (1) Changes in sensitivity and magnitude with implementation of suggested mitigation measures. Sensitivity: Low (1) and Magnitude: Minimal (1); the resultant significance

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	▪ Mitigation and Enhancement Measure	Residual Significance
							▪ Water supply system should be leakage proof. ▪ Aquifer recharge could be an effective option through groundwater injection well[18] if groundwater drawdown effect is observed. ▪ Whole colony should be supplied with purified surface water for potable use.	is 'Minimal Adverse'.
Storm water management	Drainage congestion	C5. Drainage congestion may be occurred due to generation of excessive storm water resulting from climate change induced erratic rainfall. In consequence of this the urea stack/pile may be	A well designed, high capacity and modern drainage system has been provisioned under this project.	Medium (2) Sensitivity of the receptor is considered 'Medium' as proper maintenance can reduce the problem.	Minor (2) Impact Duration : Majr (4) Spatial Extent : Minr (2) Reversibility : Minr (2)	Minor Adverse (4) Sensitivity of receptor is found 'Medium' while the magnitude is assessed as 'Minor'. The resultant	▪ Regular O&M works and cleaning of drainage system should be conducted for preventing from congestion. ▪ Plinth level of urea pile should be raised at safer	Minimal Adverse (2) Changes in magnitude with implementation of suggested

18 The U.S. Environmental Protection Agency (EPA) regulates around 850,000 underground injection wells through its Underground Injection Control program under the Safe Drinking Water Act: https://www.americangeosciences.org/critical.../what-underground-injection-wells-use.

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	▪ Mitigation and Enhancement Measure	Residual Significance
		inundated and damaged.		New factory will have enough capacity to resolve drainage problem in construction phase.	Legal Comp. : N/A (1) Likelihood : Minr (2) As such the resultant impact magnitude is (11/5= 2.2~2) 'Minor'.	impact significance is 'Minor Adverse'.	height or construction of 'Killa' with shed for piling up of urea urea for avoiding torrential rainfall induced wet and damage to urea bag.	mitigation measures. Sensitivity: Medium (2) and Magnitude: Minimal (1); the resultant significance is 'Minimal Adverse'.
Drainage of rejected water and effluents, into the Shitalakhya	Surface water quality	C6. During the operation, huge volume of drainage water will be generated. In addition, all the process will also generate effluents mixed with chemicals (urea, nitrate, NH4+) and various lubricants. Disposal into water might changes the water quality largely.	Drainage system, Lagoon, Waste Water Treatment Plant (WSTP) and Effluent Treatment Plant (ETP)	Medium (2) River and adjacent pond water quality will be polluted extensively if the water is not treated well enough. Ecosystem might loss its full functionality for the long term dumping of untreated effluents.	Minor (2) Impact Duration : Minr (2) Spatial Extent : Minr (2) Reversibility : Minr (2) Legal Comp. : Mini (1) Likelihood : Minr (2) As such the resultant impact magnitude is (9/5= 1.8~2) 'Moderate'.	Minor Adverse (4) Sensitivity of receptor is found 'Medium' while the magnitude is assessed as 'Minor'. The resultant impact significance is 'Minor Adverse'.	▪ Storm mixed drainage and treated effluents should be disposed into the lagoon first where natural treatment will also remove some nutrients from the waste water; ▪ The lagoon water then be disposed into the Shitalakhya river slowly; ▪ Monitoring of the functionality of the WWTS, ETP and the drainage network.	Minimal adverse (2) (Both biological and natural treatment will reduce the impact vastly)

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	▪ Mitigation and Enhancement Measure	Residual Significance
Biological Environment (Ecology/Fisheries/Agriculture)								
Water intake from the Shitalakhya River	Habitation of aquatic organisms	C7. Raw water abstraction through intake pumps with the designed velocity (0.51 m/s) may destabilize habitation of aquatic organisms including fish and causing the alterations to substrates and aquatic community structure and diversity. Low velocity tolerant species become trapped and died. This will continue.	The specific relative consumption of water is less with respect to production of urea in previous plants (UFFL and PUFFL; production was 900 TPD; water intake 0.583 m^3/s) in the the selected technology for GPUFP (production 2,800 TPD; water intake 0.567 m^3/s). [Para: 301]	Medium (2) Sensitivity of the receptor is considered 'Medium' as river water withdrawal would be little less or equal in the new plant than that of the existing situation.	Moderate (3) Impact Duration : Majr (4) Spatial Extent : Mod (3) Reversibility : Mod (3) Legal Comp. : Minr (2) Likelihood : Majr (4) As such the resultant impact magnitude is (16/5= 3.2~3) 'Moderate'.	Moderate Adverse (6) Sensitivity of receptor is found 'Medium' while the magnitude is assessed as 'Moderate'. The resultant impact significance is 'Moderate Adverse'.	▪ Water intake pipe diameter should be increased to reduce intake velocity to around 0.3 m/s for avoiding fish entrainment. ▪ Double layer strainer of adequate mesh size should be installed around the intake point for . Regular monitoring of dry season water flow should be ensured. ▪ Cooling water should be reused with due treatment. ▪ Rainwater Harvesting System should be installed in the factory level. ▪ System loss during plant operation should be minimized as	Minimal Adverse (2) Changes in magnitude with implementation of suggested mitigation measures. Sensitivity: Medium (2) and Magnitude: Minimal (1); the resultant significance is 'Minimal Adverse'.

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	▪ Mitigation and Enhancement Measure	Residual Significance
							much as possible.	
	Fish mortality	C8. Water intake at the rate of 0.567 m^3/s would generate velocity of about 0.51 m/s at (considering 24 m diameter of pipeline) that point may cause entrainment of fish which cannot sustain the resultant velocity.	NA	High (3) Sensitivity of the IEC is assessed as 'High' because there are small sized fishes move along the bank susceptible to the given intake water velocity and have limited option of mitigation.	Major (4) Impact Duration : Majr (4) Spatial Extent : Mod (3) Reversibility : Mod (3) Legal Comp. : Minr (2) [National Water Rules 2017] Likelihood : Majr (4) As such the resultant impact magnitude is (16/5= 3.2~3) 'Moderate'.	Major Adverse (12) Magnitude of impact on the IEC is assessed as 'Major' as fish mortality through intake would occurred for a considerable area and recovering time would be at least one six months if intake will be stopped.	▪ Maintaining minimum water velocity of 0.3 m/s during pre-monsoon and monsoon period ▪ Strainer with 6 mm mesh size should be placed before the intake of water; ▪ An additional reservoir should be constructed with regulated canal for conserving fish when dry down of the basin required. ▪ Acoustic Air Bubble Curtain using perforated pipe should be installed as a deterrent system for fish in order to be avoiding from water intake point.	Minimal (-2) Implementation of mitigation measure would reduce the magnitude of impact. Sensitivity: High- 3 Magnitude- Minimal-2

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	▪ Mitigation and Enhancement Measure	Residual Significance
Effluent discharge	Fish and other aquatic resources	C9. Fishery resources and others aquatic organisms along with benthic habitats may degrade along with the Gangetic River Dolphin [Para: 515].	The proponent has provisioned WWTS and ETP.	Medium (2) Sensitivity of the receptor is considered 'Medium' as river water withdrawal would be little less or equal in the new plant than that of the existing situation.	Moderate (4) Impact Duration : Majr (4) Spatial Extent : Mod (3) Reversibility : Minr (2) Legal Comp. : Minr (2) Likelihood : Minr (2) As such the resultant impact magnitude is (13/5= 2.6~3) 'Moderate'.	Moderate Adverse (8) Sensitivity of receptor is found 'High' while the magnitude is assessed as 'Major'. The resultant impact significance is 'Major Adverse'.	▪ Minimize NOx emission by using low NOx burner. ▪ Ensure proper operation of Effluent Treatment Plant (ETP) ▪ Reuse of treated water	Minimal Adverse (2) Changes in magnitude with implementation of suggested mitigation measures. Sensitivity: Medium (2) and Magnitude: Minimal (1); the resultant significance is 'Minimal Adverse'.
	Heavy metal accumulation in fish	C10. Detritus feeders, marginal small fishes, planktivores and even predator fish would become susceptible to accumulate trace heavy metal.	NA	Medium (2) Sensitivity of the IEC is assessed as 'Medium' because mentioned fish species would accumulate heavy metals but it can be controlled through taking	Major (4) Impact Duration : Majr (4) Spatial Extent : Mod (3) Reversibility : Mod (3) Legal Comp. : Majr (4) [National Water Rules 2017]	Moderate Adverse (8) Magnitude of impact on the IEC is assessed as 'Moderate' as damage to habitat would occurred for a considerable area and	▪ Keep functional ETP and do continuous monitoring for maintaining the accepted limit of heavy metal values in effluent	Minimal (-1) Implementation of mitigation measure would reduce the magnitude of impact. Sensitivity: Low- 1

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	▪ Mitigation and Enhancement Measure	Residual Significance
				action of mitigation measures.	Likelihood : Majr (4) As such the resultant impact magnitude is (18/5= 3.6~4) 'Major'.	recovering time would be at least one year.		Magnitude-Minimal-1
Urea Plant Operation	Crop production	C11. Burning of tender plant and their leaves due to NH^3 emission in turn would affect the crop yield and reduce the crop production.	NH_3 vented with inerts is minimized in the selected technology as quantity of air required for passivation is much less than other technologies.	Medium (2) Sensitivity to the receptor is considered 'Medium', as the crop fields are located distantly, amount of crop fields are minimum but vulnerability to crops is moderate.	Minor (2) Impact Duration : Mini (1) Spatial Extent : Mod (3) Reversibility : Minr (2) Legal Comp. : Mini (1) Likelihood : Minr (2) As such the resultant impact magnitude is (9/5= 1.8~2) 'Moderate'.	Minor Adverse (4) Sensitivity of receptor is found 'Medium' while the magnitude is assessed as 'Minor'. The resultant impact significance is 'Minor Adverse'.	▪ Regular maintenance of the machineries of the plant may help in avoiding the abnormal condition of releasing NH^3 gas. ▪ Change of landuse from crop field to aquaculture is suggested.	Minimal adverse (2) The reason for changing in residual significance is because of implementation of suggested measure of aquaculture instead of crop cultivation would reduce the sensitivity. Sensitivity: Low (1)Magnitude : Minor (2)

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	▪ Mitigation and Enhancement Measure	Residual Significance
Sludge to Shitalakhya river	Surface water quality	C12. Sludge from water treatment plant enriched with high Iron. Direct dumping into river will affect the irrigation water availability and the aquatic ecosystems largely.	WWTS/ETP is provisioned.	Medium (2) River water quality will be polluted extensively if the sludge (sludge from pre-treatment plant and oil separation plant) is not treated well enough and disposed properly. Ecosystem might loss its full functionality for the long term dumping of sludge into rivers.	Minor (2) Impact Duration : Minr (2) Spatial Extent : Minr (2) Reversibility : Minr (2) Legal Comp. : Mini (1) Likelihood : Minr (2) As such the resultant impact magnitude is (9/5= 1.8~2) 'Moderate'.	Minor Adverse (4) Sensitivity of receptor is found 'Medium' while the magnitude is assessed as 'Minor'. The resultant impact significance is 'Minor Adverse'.	• Outsourcing into various still factory for the selling of iron rich sludge from the pre-treatment of wastewater; • Reuse of the recycled water for the process again, gardening, and into the drainage network; • Management of oil separation sludge according to the Hazardous Waste and Ship Waste Rules 2011.	Minimal adverse (2) (Selling iron rich sludge into still factory and waste management by regulations of 2011 will minimize the impacts extensively.)
Ammonia and Urea Plant Operation	Surface water quality	C13. Process leakage and other spills of urea, ammonia, lubricants and oils will come into the surface runoff and later into drainage system. This could degrade the river water quality.	WWTS/ETP is provisioned.	Low (1) Very low amount and then could be diluted into lagoons and rivers. Sensitivity to the receptor is considered 'Low', as the vulnerable	Minor (2) Impact Duration : Majr (4) Spatial Extent : Mod (3) Reversibility : Mini (1) Legal Comp. : Mini (1)	Minor Adverse (2) Sensitivity of receptor is found 'Low' while the magnitude is assessed as 'Minor'. The resultant impact significance is	• Inspection of the plants and its installation every day for any kind of leakage and its immediate repairmen; • Collection of the spills and process loss chemicals separately and managed it either	Minimal adverse (1) (Regular inspection and separate management of the chemical and oily materials must reduce the chance of

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	▪ Mitigation and Enhancement Measure	Residual Significance
		Besides large volume of effluents will be released from these units. Around 3 tons of ammonical nitrogen, 0.6 ton of nitrate, 0.5 ton of dissolved phosphorous and 0.1 ton of iron will be loaded daily into the Shitalakshya river. Due to tidal influence, these will be diluted immediately in the wet season. In dry season, it might slightly increase the river concentration for a very short period.		receptor has good capacity to absorb proposed changes or good capacity for mitigation.	Likelihood : Mini (1) As such the resultant impact magnitude is (10/5=) 'Minor'.	'Minor Adverse'.	through ETP or disposed into other confined areas; • Condensates should be steam-stripped to reduce the ammonia content, and re-used as boiler make-up water after an ion exchange treatment or sent to a wastewater treatment plant for treatment with other ammonical streams. • Ammonia absorbed from purge and flash gases should be recovered in a closed loop; • Improve evaporation heater/separator design to minimize urea entrainment; • Remove NH_3, CO_2, and urea from the process	degrading river water quality.)

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	▪ Mitigation and Enhancement Measure	Residual Significance
							water in a process water treatment unit, and recycle the gases to the synthesis to optimize raw material utilization and reduce effluents;	
Dispatch of Urea	Surface water quality	C14. Increase of barges and water vessels might affect the surface water quality by bilge and ballast water. Increase of coolant, lubricants and oils are the main concern by this water into rivers.	No abatement measures present	Medium (2) Tidal influence of Shitalakhya river might reduce the bilge and ballast water effect in short period.	Minor (2) Impact Duration : Minr (2) Spatial Extent : Minr (2) Reversibility : Minr (2) Legal Comp. : Mini (1) Likelihood : Minr (2) As such the resultant impact magnitude is (9/5= 1.8~2) 'Moderate'.	Minor Adverse (4) Sensitivity of receptor is found 'Medium' while the magnitude is assessed as 'Minor'. The resultant impact significance is 'Minor Adverse'.	•Disposal of bilge and ballast water into the rivers is strictly prohibited; •Handling of bilge and ballast water following the national/international rules of BIWTA/DoE; •Aware the barge crews about the negative impacts of bilge and ballast water;	Minimal adverse (2) (Application of suggested measures and following the rules and regulations properly will reduce the risk of oil and lubricant pollution into the Shitalakhya River.)
Social Environment (Socio-economic)								
Project Operation	Occupational health and safety	C16. Injuries to the workers, even casualty or life loss in case of accident may be held during	NA	Very High (4) Sensitivity is considered 'Very	Minor (2) Impact Duration : Majr (4)	Moderate Adverse (8)	• Need contingency fund for affected people to address accidental issues	Minimal adverse (2)

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	▪ Mitigation and Enhancement Measure	Residual Significance
		operation of urea plant and dispatch of urea.		High', as accidental event may be occurred during operation of the Urea Plant. As such the sensitivity for the receptors (workers' safety) are kept very high.	Spatial Extent : Minr (2) Reversibility : Majr (4) Legal Comp. : Mini (1) Likelihood : Mini (1) As such the resultant impact magnitude is (12/5= 2.4~2) 'Moderate'.	Sensitivity of receptor is found 'Very High while the magnitude is assessed as 'Minor'. The resultant impact significance is 'Moderate Adverse'.	during operational period • Ensure proper emergency response team and facilities in place • Proper awareness program about possible accidents should be ensured and regular evacuate training for the employees • PIU will establish a grievance mechanism and documenting its use for complaints about unfair treatment or unsafe living or working conditions without reprisal.	The reason for the change in residual significance is because of the change in magnitude with implementation of suggested mitigation measures. Sensitivity: Medium (2) Magnitude: Minimal (1)
Do	Impact on Public Health and Safety	C17. In case of any serious accident, the Plant may become a risk factor for those people who are living/working adjacent to it. Particularly, it may cause safety risk to	NA	Very High (2) Sensitivity is considered 'Very High', as during operation of the Project may cause accidents. As such the	Minor (2) Impact Duration : Majr (4) Spatial Extent : Minr (2) Reversibility : Majr (4)	Moderate Adverse (8) Sensitivity of receptor is found 'Very High while the magnitude is assessed as	• Need contingency fund for affected neighboring people to address accidental issues during operational period • Ensure proper emergency response team	Minimal adverse (2) The reason for the change in residual significance is because of

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	▪ Mitigation and Enhancement Measure	Residual Significance
		the nearby residential areas, school and offices. It is apprehended that fatalities may take place if any accident occurs.		sensitivity for the receptors (public health) are kept very high.	Legal Comp. : Mini (1) Likelihood : Mini (1) As such the resultant impact magnitude is (12/5= 2.4~2) 'Moderate'.	'Minor'. The resultant impact significance is 'Moderate Adverse'.	and facilities in place • Proper awareness program about possible accidents should be ensured for the neighboring people • PIU will establish a grievance mechanism and document its use for complaints about unfair treatment or unsafe living or working conditions without reprisal.	the change in magnitude with implementation of suggested mitigation measures. Sensitivity: Medium (2) Magnitude: Minimal (1)
Project Operation	Employment generation	C18. Generation of employment opportunity for about 126 officials and significant number of technicians and workers at different levels people at different operation levels (i.e. Urea production, Jetty operation, dispatch of urea,etc.) will be required which would promote	NA	Medium (2) Sensitivity is considered 'Medium', as during temporary works may cause accidents. As such the sensitivity for the receptors (workers) are kept medium.	Moderate (3) Impact Duration : Mod (3) Spatial Extent : Mod (3) Reversibility : Mod (3) Legal Comp. : Minr (2) Likelihood : Majr (4)	Moderate beneficial (6) Sensitivity of receptor is found 'Medium' while the magnitude is assessed as 'Moderate'. The resultant impact significance is 'Moderate Adverse'.	•In employing workforces in different operational activities, it is suggested to involve largely the local people particularly the Project-affected Persons (PAPs) directly or indirectly. •In employing workforces in operation phase, it	Moderate beneficial (8) The reason for the change in residual significance is because of the change in magnitude with implementation of suggested mitigation measures.

Activities	IESCs/ VECs	Impact and Risk from various activities	Abatement Measures	Sensitivity of the Resources/ Receptors	Magnitude of the Impact	Significance Prior to Mitigation	▪ Mitigation and Enhancement Measure	Residual Significance
		livelihood for local people.			As such the resultant impact magnitude is (15/5= 3) 'Moderate'.		is suggested to involve largely the permanent employee who are working at PUFFL at present.	Sensitivity: Medium (2) Magnitude: Major (4)
Operation Phase	Transportation of urea fertilizer	C21. For dispatching produced urea about 600 trucks will mobilize every day which may increase traffic and accidents within the area.	The proponent will develop separate truck stand and access road for dispatching the urea.	Medium (2) Sensitivity is considered 'Medium', as dispatching the urea will create traffic congestion temporarily, in the Project adjacent area. As such the sensitivity for the receptors (traffic) are kept medium.	Major (4) Impact Duration : Mod (3) Spatial Extent : Minr (2) Reversibility : Minr (2) Legal Comp. : Minr (2) Likelihood : Majr (4) As such the resultant impact magnitude is (19/5= 3.8~4) 'Major'.	Moderate Adverse (8) Sensitivity of receptor is found 'Medium' while the magnitude is assessed as 'Major'. The resultant impact significance is 'Moderate Adverse'.	▪ The movement of vehicles in the project area should be restricted during peak hours. No vehicular movement should be made during school time (9:00 a.m. to 16:00 p.m.) and on the days of weekly markets (Haatbars).	Minimal adverse (2) The reason for the change in residual significance is because of the change in magnitude with implementation of suggested mitigation measures. Sensitivity: Medium (2) Magnitude: Moderate (3)

*Note: * According to Article 19 of National Water Rules 2017 (Small and medium industries should collect license from Zila Commitee for installing shallow tubewell; and for installation of deep tubewell or use of submergible pump, license should be collected from WARPO)*

7.5 Impact on the Surface Water Flow

7.5.1 Option development

555. For the assessment of water availability of the Shitalakhya River, the models (hydrological and hydrodynamic) have been simulated for four scenarios; baseline condition, future without project, future with project and other developments including the consideration of upstream flow reduction and climate change impacts. The following Table 7.6 presents the detail descriptions of scenarios.

Table 7.6: Detail description of option development

Scenario	Condition	Implication
Base condition	Average (1 in 2.33 year return period) of last 36 years (1981 – 2017)	• Model has been derived for the existing situation considering historical hydrological and meteorological data (water level, GW level and rainfall and air temperature) for the year 1981 through 2017. • Present water demand (agriculture, domestic, industrial etc.) has been assessed and integrated in the model.
Option 01 (Without project scenario)	Future without project scenario considering Climate change	• Model has been simulated for the next 20 years (2017-2037) considering without project with climate change condition. • The change in upstream flow due to climate change has been considered during model setup. • Future domestic, industrial and agricultural water demand has been assessed and incorporated in the model.
Option 02 (With project)	Future with project considering Climate change and future water demand	• Model has been simulated for the next 20 years (2017-2037) considering future climate change condition. • Water abstraction (0.567 m3/s) for the GPUFP has been included into the model. • The change in upstream flow due to climate change has been considered during model setup. • Future domestic, industrial and agricultural water demand has also been incorporated in the model.
Option 03 (With project)	Future with project considering Climate change, reduction of upstream flow and future water demand	• Model has been simulated for the next 20 years (2017-2037) considering future climate change condition. • Water abstraction (0.567 m3/s) for the GPUFP has been included into the model. • The upstream flow is considered to be reduced by 25% in future. • Future domestic, industrial and agricultural water demand has also been incorporated in the model.
Option 04 (With project)	Process Plant	• Model has been simulated for the next 20 years (2017-2037) considering. • Frequency analysis has been done to see future level of water

7.5.2 Climate change impact on the Ganges, Brahmaputra and Meghna basins

556. CEGIS has carried out water availability assessment for the Ganges, Brahmaputra and Meghna basins under different climate change scenarios (A1B, A2 and B1). The study was financed under the Abu Dhabi Dialogue Knowledge Forum Small Grants Program (ADDKF-SGP) of the World Bank and coordinated by the International Centre for Integrated Mountain Development (ICIMOD), Nepal. Based on this study, it was found that about 8% of monsoon flow and about 17% dry season flow of the Brahmaputra River will increase by 2050. Change of monthly flow of the Brahmaputra River is given in Table 7.7.

Table 7.7: Changes of monthly flow of the Brahmaputra River in percentage

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Percentage change of monthly flow	11.1	16.3	24.3	1.6	0.6	-2.6	7.8	14.2	12.8	16.9	17.2	17.8	9

557. From the historical data analysis, it is found that the annual flow of the Brahmaputra River is increasing due to climate change but flow of the Old Brahmaputra River is decreasing which is mainly due to the change in off-take morphology of the Old Brahmaputra River. It is estimated that around 268 Mm^3 flow reduced per year in the Old Brahmaputra River (Figure 7.1).

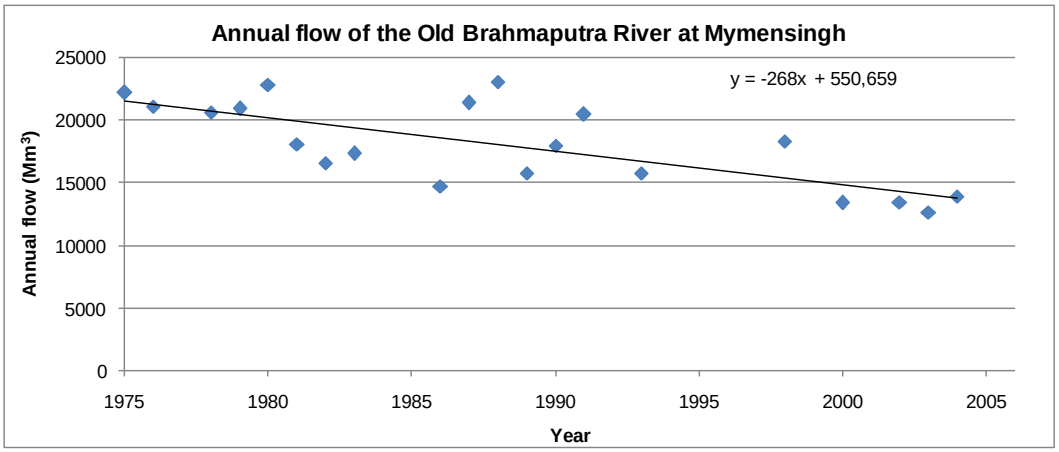


Figure 7.1: Historical annual flow of the Old Brahmaputra River at Mymensingh

558. For assessment of water availability of the Shitalakhya River, the models (hydrological and hydrodynamic) has been simulated for four scenarios; base condition, future without project considering climate change, future with project considering climate change and future water demand, and future with project considering climate change, future water demand, and reduction of upstream flow.

7.5.3 Climate Change Impact on Water Balance

559. The precipitation and temperature are assumed to be changed in future under different climate change scenarios. To understand the climate change impact for the next 20 years (2017-2037), the model was run for RCP 4.5 scenario and the results are shown in Table 7.8.

Table 7.8: Climate change impact on water availability in the catchment area

Sl. No.	Hydrological parameters	Base condition (mm)	Climate change condition (mm)	Difference (mm)	Percentage of change
1	Precipitation	2055	2255	(+) 200	(+)10
2	Evapotranspiration	776	795	(+)19	(+) 2.4
3	Percolation	575	593	(+)18	(+) 3
4	Surface Runoff	874	1006	(+)132	(+)15
5	Base flow	83	40	(-) 43	(-) 52

(+) indicates increasing and (-) is for decreasing

560. The climate change impact on annual water balance for the study area is given in Table 7-8 for climate change scenario RCP 4.5 in 2050s.The annual average rainfall for the study area will be 2255 mm which is about 10% more than the base condition. The surface runoff also increases (15%) as there is an increase in annual rainfall. There is a little increase in annual evapotranspiration (19 mm) which is mainly due to the increase of temperature. There is also a bit increase in annual percolation due to climate change. However, the base flow will be decreased by 52% as ground water extraction rate will be increased in future.

7.5.4 Water yield

561. The generated water yields were estimated and compared with the base condition to assess the impact of climate change on water availability. Water yield is the net amount of water that contributes to stream (water yield = surface runoff + lateral flow + base flow - total loss - abstraction). The monthly water yield for the base and climate change condition is given in Figure 7.2.

562. The availability of water will increase during February to June as there is an increase in rainfall during that period. During the dry period (November-January), the water availability will decrease due to climate change by 2050s.

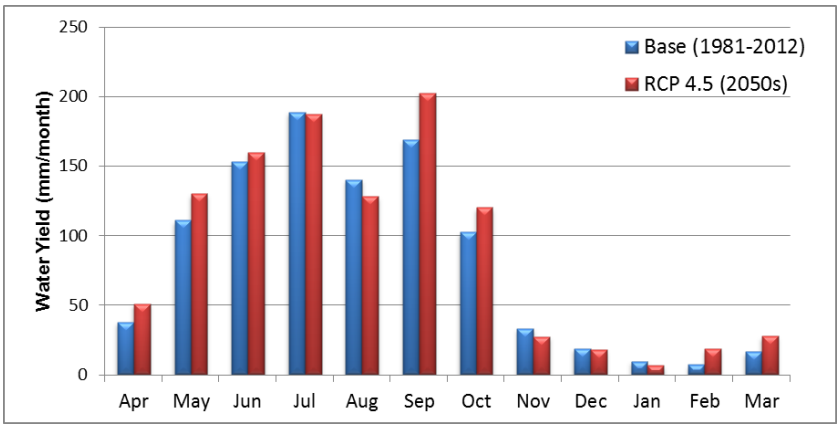


Figure 7.2: Climate change impact on monthly water yield for climate scenario RCP 4.5 by 2050s

563. Variations of seasonal water yield due to climate change scenario RCP 4.5 by 2050s are shown in Table 7.9. The table shows increase in seasonal water yield during the dry season and pre-monsoon as 36% and 22%, respectively. Water yields during pre-monsoon and monsoon are almost similar to the base condition.

Table 7.9: Climate Change impact on seasonal water yield by 2050s for scenario RCP 4.5

Season	Water Yield during base (mm)	Change in water yield due to CC (%)
Pre-monsoon (Apr-May)	149	22
Monsoon (Jun-Sep)	651	4
Post-monsoon (Oct-Nov)	135	9
Dry (Dec-Mar)	52	36

564. **Water level:** Frequency analysis has been done using Gumbel Distribution method (Gumbel, 1958)[19] with respect to maximum and minimum water level shown in Table 7.10. The key observation is that this river is tidally influenced under the low flow regimes such that reverse flow (down stream flow) will tend to maintain constant water level despite of surface water (0.556 m^3/s) withdrawal from river for the cooling purposes of the Project. As a result, hydrological analyses for different options indicate that the changes of average minimum water level are insignificant.

Table 7.10: Statistical analysis on maximum and minimum water level for different return period

Return Period (year)	Maximum Water Level (mPWD)				Minimum Water Level (mPWD)			
	Base condition	Option 1 (Without project scenario)	Option 2 (with project considering Climate change and future water demand)	Option 3 (with project considering Climate change, reduction of upstream flow and future water demand)	Base condition	Option 1	Option 2	Option 3
2.33	6.62	6.79	6.77	6.29	0.94	0.99	0.92	0.91
5	7.19	7.40	7.40	6.84	0.85	0.90	0.84	0.81
10	7.66	7.89	7.90	7.29	0.78	0.83	0.77	0.74
20	8.12	8.37	8.39	7.72	0.71	0.77	0.70	0.66
30	8.38	8.64	8.67	7.97	0.67	0.73	0.66	0.62
50	8.70	8.98	9.02	8.28	0.61	0.68	0.61	0.57
100	9.14	9.44	9.49	8.69	0.55	0.62	0.54	0.50

7.5.5 Monthly average discharge for different scenarios

565. The average monthly discharge of the Shitalakhya River at project site varies from about 84 m^3/s to 1,181 m^3/s for the base condition. The highest discharge occurs during the month of July and the lowest in January. The average monthly flow of the Shitalakhya River at the project site for different condition is given in Table 7-11.

[19]Gumbel EJ (1958) Statistics of Extremes, Columbia University Press, New York, USA

Table 7.11: Average Monthly flow at project area on Shitalakhya River

Month	Base Condition (Flow, m^3/s)	Option 1 (Without Project Scenario) (Flow, m^3/s)	Option 2 (With Project Considering Climate Change And Future Water Demand) (Flow, m^3/s)	Option 3 (With Project Considering Climate Change, Reduction Of Upstream Flow and Future Water Demand) (Flow, m^3/s)
January	83.39	100.13	98.96	96.8
February	83.71	100.46	98.95	96.7
March	90.01	107.18	104.27	102.2
April	111.76	125.74	124.98	121.2
May	202.60	211.64	211.75	181.3
June	563.69	555.85	556.03	435.9
July	1181.43	1275.22	1275.12	891.5
August	1177.86	1339.54	1339.38	889.4
September	1066.69	1205.27	1205.42	808.8
October	692.91	807.62	807.45	527.4
November	170.98	192.57	192.26	157.1
December	109.09	125.73	125.19	116.9

566. As the dry season flow of the Brahmaputra River is expected to change due to climate change, the dry season flow to the Shitalakhya River may also change, depending on the off-take morphology. The difference of dry season flow between Option 1, Option 2 and Option 3 is insignificant because after withdrawing 0.567 m^3/s of river water for the Project, reverse flow will mount up from downstream and maintain the constant water level of the Shitalakhya River. Furthermore, flooding would be increased immediately which may increase the flood flow in the Shitalakhya River for Option 1 and Option 2. However, flood flow will be reduced in Option-3 because the Shitalakhya River receives 25% less water from the Old Brahmaputra River.

7.5.6 Assessment of Environmental flow (E-flow)

567. The increasing demand for river water conflicts with the environmental needs for sustaining flows during drought and low flow periods, leads to competition between water demand and river flow needs. Tennant (or Montana) method (1976) is the most common hydrological method to assess the environmental flow requirements as percentage of mean annual flow. According to Bari and Marchand (2006)[20], the monsoon flow requirement with respect to environmental flow for flushing is 200% of the mean annual flow, while dry season requires 20% of mean annual flow for the good condition of aquatic habitat.

568. E-flow requires for flushing is about 922 m^3/s for the base condition, while about 1,181 m^3/s (21.9 % more) flow is available shown in Table 7.12. Similarly, during monsoon the E-flow will also adequate for Option 1, Option 2 and Option 3.

569. During dry season, E-flow for base condition is 92.2 m^3/s whereas 83.4 m^3/s is available which is partially sufficient for the good condition of aquatic habitat. However, due to climate change impact in 2050s, dry season flow of the Shitalakhya River will be increased for Option 1 and Option 2. Consequently, environmental flow will be increased in that period. Dry

[20] Bari, M F and Marchand, M. 2006. Introducing Environmental Flow Assessment in Bangladesh: Multidisciplinary Collaborative Research. BUET-TUDelft.

season flow for those scenarios (Option 1 and Option 2) is fairly available to meet the E-flow in future.

570. Besides, Option 3 is considered as worse scenario whereas, E-flow is also sufficient (31% more flow is available) during dry period.

Table 7.12: Environmental flow requirement of Shitalakhya River

Seasons	Base condition		Option 1		Option 2		Option 3	
	E-flow (m^3/s)	Available flow (m^3/s)	E- flow (m^3/s)	Available flow (m^3/s)	E- flow (m^3/s)	Available flow (m^3/s)	E-flow (m^3/s)	Available flow (m^3/s)
Dry season (20%)	92.2	83.4	102.4	100.1	102.3	98.9	73.8	96.7
Monsoon (200%)	922.4	1181.4	1024.5	1339.5	1023.3	1339.4	737.6	889.4

571. The environmental flow for the Shitalakhya River during dry season is expected not to be a major concern as there is a tidal influence during that period. Even, if water is diverting from this river, downstream flow (tide) will even out the withdrawal and maintain a constant water level. Besides, the major part of the diverted amount will return to the river as return flow after the condenser cooling process.

572. The observations on above analyses as follows:

- Flow of the Shitalakhya River is expected to be increased in near future due to climate change and adequate flow will be available at the project site.
- Abstraction of surface water at the rate of 0.567 m^3/s for condenser cooling and other operational purposes will have no or slight impact on availability of water in Shitalakhya River for the next 20 years.
- Monsoon flow will be increased in 2050s which may intensify the flood level in and around the study area.
- Dry season flow and water level will also increase in future which will further facilitate the navigation.
- In options 2 and 3, without considering climate change, both dry and wet season flows will roughly be reduced by 10%. The E-flows in option 2 would be 920.7 m^3/s (available flow 1,205 m^3/s) and in option 3 would be 664 m^3/s (available flow 800 m^3/s). So even without climate change, the flow would be sufficient during monsoon season and dry period (considering tidal impact).

7.5.7 Option-4

573. The design life is 20 years for the process plant subject to appropriate maintenance and replacement for items such as catalysts, furnace tubes and mechanical seals which have shorter life duration and will require replacement during the life of the Process Plant. The operating time of the proposed Project is 330 days per annum.

574. At present, approximately 0.583 m^3/s of surface water from the Shitalakhya River is used for different cooling water systems, boiler and cooling blow down, etc. of both UFFL and PUFFL. Raw water withdrawal from the Shitalakhya River would be about 0.567 m^3/s (2,040 t/h) (Design value) for the Project; after storage tank it would be about 0.322 m^3/s (1,159 m^3/h); and after clarified water tank it would be about 0.283 m^3/s (1,020 t/h).

575. The Model was developed and simulated to make a comparison between without project and with project condition. Analysis of hydrological regime has been performed with supplements from developing hydrodynamic and hydrologic model using SOBEK 1D to assess the impact of pump extraction at the project location.

576. The SOBEK modelling suite is an implicit, finite difference model for the computation of unsteady flow, which is developed by Deltares of the Netherlands. The overall approach of hydrological and hydrodynamic modelling is given in Figure 7.3.

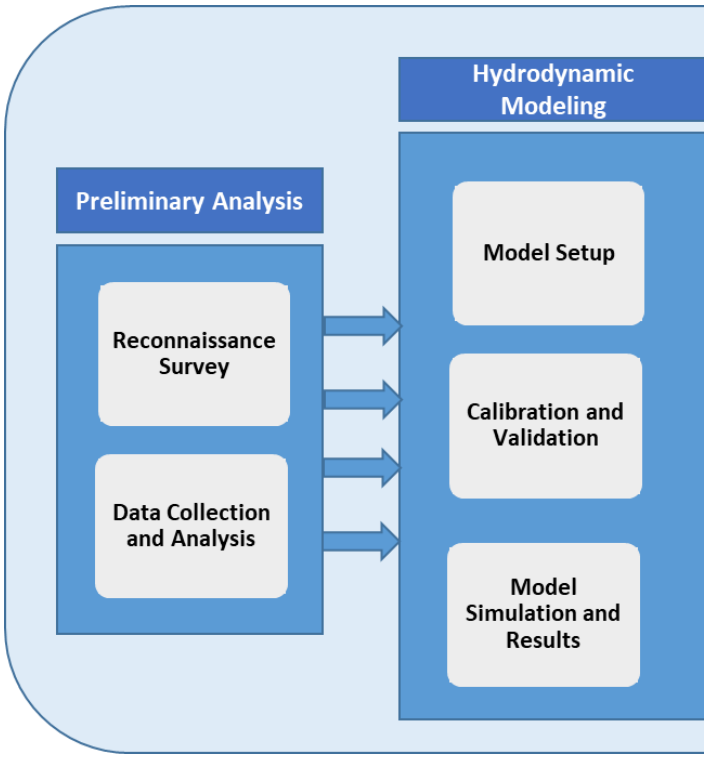


Figure 7.3: Overall approach of the modeling

577. It is to be noted here that, all the pump stations near the study location have been considered in the model. The overall model schematization looks like below (Figure 7.4):

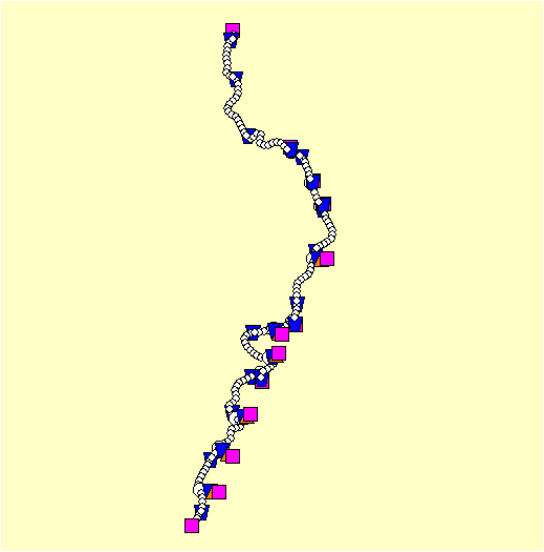


Figure 7.4:Schemtized Model in SOBEK

578. The model result shows that there will be no signifcant change in water availability due to pumping in that area. In the Figure 7.5 below, it can easily be seen that no significant change in highest flood level has been observed sue to extraction of water with pump. The same thing happened in the case of lowest flood level, where a minimum water level was alawys observed in thewater extraction of pump (Figure 7.6).

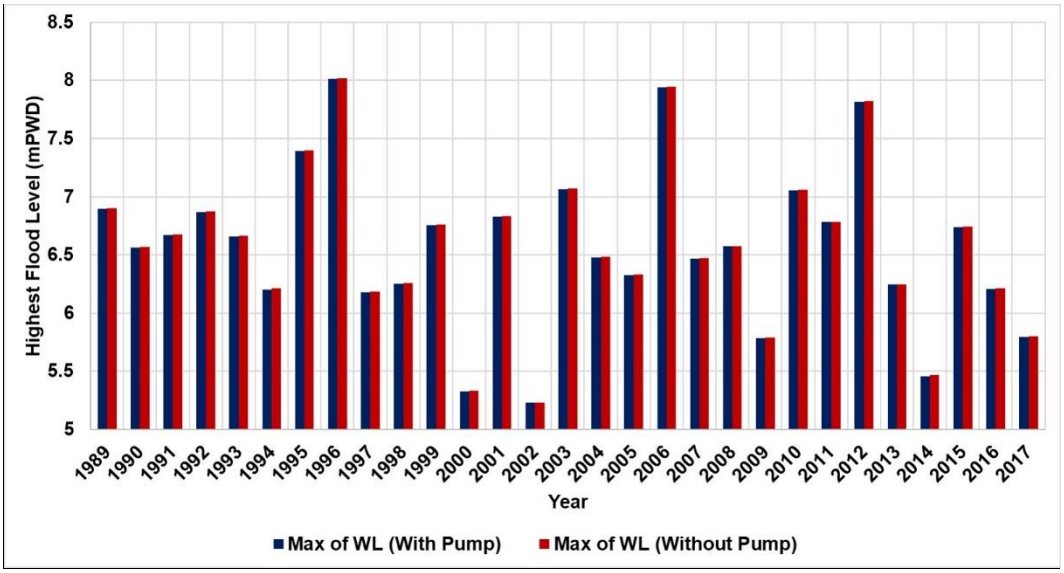


Figure 7.5: Highest Flood Level With and Without Pump

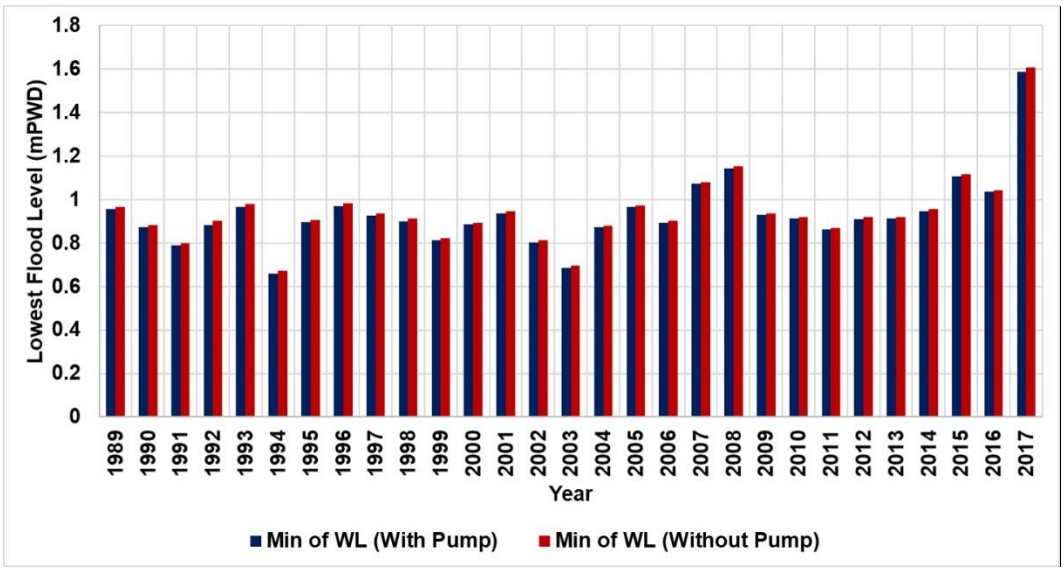


Figure 7.6: Lowest Flood Level With and Without Pump

579. The annual maximum discharge also shows no significant change due to extraction of ground water using intake pump. Also, E-flow required for flushing is about 922 m^3/s during monsoon for the base condition, while about 1013 m^3/s (20% more) flow is seen available shown as in Figure 7.7 below. Also, in case of maximum discharge it also shows no significant change.

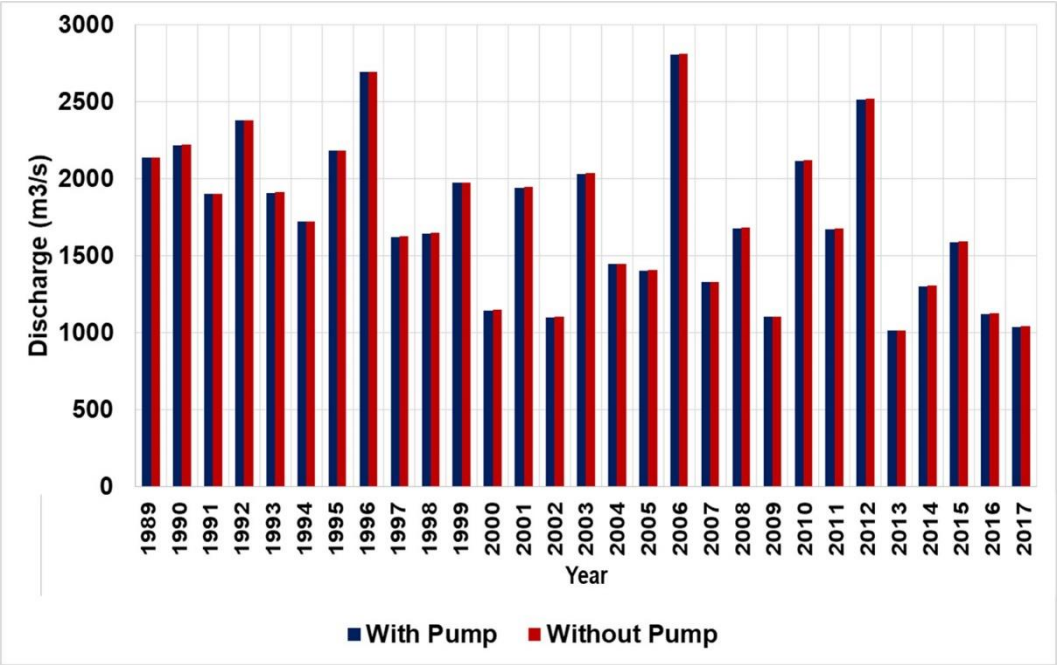


Figure 7.7: High Discharge Rate With and Without Pump

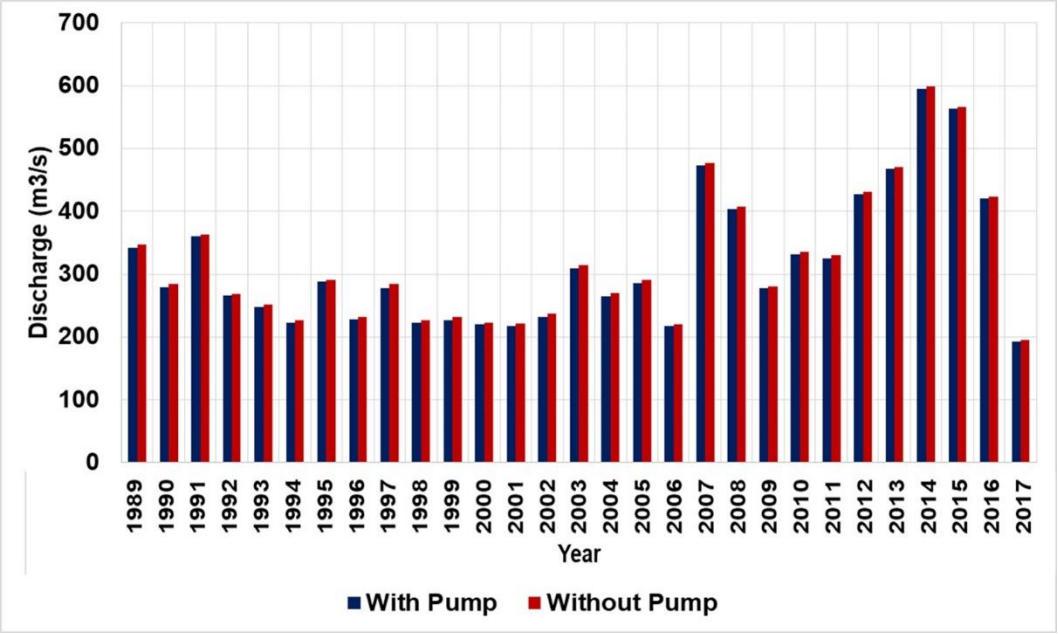


Figure 7.8: Low Discharge Rate With and Without Pump

580. Also, E-flow required for flushing is about 92.2 m^3/s during monsoon for the base condition, while about 192.5 m^3/s (48% more) flow is seen available as in Figure 7.8. Also, in case of minimum discharge it also shows no significant change.

581. Frequency analysis has been done to assess the future water availability with existing pumping rate. Results of frequency analysis are tabulated below:

582. For discharge and water level, four methods (Normal distribution, Log Normal, Log Pearson Type III, Gumbel) have been applied for frequency analysis and compared against each other for the ease of selecting the best method for frequency. In case of frequency analysis result for both minimum (Table 7.13) and maximum discharge (Table 7.14) it has

been seen that, gumbel frequency distribution gives the maximum result hence the outcome of gumbel distribution will be considered.

Table 7.13: Frequency Analysis of Minimum Discharge

Return Period	Normal	Log-n	LP3	Gumbel
2	317	302	300	299
5	407	391	390	394
10	454	448	449	456
20	493	501	505	516
50	537	568	577	594
100	566	617	631	652
200	592	667	686	711
500	625	732	760	787

Table 7.14: Frequency Analysis of Maximum Discharge

Return period	Normal	Log-n	LP3	Gumbel
2	1,751	1,679	1,682	1,668
5	2,178	2,156	2,159	2,116
10	2,401	2,458	2,461	2,412
20	2,585	2,738	2,741	2,697
50	2,792	3,091	3,094	3,065
100	2,931	3,352	3,355	3,342
200	3,057	3,610	3,613	3,617
500	3,210	3,950	3,953	3,980

583. From the above table, it has been seen that, following the gumble distribution the minimum discharge with pumping condition after 100 year becomes 652 m^3/s and maximum discharge after 100 year bcomes 3,342 m^3/s.

Table 7.15: Frequency Analysis of Highest Flood Level

T	Normal	Log-n	LP3	Gumbel
2	6.57	6.54	6.53	6.46
5	7.16	7.15	7.15	7.07
10	7.46	7.49	7.50	7.48
20	7.72	7.79	7.81	7.87
50	8.00	8.13	8.18	8.38
100	8.19	8.37	8.44	8.76
200	8.36	8.60	8.68	9.13
500	8.58	8.88	8.99	9.63

Table 7.16: Frequency Analysis of Lowest Flood Level

T	Normal	Log-n	LP3	Gumbel
2	0.93	0.92	0.92	0.91
5	1.07	1.05	1.05	1.05
10	1.14	1.13	1.13	1.15
20	1.20	1.20	1.20	1.24
50	1.27	1.27	1.29	1.36
100	1.31	1.33	1.35	1.45
200	1.35	1.38	1.40	1.54
500	1.40	1.45	1.48	1.65

584. From the above table, it has been seen that, following the gumble distribution the minimum water level with pumping condition after 100 year becomes 1.45 mPWD and maximum water level after 100 year becomes 8.76 mPWD.

7.6 Pre-construction and Demolition Phase

7.6.1 Impact on Surface Water Quality:

585. Surface water quality degradation due to temporary works include temporary warehouse construction, site canteen preparation and camp accommodation for contractors and for the sub-contractors. Waste water from construction site of structures and buildings might affect the physical (turbidity, pH and TSS and TDS) and chemical (Phosphate, Nitrate) quality of the adjacent water bodies. Earth works; material storage and finally the construction of warehouse, site canteen and accommodation for the contractors and sub-contractors will bring lots of fine sand, debris, dirt and rubbles and cement mixed waters into the drainage system and finally into the lagoon and Shitalakshya River. In addition, metals could also be directed into those water bodies by the above-mentioned activities.

7.6.2 Impact on Ambient Air Quality

586. The proposed Project will be constructed after the demolition of the civil structures and residential buildings of the PUFFL. During demolition, fugitive dust particles will be generated due to dismantling of mechanical equipment, buildings and other civil construction, rubbish storage and transportation, piling up of debris, excavation of trenches, etc. The anticipated volumes of traffic and plant activity will increase over current traffic movement of roads causing emission of dust particles. Therefore, impact on ambient air quality during demolition is limited to dust dispersion on temporary basis. Prolonged inhalation of dust by the site engineers and workers might suffer from lung diseases with symptoms of shortness of breath, coughing, wheezing; chest pain; loss of appetite; tiredness etc.

7.7 Construction Phase

7.7.1 Impact on Surface Water Quality

587. Surface water quality degradation due to civil work (piling, foundation, structure, buildings, shades, roads, drains, pavements etc.). Wastewater from piling and construction site of structures and buildings might affect the physical (DO, turbidity, pH, TSS and TDS) and chemical (Phosphate, Nitrate, and Silica,) quality of the adjacent water bodies. In addition, metals (Iron, Copper and Nickel) could also be directed into those water bodies by these activities. Piling will produce lots of turbid water mixed with sand and other minerals that could increase the nutrients of surface water bodies. Furthermore, fine construction materials could come into water bodies though atmospheric deposition during rainy season. Construction of roads drains and pavements could affect the water bodies in the same way along with oil, grease, and lubricants pollution from the roads pavement.

7.7.2 Impact on Ambient Air Quality

588. Implementation of proposed Plant will involve various activities and machineries for the construction of civil structures and residential buildings. During construction, fugitive dust particles will be generated during erection of mechanical equipment, buildings and other civil construction and transportation, piling up of debris, excavation of trenches, batch mixing plant, etc. The anticipated volumes of traffic and plant activity will increase over current traffic

movement of roads causing emission of dust particles. In addition to these, operation of construction equipment and vehicles may generate insignificant amount of SPM and PM (PM_{10} and $PM_{2.5}$) etc. Therefore, impact on ambient air quality during construction phase is limited to dust dispersion on temporary basis. Prolonged inhalation of dust by the site engineers and workers might suffer from lung diseases with symptoms of shortness of breath, coughing, wheezing; chest pain; loss of appetite; tiredness etc.

7.8 Operation Phase

7.8.1 Impact on Surface Water Quality

589. Though large volume of effluents will be generated in this operation phase, still there will be no considerable impacts. Respecting the ECR'1997 and IFC guidelines in disposing effluents within a certain range of concentrations, this large river has high buffering capacity to dilute the concentrations within short time. Therefore, no considerable/Moderate impacts are assumed/predicted here following the implementation of suggested mitigation measures.

7.8.2 Impact on Ambient Noise

590. Generation of noise from different sources of the Project like utilities, Ammonia Plant, Urea Plant, Granulation Plant, Power Plant and gas transmission line are the major social and environmental concerns for the employees and residential as well as for the passers-by. It is envisaged that the noise level would be increased due to the operation of cooling tower, boiler for steam generation, compressor, RMS, GEG and ST Power Plant operation, primary and secondary reformers, synthesis plant etc. The generated noise will be propagated to the adjacent areas both inside and outside the project boundary. Increasing noise level at the susceptible places may affect the community as well as the wildlife. To assess the noise level, around 13 sensitive receptor points have been selected considering the impact potentiality and susceptible points around the Project site (Figure 7.9). However, a noise propagation modeling has been conducted in order to understand the level of noise dispersed around the project site during operation stage.

591. The noise propagation simulation has been done by using SoundPlan Essential 3.00 software developed by SoundPLAN GmbH. SoundPLAN GmbH is the widely used modeling software for noise propagation simulation in research and consultancy services. A number of standard processes can be calculated through this SoundPlan model. The ISO-9613 calculation process is used for this modeling purpose. Different factors were considered for predicting the noise level at the receiver end, such as the amount of noise generating from the sources, in association with the vehicular transportation on the access road, etc. The model considers the average temperature, 28°C and average relative humidity 80%.

592. As per the specification of the compressor, turbine, reformer, cooling tower, boiler engine, etc. collected from BID Document, noise to be generated from the sources are given below in Table 7.17, which has been used for this modeling study. The land type of the project site has been marked as flat and plain land having vegetation coverage and civil buildings in and around the Project site.

Table 7.17: Noise Generation from different components of the proposed Project

Facility and Zone	Noise Limit Level, dB(A)
Process Compressor/ Turbine/Steam Turbine Generator	95 at one (1) m from source
Rotating machines other than Process Compressor, Turbine, and	90 at one (1) m from source

Facility and Zone	Noise Limit Level, dB(A)
Steam Turbine Generator	
Reformer	85 at one (1) m from source

593. During operation period, the project area will be bounded by 2.5m with 0.5 m barbed wire high brick boundary. Most of the fallow areas inside the Project boundary will be covered by greenery. Boundary wall, structure and green belt will protect dispersion of noise level from the sources. Considering the noise level attenuation measures, the modeling study has been conducted. The results of noise modeling have been shown in Figure 7.10 and Figure 7.11.

Figure 7.9: Noise level at different sensitive receptors during Plant Operation

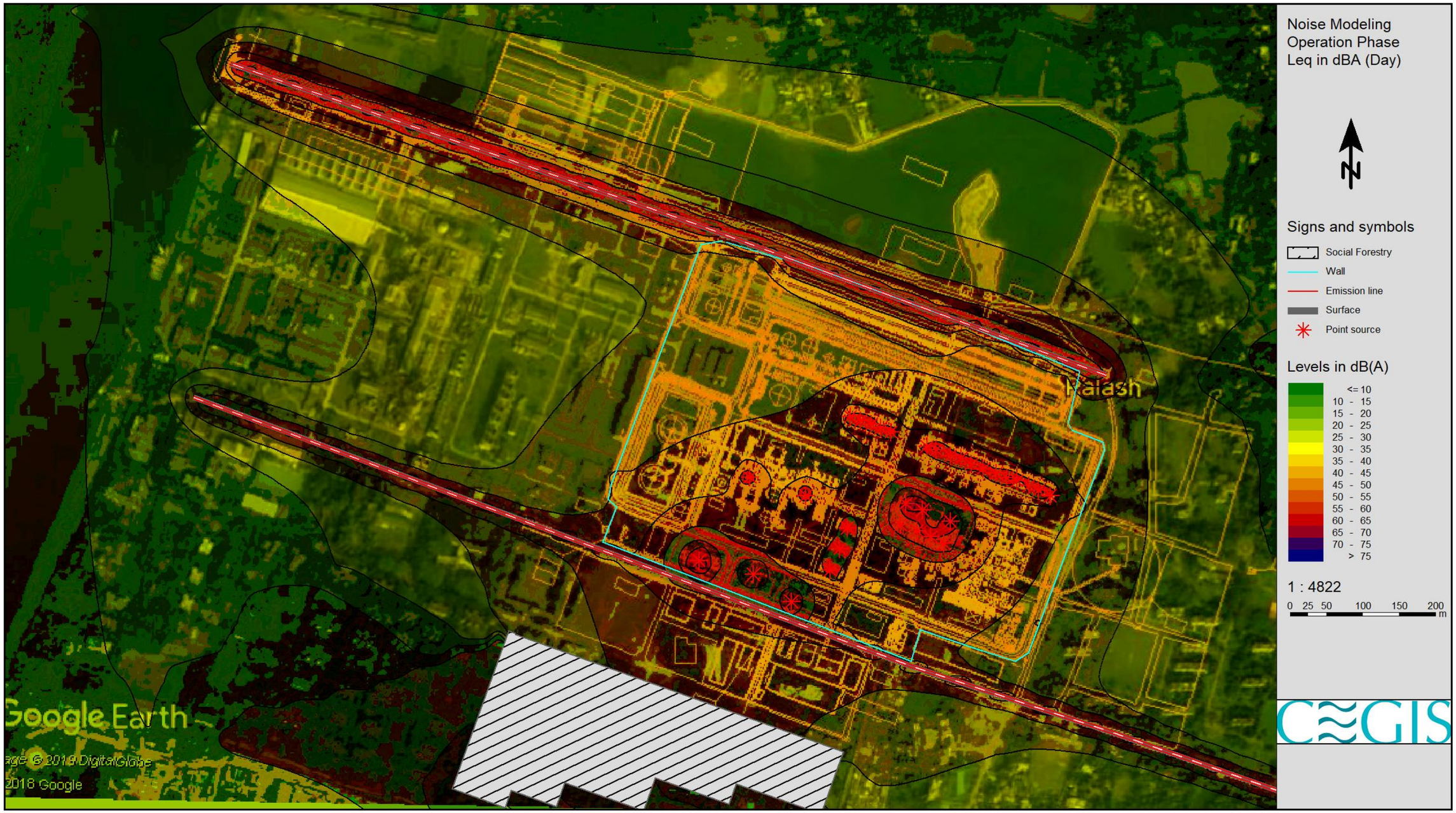


Figure 7.10: Noise Propagation Modeling during Daytime