PART: I - SURVEY REPORT INCLUDING FEASIBILITY STUDY

FEASIBILITY STUDY (SERIES 4 OF 4)

Engineering Economic Analysis

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EXECUTIVE SUMMARY

Tourism is travel for pleasure or business; also the theory and practice of touring, the business of attracting, accommodating, and entertaining tourists, and the business of operating tours. Tourism can be domestic (within the traveler's own country) or international, and international tourism has both incoming and outgoing implications on a country's balance of payments. Bangladesh's tourist attractions include historical monuments, resorts, beaches, picnic spots, forests and tribal people, wildlife of various species. Activities for tourists include angling; water skiing, river cruising, hiking, rowing, yachting, and sea bathing.

In the south-eastern part, which is the Chittagong Division, there are natural and hilly areas like Chittagong Hill Tracts, along with sandy sea beaches. The most notable beach, in Cox's Bazar, is a contender for the title of longest unbroken sandy sea beach in the world. Teknaf is an upazila of Cox's Bazar district under Chittagong division. It is the southern-most point in Bangladesh and it shares the border with Myanmar. The upazila is situated on the bank of Naf River and the hilly areas of Cox's Bazar. The scenic and enchanting beauty of Naf River, hills, forests and sea beach of Teknaf attract the tourists. Tourists can enjoy the river from the top of the hill which is the entrance of the town. Teknaf Sea Beach is one of the longest sandy beach ecosystems (80 km) in the world which is also very attractive for its blue and clear water. There is Mangrove forest also. One of the main attractions of teknaf will be the Naf Tourism Park. The Naf Tourism Park is a proposed economic zone in the Jaliardwip, Cox's Bazar, and will be the first exclusive tourism park in Bangladesh. BEZA is developing this as part of its plan to develop 100 special economic zones throughout the country.

Naf Tourism Park will be located in the Jaliardwip Island which is situated in the middle of the Naf River that divides Myanmar and Bangladesh. The island is diverse and multifaceted as it has both hill and river view. Naf Tourism Park will be the first island based tourism park in Bangladesh encompassing an area of 271 acres. Naf Tourism Park is located on an egg-shaped island raised in the middle of the Naf River under Teknaf Upazila of Cox's Bazar. It has scenic Beauty with a hill view on both Myanmar and Bangladesh

Specialty of Naf Tourism Park will be Theme cruise for St. Martin Coral Reef Island, 5 star hotel, Restaurant, Honeymoon Park, Multi formatted Food Court & Themed Pavilions Jungle, jogging Tracks, Night Camps, Eco-Friendly Resorts, Mini Golf Course, Light & Sound Show, Entertainment Zone, Infant Swimming Pool, Cable Car, Sky Bridge, Oceanerium, Water Sports Complex, Game Parlors, Birds Watching and View Tower, Harbor Bridge, **Cable Car Hanging**, Hanging Bridge.

A feasibility study is an analysis used in measuring the ability and likelihood to complete a project successfully including all relevant factors. A good feasibility study should focus on the proposed plan of action and provide a detailed estimate of its costs and benefits. The ONUSHANDHANI CREEDS LIMITED has carried out a feasibility study for "the construction of Cable Car at Naf Tourism Park" project. The purpose of this report is to investigate and provide reliable, specific and detailed information about the ability and likelihood to complete the project successfully including all relevant factors.

The project's return like IRR, NPV and BCR is **positive** specially the IRR is greater than 12%. In case of sensitivity analysis with 10% cost increase the return of the project is positive and

especially IRR is more than 12%. So the project is both economically and financially viable. It is, therefore recommended for implementation of the project.

BEZA is responsible to execute this project Construction of Cable Car at Naf Tourism Park. At present, the route is Ne-Taung Hill to Naf Tourism Park (9.5km), after the construction of the Cable Car tourist attraction will increase in this area. As a result, this project will have a positive impact on overall economic development and at the same time, it will play an important role in promoting national tourism and improving the living standard of the locals.

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ACRONYMS AND ABREVIATIONS

Name	Description
BMD	Bangladesh Meteorological Department
BPDB	Bangladesh Power Development Board
EC	Environmental Clearance
ECR	Environmental Conservation Rules
EIA	Environmental Impact Assessment
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
FGD	Focus Group Discussion
FMO	Netherlands Development Finance Company
GRM	Grievance Redressal Mechanism
IEE	Initial Environmental Examination
IFC PS	International Finance Corporation's Performance Standards (2012)
IP	Indigenous Peoples
IPDP	Indigenous People's Development Plan
IUCN	International Union for the Conservation of Nature
KII	Key Informant Interview
LRP	Livelihood Restoration Plan
PAH	Project Affected Household
PAP	Project Affected Person
PGCB	Power Grid Company of Bangladesh Limited
RAP	Resettlement Action Plan (inclusive of a Livelihood Restoration Plan)
RoW	Right of Way
SEP	Stakeholder Engagement Plan
ToR	Term s of Reference

CHAPTER 01: INTRODUCTION

1.1. Background of the Project

The Government of Bangladesh has embarked on the program to develop new Economic Zones in the country, with the objective of inclusive economic growth and job creation through developments of industries. For the development of Naf Tourism Park on 291 acres of land in the middle of the Naf River, joint efforts have been made with the forest department to set up 9.5 kilometer long cable car as a mean of communication and tourist attraction.

The project site is located at approximately 8 km from the center of Teknaf Upazila. The proposed EZ will be connected with the Marine Drive at the northern periphery, which will be used for access to the EZ. The proposed project is planned on area of 967 acres of which the Khas land constitutes 935.88 acres and 31.18 acres' land belong to Bangladesh Water Development Board (BWDB). The Marine drive is under construction. Highway Teknaf-Shahparirdwip Road (Z1099) runs parallel to the site at a distance of 5 KM. It connects the National Highway N1. The site is about 210 KM from Chittagong Railway Station and around 96 KM from Cox's Bazar Domestic Airport. A cable car connection will be constructed from Ne-Taung Hill to Naf Tourism Park (9.5km).

Figure 1.1: Present Scenario of Teknaf Upazila

The economic zone is proposed to be located in the Sabrang Mouza of Upazila Teknaf at Cox's Bazar district of Bangladesh, approximately 90 KMS from the Cox's Bazar. The total land area demarcated for the proposed economic zone is 967 acres, which includes Khas

Land (878.26 acres), canals and ponds (57.62 acres) and land under Bangladesh Water Development Board (31.18 acres).

Figure 1.2: Beauty of Teknaf Upazila

The economic impact of a fully developed and thriving cable car can be substantial boon to local and regional economies. Consequence of this has planned to build up a cable car at Naf Tourism Park, Teknaf Upazila of Cox's Bazar district. For this The Onushandhani Creeds Limited has carried out a feasibility study for the Cable car of Naf Tourism Park project by measuring the ability and likelihood of the project successfully including all relevant factors. This study should focus on the proposed plan of action and provide a detailed estimate of its costs and benefits.

Figure 1.3: Study Area map of Proposed Project

1.2 Project Objectives

This project is planned for enhancing tourism opportunities in Teknaf area, at present and in the future. The main goal of the project is to enhance whether or not it will work, and whether or not it is worth doing economically.

The objective of this study is to evaluate the economic and financial feasibility of the project Cable Car at Naf Tourism Park, Teknaf Upazila of Cox's Bazar district. The Feasibility study has the following specific objectives:

- To acquire a sense of its scope
- To determine how successful the project will be
- To provide quality information in order to assist in decision making
- Efficiency indicators that focuses on financial and economic appraisal
- Equity indicators that focuses on distribution of project benefits
- Efficiency indicators that focuses on financial and economic appraisal

1.3 Scope of Work

The Scope of Work for this feasibility study includes:

- Prioritize and specify the required physical investments;
- Develop business plans, undertake feasibility assessments including complete financial modeling
- The technical design and the needed investment and operational costs in terms of structure costs, staff costs, routine maintenance costs and energy costs
- An analysis of the demand, the applicable fares and the consequent revenues
- The project benefits mainly in terms of additional contributions to national and local GDP
- Undertake detailed environment and social impact assessment, Incorporate environmental and social management considerations to manage safeguards risks, and Provide technical engineering designs for the project

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1.4 Content of this Report

The Final Feasibility Report is divided in various sections as follows:

- Section 1: Introduction
- Section 2: The Cable Car
- Section 3: Previous Study
- Section 4: Survey and Investigation
- Section 5: Demand Assessment
- Section 6: Project Cost Estimation
- Section 7: Financial and Economic Analysis
- Section 8: Environmental Review
- Section 9: Social Review
- Section 10: Stakeholder Discussion
- Section 11: Findings and Recommendations

2.1 Project Location

Teknaf Upazila is the southern-most city on the mainland in Bangladesh, on the narrow strip running along the coast of Myanmar. It's a dusty featureless frontier town - this is remote Bangladesh and it feels like it. Electricity can be scarce, so having a flashlight for the dark evenings is wise. Teknaf Upazila (cox's Bazar district) area 388.68 sq km, located in between 20°23' and 21°09' north latitudes and in between 92°05' and 92°23' east longitudes. It is bounded by ukhia upazila on the north, the Bay of Bengal on the south, arakan state of Myanmar on the east, the Bay of Bengal on the west. Teknaf upazila, located on the south east extremity of Bangladesh, is 86 km on the south of Cox's Bazar Town.

Teknaf is an Upazila of Cox's Bazar District in the Division of Chittagong, Bangladesh. It forms the southern-most point in mainland Bangladesh (St. Martin's Island is the southern-most point). The name of the region comes from the Naf River which forms the Eastern boundary of the upazila. It shares the border with Myanmar. Tourist spot of teknaf is St. Matin's Island (It is located 12 km from the main land and is the only coral island of Bangladesh). St. Martin's Island is comprised with four islands such as Zinzira, Dakshin Para, Chhalchhira and Bechhadia. The total area of the island is 4.8 km.

Figure 2.1: Colorful Boats at Teknaf Beach

Teknaf beach is a large beach about 5km west of the center of town, very popular with locals at sunset. It's much quieter than Cox's Bazar, though the 50+ motorcyclists racing back and forth along the shoreline won't help you to relax, nor will all of your new friends. There's a small snack shack where the road meets the beach.

Figure 2.2: Sea Beach of Teknaf

Take a walk over the bridge, passing the river filled with colorful fishing boats, makeshift houses filled with curious children, and beautiful farmland looking out towards Myanmar, dotted with patrolling soldiers.

2.2 Route Description

Buses running from Cox's Bazar are crowded and pass through nice scenery as get closer to Teknaf. It takes nearly two hours to enter into teknaf from cox's bazaar. There are also Straight bus service Directly from Dhaka to Teknaf. Naf Tourism Park is located on an egg-shaped island raised in the middle of the Naf River under Teknaf Upazilla of Cox's Bazar. It has scenic Beauty with a hill view on both Myanmar and Bangladesh. The cable car connection will be constructed from Ne-Taung Hill to Naf Tourism Park (9.5km).

Figure 2.3: Distant View of Jaliardwip

2.3 Terminal Locations

The cable car connection will be constructed from Ne-Taung Hill to Naf Tourism Park (9.5km). There will be three terminals which have been named Terminal A, B and C. In this three terminals only B point will be in an elevated position from ground and other two terminals will be on ground.

Figure 2.4: Approximate location of point A- Near Marine drive side

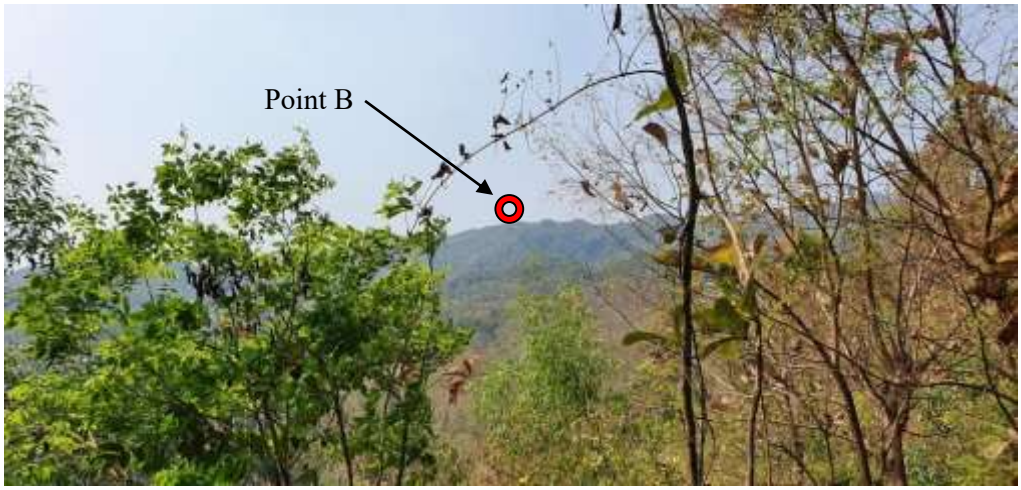


Figure 2.5: Approximate location of point B- Top of the Ne-Taung Hill

Figure 2.6: Approximate location of point C- Jaliardwip

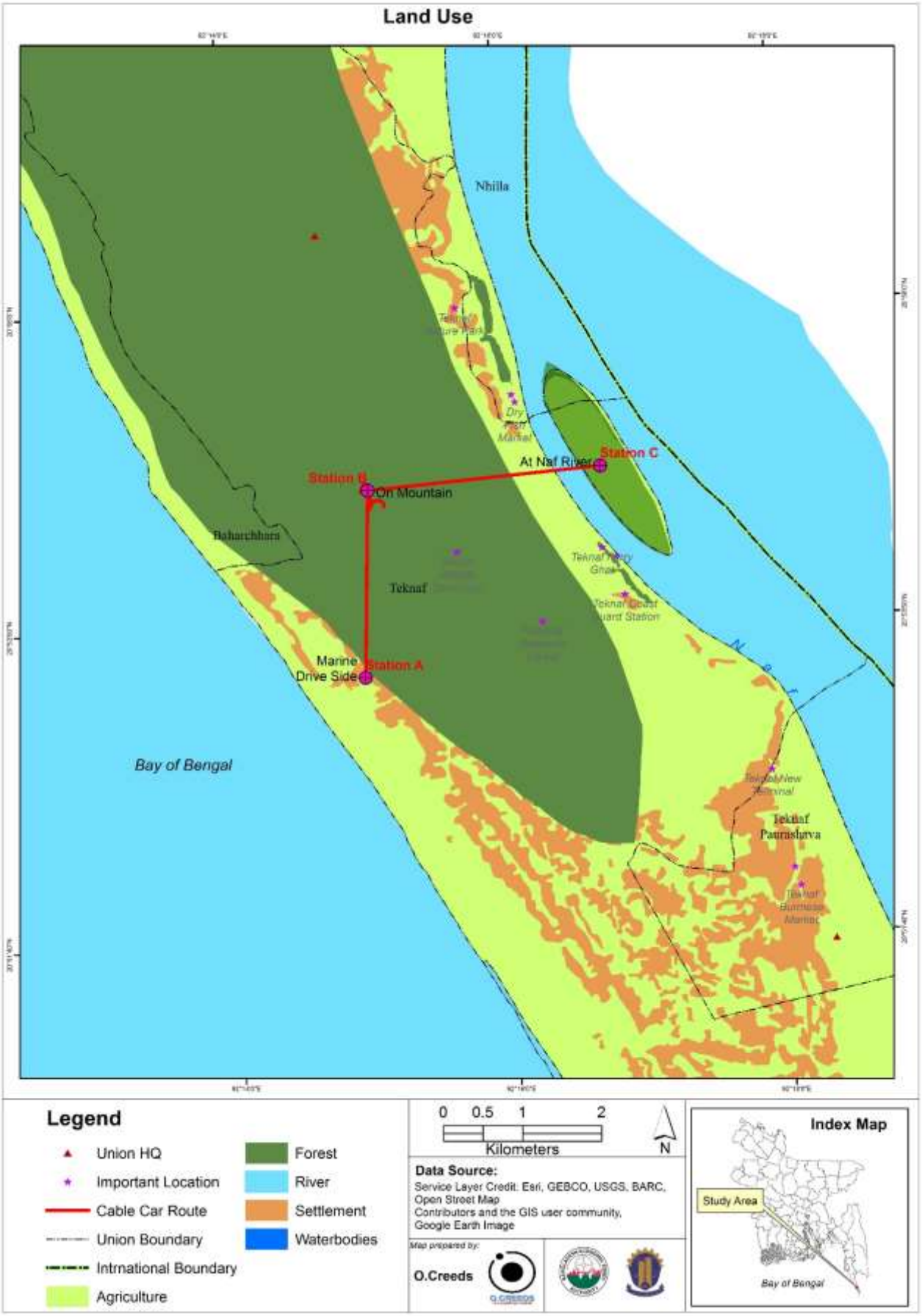


Figure 2.7: Project Area Land use map locating three terminals

3.1 Tourism Trends

Every industry has trends and innovations — the tourism industry is no exception. Changing demographics, advances in technology, shifting social mores: these influences and others all help give rise to important new tourism trends. In a rapidly-evolving landscape, new trends are appearing and taking hold all the time.

Creative tourism is distinct in that visitors actively seek contact experiences and an authentic sociocultural encounter. Authentic tourism is closely connected to other tourism trends, such as the impact of Millennials. Millennials are typically aged between 18 and 30, and are interested in pushing the boundaries of travel so that they experience non-resort events.

Some trends are driven by customers and their desire for experiences different from what we've previously seen as commonplace. Others are driven by the tourism industry itself and its adoption of new technologies that improve their companies and the experiences their customers have. Read on now to find out more about the current trends in the travel and tourism industry.

3.1.1 Global Context

Historical System evolution and description of Cable Car

Historical System evolution and description generally, cable cars are mainly used in regions of high altitude for tourism, and for public transportation in some cities located in mountains, with Medellin in Columbia, Caracas in Venezuela, and Algeria in the world considered as some examples. This alternative means of transport has shown a remarkable change in the people's daily life. It improved accessibility and mobility for residents, particularly for citizens living in areas where the topography limits other forms of transport. Some of the major advantages of cable car technology have ability to climb gradients with slopes as high as 100 percent or greater, minimum direct impact to the environment due to the use of electricity instead of fuel and reduced noise pollution lower cost of implementation and operation than other transportation systems, and accident rate of approximately 0%. Medellin is the second largest city in Columbia with a population of approximately 3.5 million. Mobility of people, especially ones located in informal settlements, was limited due to high steep sloppy mountains. It was in 2004 that the government together with private sectors took initiative of constructing the first cable lines above the city as a means of public transport.

Like Medellin, in Caracas, the aerial ropeway systems were planned as feeders to the existing rail based high capacity public transport line connecting hillside neighborhoods to the remaining urban areas. The first metro-cable line in Caracas was planned to connect the community of San Agustin to central park station, where it is linked to the subway system. The Cable of Constantine opened in 2008 to connect the east and west sides of the city of Constantine, Algeria. The system has three stations, including two terminals and one intermediate station. The first section of the line is 425 m long and the second section is 1,091 m long, resulting in a total line length of 1,516 m. The system serves 100,000 residents of the northern sector of the city. The system is popular among the residents, as it carries more than 10,000 passengers per day. In fact, the success of the first aerial rope transport line in Constantine seems to have encouraged the local authorities to repeat the experience by

offering the government to create no fewer than four new lines to relieve transportation problems in Constantine, which is known for its particularly rugged topography.

Previous Studies Related to Cable Cars

Different authors have conducted many studies. Below is presented an overview on some of them. In the study of Sergej et al. on increasing the capacity of cable cars for use in public transport, two types of the use of cable cars discussed deeply. One based on a single platform (the existing system) and the other one based on two platforms (the proposed system). The theoretical capacity of the existing system established at 4114 persons per hour, while the one for Gondolas estimated at 8228 persons/hr. The capacity found using this system is comparable to the capacities of other high-performance systems designed to carry persons in public passenger transport. Top speeds in relation to regulations would be 6 m/s for mono-cables and 7 m/s for bi-cable systems [3] [10]. Regarding the cost estimation, the study conducted by Clement et al. presents the investment cost for mono-cable gondolas in mountain areas. Sergej et al. also mentioned that the price of gondolas with two platforms in stations would be slightly lower than for two parallel conventional gondolas.

Before conducting this feasibility analysis, it was necessary to compile a list of major cable cars, which built to traverse shipyards and water bodies. The map below illustrates some of these major systems and their respective locations. This section will mostly focus on discussing best practices for cable cars operating above water

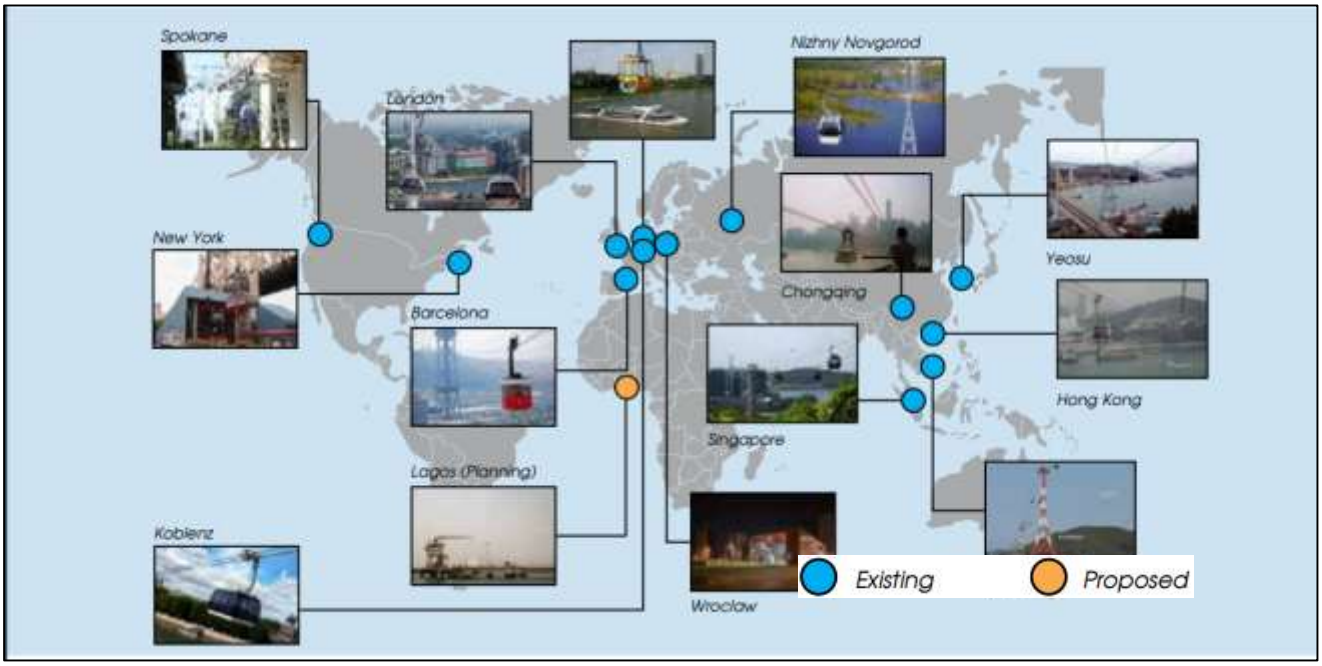


Figure 3.1: Major Shipyard/ Water Crossing Cable Cars

Table 3.1: Major Water Crossing Cable Car

System	Application/ Purpose	Water Body /Harbour	Length (km)	City	Technology	Speed (m/s)	Capacity (pphpd)	Cabins
Singapore Cable Car	Tourist / Urban	Keppel Harbour	1.7	Singapore	MDG	5	2000 (up to 2800)	112
Ngong Ping 360	Tourist / Urban	Tung Chung Bay	5.7	Hong Kong	BDG	7	3500	67
Emirates Air Line	Tourist / Urban	Thames River	1	London	MDG	6	2500	34
Yeosu Cable Car	Tourist / Urban	Namhae Sea	1.5	Yeosu	MDG	5		50
Roosevelt Island Tram	Tourist / Urban	East River	1	New York	Dual Haul	7.5	1000+	2
Vinpearl Cable Car	Tourist / Semi-Urban	Nha Trang Bay	3.3	Nha Trang	MDG	6	1500	65
Nizhny Novgorod Cable Car	Tourist / Urban	Bor River	3.6	Nizhny Novgord	MDG	6	500 (up to 1000)	28 (up to 56)
Yangtze River Cable Car	Tourist / Urban	Yangtze River	1.2	Chongqing	Aerial Tram	10	1150	2
Polinka	Tourist / Semi-Urban	Oder River	0.3	Wroclaw	Aerial Tram	5	370	2
Spokane Falls Skyride	Tourist / Urban	Spokane River	0.4	Spokane Falls	Pulsed Gondola			6
Kolner Seilbahn	Tourist / Urban	Rhein River	0.9	Cologne	BDG	2.8	1600	44
Wuhan Cable Car	Tourist / Urban	Hanjiang River	0.9	Wuhan	MDG	5	1000	18
Koblenz Seilbahn	Tourist / Urban	Rhein River	0.9	Koblenz	3S	7	3800	18
Port Vell Aerial Tramway	Tourist / Urban	Port Vell	1.3	Barcelona	Aerial Tram	3	150	2

Polinka Cable Car

Year: 2013 Location: Wroclaw, Poland Length: 0.3km Capacity: 370 pphpd Ridership: N/A Cost: USD $4mm Trip Time: 2.5 minutes. The Polinka is one of the only known cable cars systems in the world that built primarily for a university. Wroclaw (pronounced vrots-wahf) is Poland's fourth largest city, and considered a hub for higher education. The Oder River separated the Wroclaw University of Technology's Campus Districts. A footbridge was considered but was eliminated because it was significantly costlier than a cable car (zl 15-17

million vs. zl 8 million) and obstructed marine traffic. When the aerial transit concept presented, it met with great enthusiasm. As a result, the university, in collaboration with the City opted to implement an urban cable car.

Figure 3.2: Polinka Cable Car, Poland

Mount Faber Cable Car

Year: 1974, Location: Singapore, Length: 1.7km, Capacity: 2,000 pphpd, Ridership: 900,000, Cost: USD $14.7mm, Trip Time: 15 minutes

Figure 3.3: Mount Faber Cable Car, Singapore

The Singapore Cable Car is a unique urban gondola located in the city-state of Singapore. While less than 2km in length, it travels through and/or above a diversity of built forms such as a forest, a 15 storey office tower, a harbor and an amusement park. It was built to provide visitors with an exciting aerial ride to the island resort of Sentosa.

Roosevelt Island Tram - Case Study

Year: 1976 (modernized 2010) Location: New York City Length: 1.0km Capacity: 1000+ pphpd Ridership: 2, 300, 00 Cost: USD $25 mm Trip Time: 3 minutes Fare: USD $2.50

The Roosevelt Island Tram is an aerial transit system that travels 76m above the East River from New York City's Roosevelt Island to Manhattan. It was initially built in 1976 as a temporary transport relief line before a subway stop was provided. However, the Tram proved to be a safe, reliable and convenient method for island residents. As such, even after a subway station was built in 1989 on the island, 4000 daily residents continued to rely on the Tram. Today, daily ridership has reached 6,400. As a temporary relief life, the system was originally designed to operate for 17 years but operated for 34 years until it underwent a $25 million modernization program.

Emirates Air Line - Case Study

Year: 2012 Location: London Length: 1.1km Capacity: 2,500 pphpd Ridership: 1,800,000 Cost: USD $90.0 mm Trip Time: 5 minutes

London's first urban cable car, Emirates Air Line, was opened in June 2012 just ahead of the summer Olympic Games. It signed a large ~USD$50 million (£36 milion) sponsorship deal with Dubai airline, Emirates Airline. Given its implementation over the River Thames in a highly urbanized context, it may provide project planners in Gotheborg with a number of important lessons. Some noteworthy designs and features implemented on the Emirates Air Line include:

- Designed with three tall towers (60m, 84m, 87m) to enable ships to pass underneath
- South main tower located 60m from shore in Thames River; has a barrier system to prevent boats from sailing into tower
- Three spiral towers have staircases to enable evacuation and maintenance
- During emergencies, passengers have access to an alarm button, which allows communication with the control station. The power is supplied by supercaps designed on the cabins
- Cabins contain emergency boxes containing food and beverages.

Reininghaus Cable Car Graz, Austria

Contract: Feasibility study
Technology: Mono-cable Gondola Detachable (MGD), tram
Duration: 2013 – 2014
The Reininghaus district in the southwest of Graz is being developed. The size of the land is about 50 ha, and in the final expansion stage 20.000 people shall populate it. A lot of attention is given on green living environments and energy optimization. The connection of the district to the public transportation network using smart and modern transport solutions shall be an integral part of the infrastructure project. Thus, the use of green means of transport such as tram and cable car with sufficient passenger capacity shall be investigated. The following tasks have been executed as part of the feasibility study:

- Ridership analysis and capacity determination
- Examination of various track alignments and station locations for tram and cable car systems
- Connection to the existing public transport network
- Evaluation of possible combinations of tram and cable car systems
- System calculations and design for the various options
- Preliminary design for station, tower, vehicle, and drive equipment
- Life cycle cost calculations
- Value benefit analysis and rating of the various options
- Development of Public-Private Partnership (PPP) finance models
- Economic calculations using the Net Present Value (NPV) method

3.1.2 National Context

The underlying technology of cable cars has been around for almost a century, where it has been applied mostly in terrain-challenged recreational contexts (i.e. in ski resorts) to transport skiers and tourists from the bottom to the top of the mountains and vice versa. In more recent times, the cost-effectiveness and flexibility of aerial lifts has seen increases of gondola lift being integrated into urban public transport systems. There are several types of ropeways. In our country, ropeways are installed and used only in two places.

Figure 3.4: Cable car at Meghla Parjatan Complex", Bandarban

One is located in the "Meghla Parjatan Complex", Bandarban and the other is in the "Sheikh Russel Aviary and Eco-Park", Rangunia, Chittagong under the supervision of Bangladesh Forest Department. Both of these are constructed in hilly areas to ease out travelling of tourists and to amuse them. The beautiful lake Meghla, around four kilometres away from Bandarban town, has become the first venue to install cable car system in the country. In "Meghla Parjatan Complex", they have the first ever cable car system in Bangladesh. The Cable Car Way of the "Sheikh Russel Eco-Park" is the longest and the 2-nd cable car system in Bangladesh. It is

one type of aerial gondola lift and installed by an Indian company “Conveyor and Ropeway Service”.

Figure 3.5: Cable car of Sheikh Russel Aviary and Eco-Park”, Rangunia

3.1.3 Tourism in Teknaf

For the greater good of the country, plans have been set in motion, to transform the tourism sector of the country in general and Cox's Bazar region in particular.

Bangladesh Economic Zone Authorities (BEZA) has taken up three projects:

1. Naf Tourism Park
2. Sabrang Tourism Park and
3. Sonadia Eco Tourism Park

All located in the district of Cox's Bazar

BEZA is currently developing three tourism parks in three islands in Cox's Bazar with the hope that it will attract tourists from both home and abroad as well as create scope for additional foreign and local investment. These island-based ecotourism parks have massive potential since people want to enjoy their vacations in a calm and peaceful environment.

Both domestic and foreign tourists are expected to get more facilities, once the projects are implemented and that will help attract more tourists. The main objective of the tourism parks is to increase economic growth by creating job opportunities through business diversifications.

Naf Tourism Park

Bangladesh is going to get a new tourist attraction as BEZA has initiated measures to develop modern tourism facilities on 'Jaliardwip' - a 271-acre island on Naf River. The project is titled as 'Naf Tourism Park'.

Jaliardwip, the once neglected island is located in the middle of Naf River and was illegally occupied by a group of locals for over 40 years. BEZA has already been able to get rid of most of these encroachers and now it is set to become the very first river based Tourism Park.

Figure 3.6: Beauty of Jaliardwip

The first park of its kind will open a new era of tourism in Bangladesh as it will have all world-class facilities found in world-class tourism parks across the globe. Siam Siam International, a Thai company is reported to have shown interest in investing USD 500 million - equivalent to BDT 4,200 crore - to develop various tourist facilities at Jaliardwip Island.

Jaliardwip is an amazing island in the middle of the Naf River and it lies between the river border of Myanmar and Bangladesh. Having hill and river view, it is multifaceted, diverse and admirably beautiful. The purest air and lofty hill create perfect conditions for the development of all types of tourism and entertainment facilities. The lofty hill and river have created a perfect condition for the island to be a world-class tourist spot.

A 5.2 km long embankment will be built around the park. BEZA has also received clearance from the Ministry of Forest and Environment to operate cable cars. The Naf Tourism Park extends over a total of 271.93 acre land, which is 456 km from Dhaka and 185km from Chittangong. It is 70km from the Cox's Bazar Airport.

An attractive hanging bridge will be constructed beside the land port for journey to Jaliardwip. Tourists will reach the Jaliardwip to enjoy the beauty of nature. The island would be connected to the main land through a cable car and roller coaster. The tourism park will have facilities like five-star hotel, hanging bridge, 9.5 kilometre cable car network, floating jetty, children's park, eco-cottage, oceanarium and water-restaurant, hanging resort, convention centre, swimming pool, fun lake, aqua lake, fishing jetty, amusement park, parking area and shopping area for the tourists.

Moreover, the economic zones authorities also plan to set up a theme park where touch pool, night camp, bird watching and watch tower, water sports complex, butterfly park, eco-energy park, game parlour, mini-golf course, MICE club, health club, light and sound show would be available for the tourists. It is expected that Jaliardwip is going to open a new chapter for

tourism sector in the country. Myanmar and Netang Hill will entertain the visitors and attract the domestic and foreign nature lovers.

Figure 3.7: Naf River View from jaliardwip

CHAPTER 04: SURVEY AND INVESTIGATION

4.1 Survey Activities

This report presents a brief description of the survey activities performed in connection with feasibility study for Cable Car at Naf Tourism Park. It has been prepared focusing on the survey activities and analysis of collected data. The outcomes of the survey have been presented in the report.

Figure 4.1: One part of The Survey Team

Due to corona pandemic situation it was really tough to visit the project site but a team of Onushandhani Creeds limited professionals have visited the project area on March 18th, 2020 for Reconnaissance Survey.

Figure 4.2: TIA and House Hold Survey Team

A team of Twelve people including environmental expert, Household surveyor and Traffic count Surveyor visited the project site for House hold survey, Traffic impact assessment, Environmental testing, FGD and KII from September 2nd to September 4th, 2020.

Onushandhani Creeds Limited has conducted the survey works primarily for two different purposes. One is directly related to the transmission line of the cable car and the other is to provide data for the study. Main components of the first purpose have been the proposed transmission route and topographic surveys at the proposed project site.

4.2 Survey Methodology

4.2.1 Reconnaissance Survey

Before mobilization of the survey team, a reconnaissance survey has been conducted by a team comprising members from Onushandhani Creeds Survey and modelling divisions.

Figure 4.3: Survey Team In front of Keari Sindabad Ship

The team visited the project site, proposed Terminal points, Project influence area, and the proposed transmission route and interest areas for the study.

Figure 4.4: Survey Team at Approximate Position of Point A

Survey team has collected soil samples, water samples, measure air quality and noise. Based on the reconnaissance survey, a detailed survey plan has been prepared in consultation with the team.

4.2.2 Survey References

The entire survey work has been carried out taking two references. One is the vertical elevation datum and the other is the geographic co-ordinate system.

4.2.3 Topographic Survey

Topographic surveys have been conducted along the proposed transmission route at the project area using by RTK and Total Station. All of these transmission route cross sections have been taken by using Optical Level machine

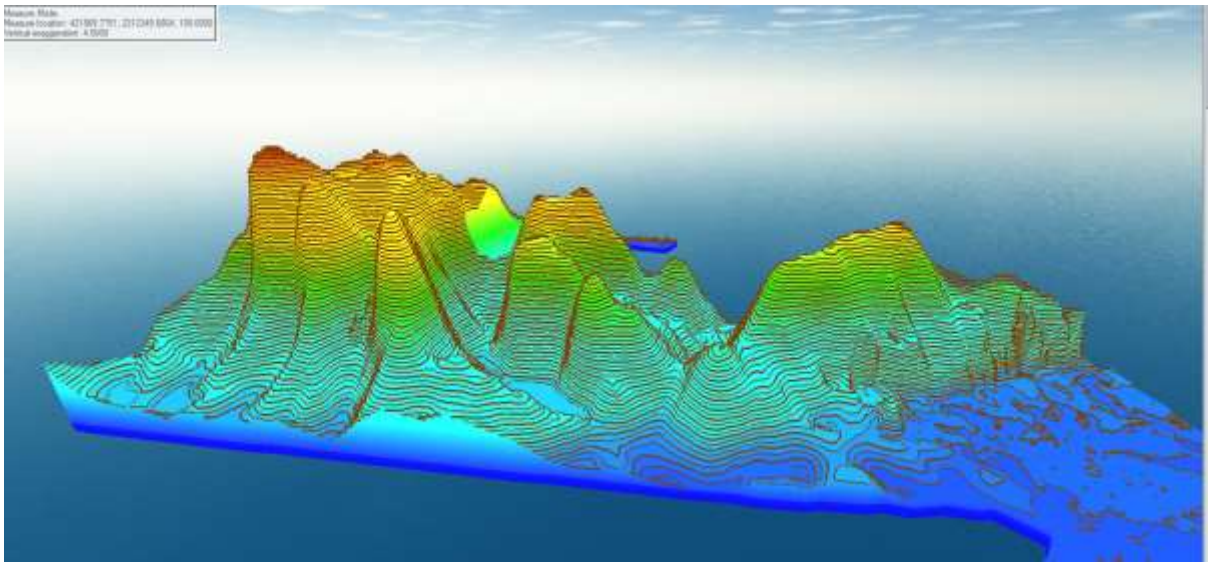


Figure 4.5: Elevated contour drawing of project location

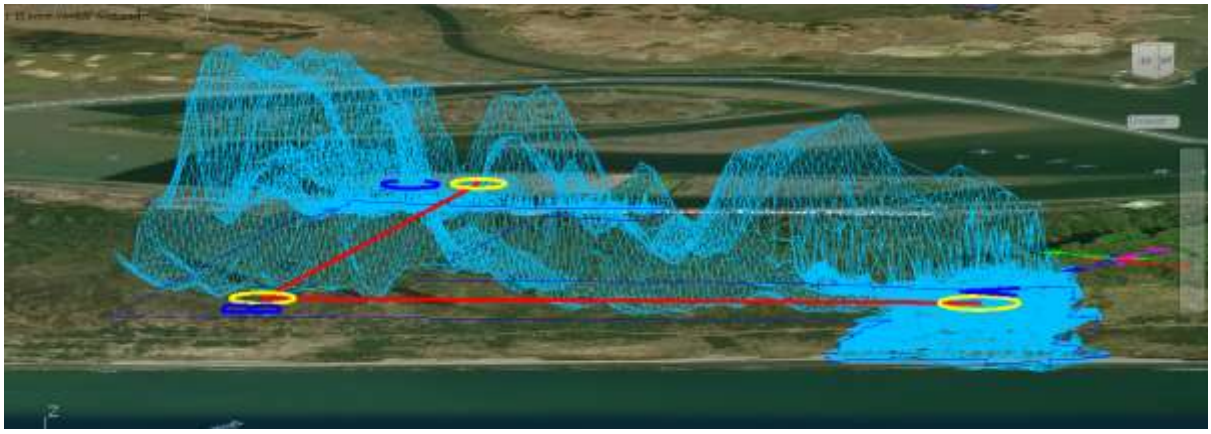


Figure 4.6: Sea side surface view of project location

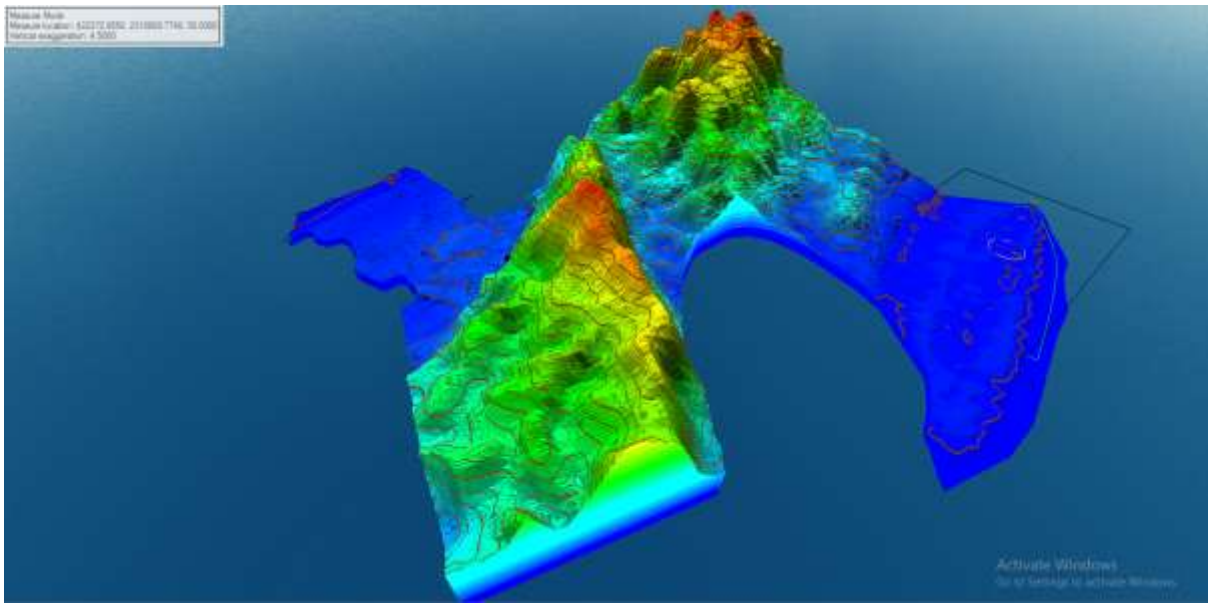


Figure 4.7: Se skew 3D view of project location

4.2.3 Household Survey

Day-1: 18th Mar - 2020: The experts from Onushandhani Creeds Ltd. have visited Teknaf Upazila for Reconnaissance survey of the project area.

Day-1: 2nd Sep - 2020: The surveyors from Onushandhani Creeds Ltd. have visited Teknaf Upazila for Household survey of the project area.

Figure 4.8: Reconnaissance Survey Team at Teknaf

Figure 4.9: Household Survey at Hatiarguna Village

Figure 4.10: Household Survey around point C

Figure 4.11: Conducting Household Survey at Damdamia

Figure 4.12: Household Survey Team Moving Forward

All the influenced area of the project site has been covered during this household survey. The field visit for household data collection was successful as the entire visit in the households, went very well with various types of local people. Almost all of them know about Naf Tourism Park and the cable car project.

Total 37 household survey has been done during this visit. All the respondents were really excited about this project, Most of the household respondents give positive response to the surveyors but some of the respondents were worried about the land acquisition for the point c terminal and the route of cable car. In short they know the consequences of the project and they are willing to have the change.

Figure 4.13: Household Survey Team

4.2.3 Traffic Count Survey

A team of six surveyors conduct traffic count survey of the project. They have surveyed three busy roads of project influenced area.

Figure 4.14: Traffic count survey team

Figure 4.15: Measuring road shoulder using tape

4.3 Focused Group Discussion (FGD)

4.2.1 Data Collection

Primary Information

There were total 37 families in our project area among them most families live around point C of the project area and the rest of the families live in near Keari Ghat which is near to point A and that is mainly a busy commercial area surrounding with bazars and local hotels. All the other areas of cable car transmission route are inside forest boundary.

Figure 4.16: Conducting FGD with the locals

4.2.3 Methodology of FGD

Instrument Development

The discussion guide and participant profile forms were prepared as per project demands. The discussion guide comprised of several key points propelling the discussion towards assessment of the current opinions of the locals about the Cable Car project.

Participant Selection

Some of the local people of Project influenced area who have a comprehensive idea regarding the Naf Tourism Park and Cable car project were selected as the participants of the focus group discussion. The selected members are the representatives of the local people and hence have a concrete knowledge about local problems with potential solutions as perceived by the local communities.

Study Team

The study team comprises of the following four (6) members:

- Environmental Expert
- Coordinator

Participant Profiles

The discussions were presided over with selected members of Damdamia of Nila union and Karachi para of Teknaf sadar union by the Environmental expert and coordinator. The Coordinator collected the necessary information and also prodded the discussion towards fruitful outcomes. The members of different families of Damdamia and Karachi para presented the present state of their respective constituencies, apparent problems and potential solutions.

FGD at Damdamia

Local Community representatives and Onushandhani Creeds Limite Professionals were present during the FGD of the survey. They conducted the FGD with the locals of Damdamia and their opinions were taken and later discussed among themselves.

FGD at Hatiarguna

Local Community representatives and Onushandhani Creeds Limited Professionals were present during the FGD of the survey. They conducted the FGD with the locals of Hatiarguna and their opinions were taken and later discussed among themselves.

4.2.4 Field Activities

A filed visit was conducted by the Onushandhani Creeds Ltd. team to comprehend the existing situation and identify the problems of about the life, livelihood, rural development, water and sanitation of Damdamia and Hatiarguna.

Day-1: 3rd Sep, 2020: The surveyors from Onushandhani Creeds Ltd. visited the Teknaf upazila and conducted FGD survey with the locals of Damda Mia and Hatiarguna.

The discussion was presided over by. A total of Twenty (20) participants at Damda Mia and Twelve (12) were present at Hatiarguna during the discussion which lasted for almost 35 minutes and 25 minutes accordingly. The nature of the discussion was voluntary.

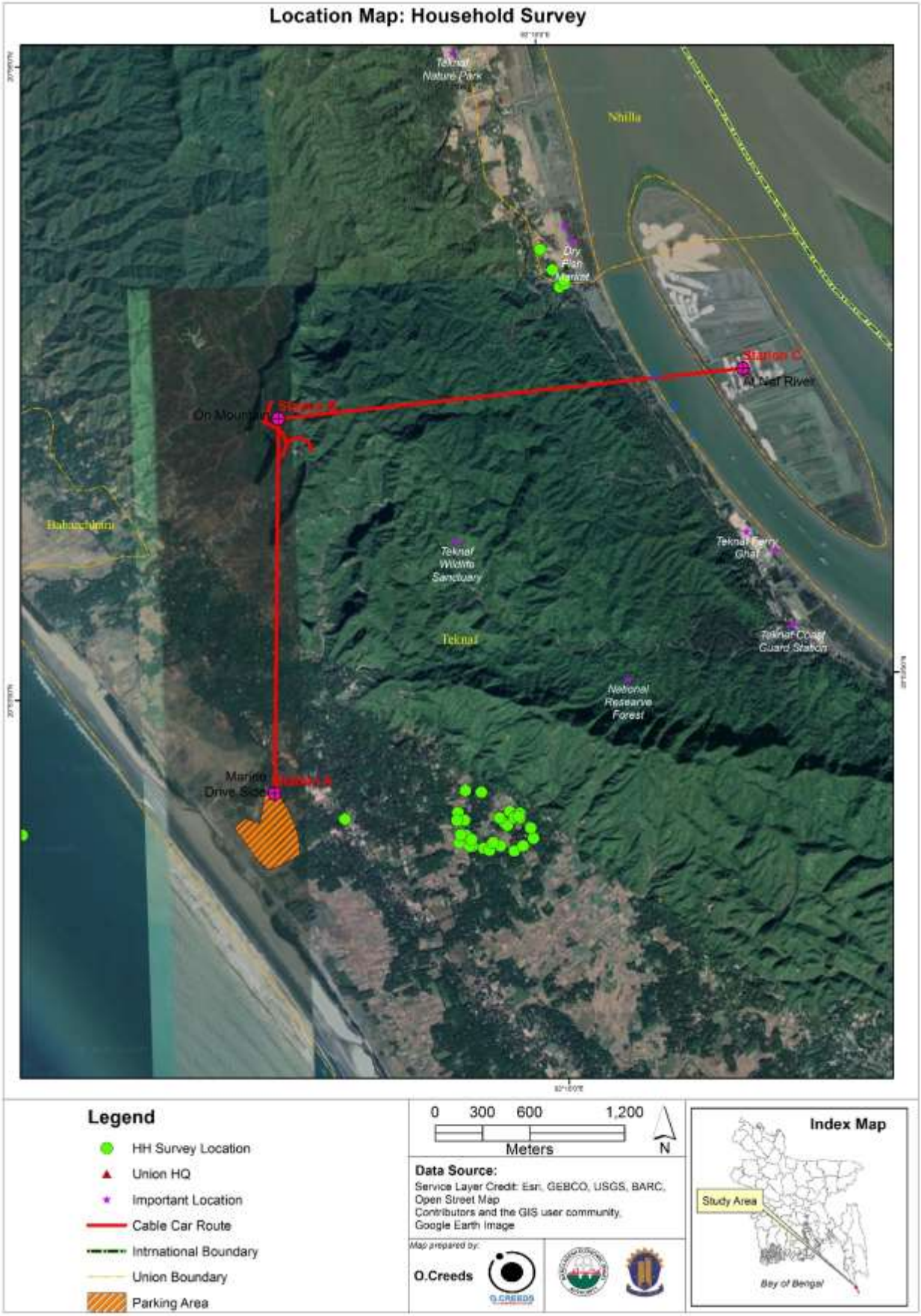


Figure 4.17: Household survey locations

4.4 GIS Mapping

Geographic Information System (GIS) is a very versatile one for storing spatial data along with other relevant items. This is now an undoubtedly essential component for project implementation, management, evaluation and monitoring. GIS can illustrate the spatial characteristics of the area of interest (AOI) having detailed information furnished with the necessary features for the decision makers, planners and engineers. The GIS and Cartography are especially important for the cable car project such as Feasibility Study of Cable Car at Naf Tourism Park.

4.3.1 Field Survey

Comprehensive field surveys have been carried out utilizing state-of-the–art survey equipment in order to collect the data related of Cable car project, route from the source to destination in the project area. High precision RTK GPS has been used for setting up the Bench Marks in the project area with a view to maintaining positional accuracy in horizontal and vertical planes. Data logger has been used for collecting alignment of the linear features such as road. A good number of hand held GPS have also been utilized for point feature collections. Total Station and Digital Level Machines have been used for surveying the land level.

Table 4.1: Topographic survey data

Serial No.	Location		Elevation	Bench Mark
1	2313323.535	424097.21	3.316	BM03
2	2313293.965	423960.413	5.7	BM04
3	2310482.243	422905.376	26.601	BM05
4	2309335.775	422105.848	6.038	BM06
5	2309520.549	421998.693	5.851	BM07
6	2312233.684	421715.722	86.175	BM08
7	2312239.653	421785.931	104.13	BM09
8	2313293.965	423960.413	3.527	BM4
9	2309335.695	422105.895	2.224	BM-6
10	2309335.695	422105.895	5.477	BM-6
11	2309520.549	421998.694	2.035	BM-7
12	2309520.549	421998.693	5.288	BM-7
13	2309474.788	422337.562	2.332	TBM1
14	2309821.408	422469.329	5.315	TBM1
15	2310018.151	423316.705	13.161	TBM-10A
16	2310421.501	422987.077	15.382	TBM15A
17	2312471.363	424484.691	2.317	TBM16
18	2309789.741	422107.822	3.575	TBM2
19	2309825.301	422460.268	5.258	TBM2
20	2313609.411	423775.915	5.878	TBM20
21	2309796.179	422948.243	9.517	TBM6A
22	2309789.813	422976.418	10.679	TBM7
23	2309878.317	423124.457	12.083	TBM8A

4.3.2 Data Processing

The Total Station and Digital Level Machine provide data which can be readily to be used for mapping and analysis. There are also data from the hand held GPS and data logger which are needed to be processed with particular software. This processing is essential to make the data sets compatible for GIS and mapping.

4.3.3 Mapping

Comprehensive mapping has been carried out along route from the Point C to the destination Point B and Point A using the collected data from the field survey. This mapping covers almost every level of details along the alignment of transmission line of cable car.

Mapping with the Transmission route has been done along with major settlement of the project area. Map of proposed alignment of cable car has also been prepared for better planning, understanding and management.

Figure 4.18: Monitoring location map of cable car project

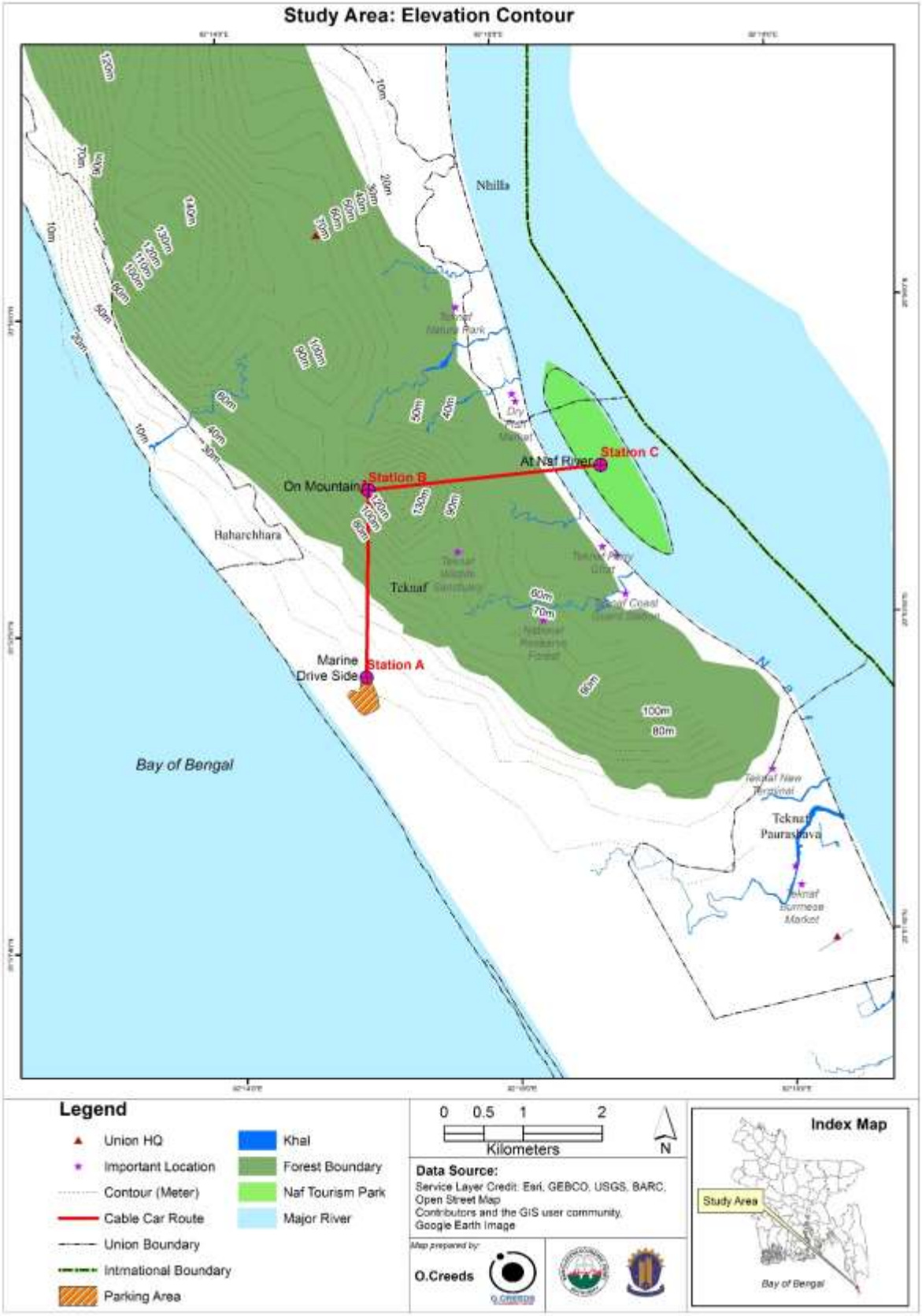


Figure 4.19: Contour map of cable car project

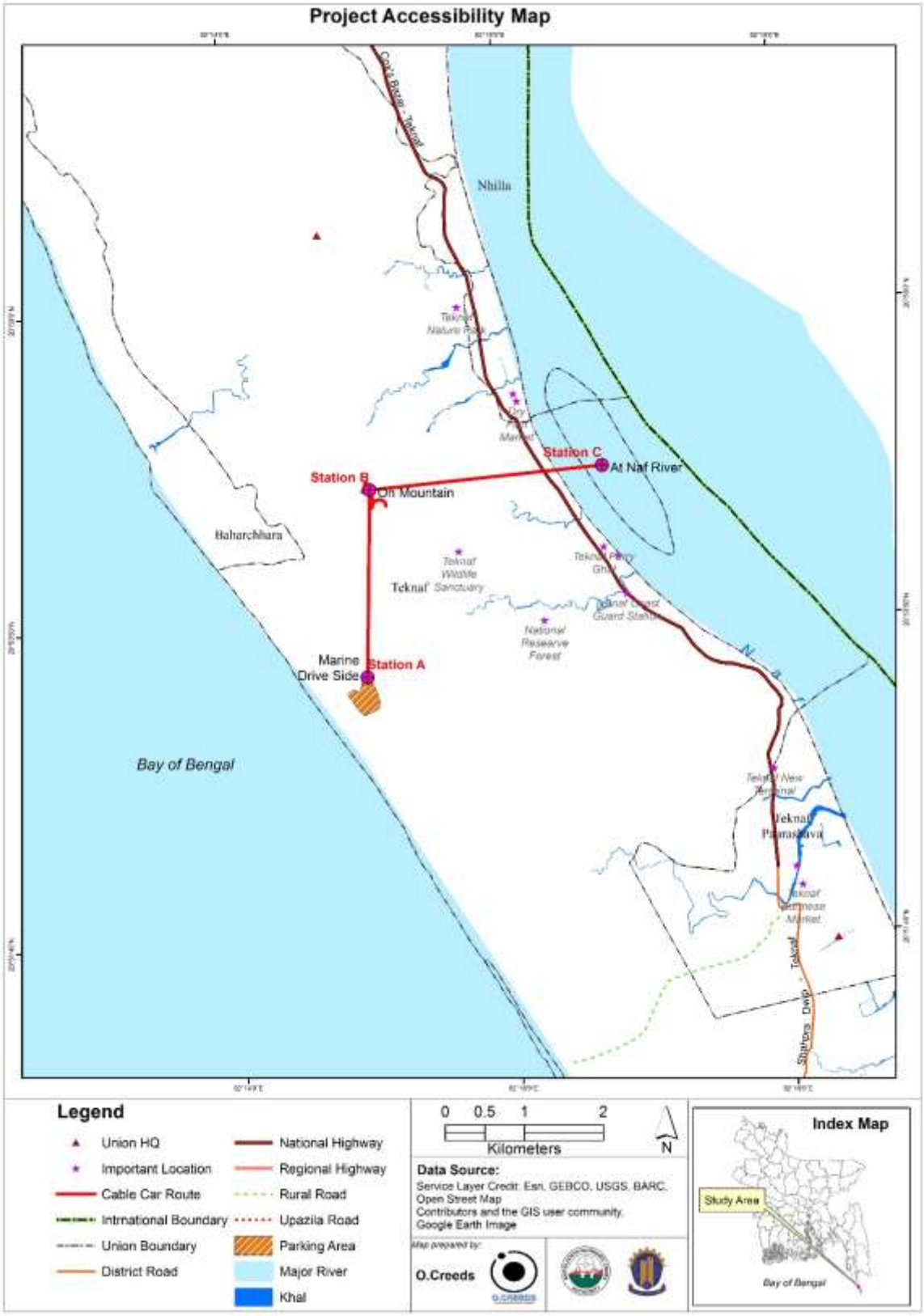


Figure 4.20: Project accessibility map

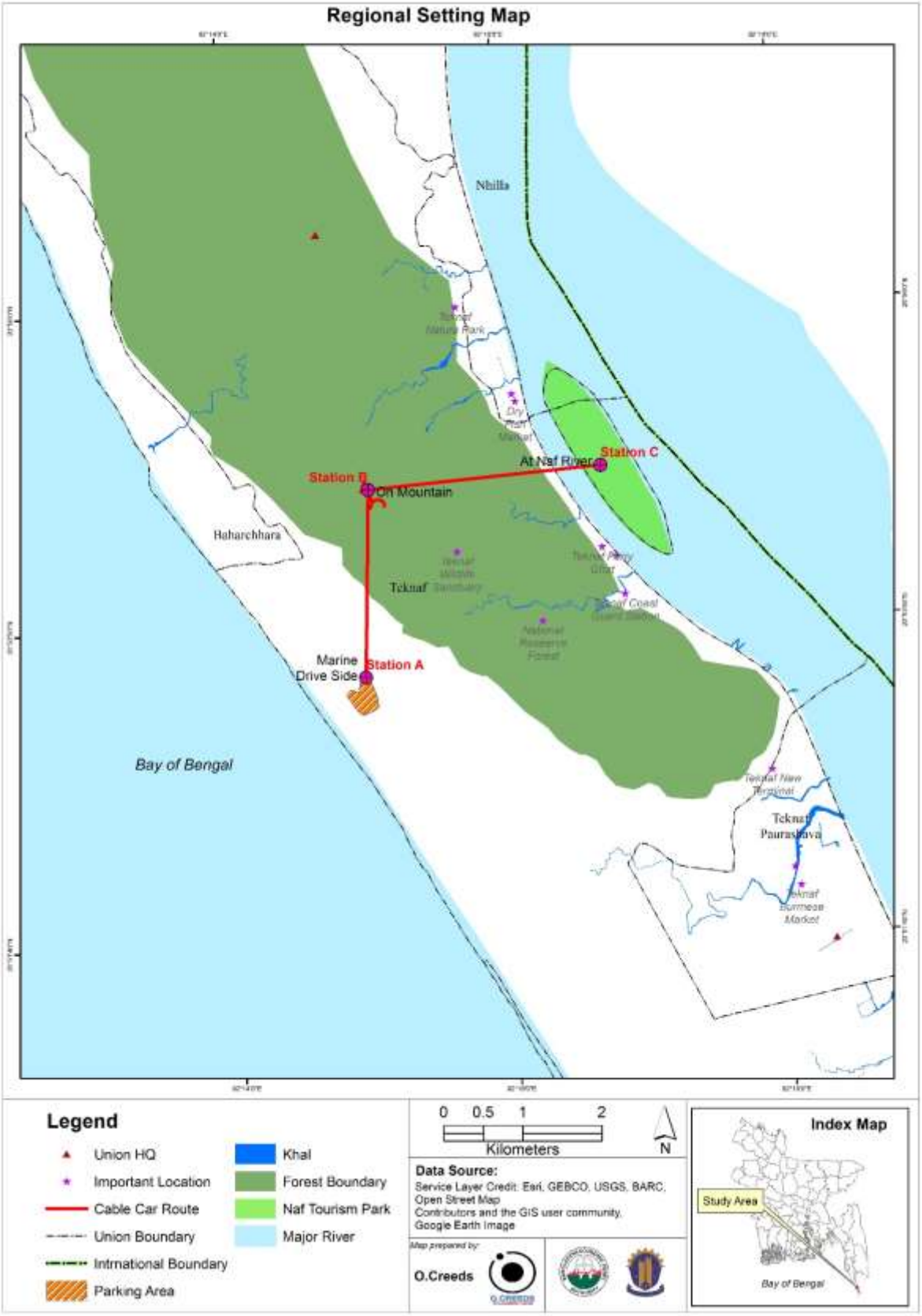


Figure 4.21: Regional setting map

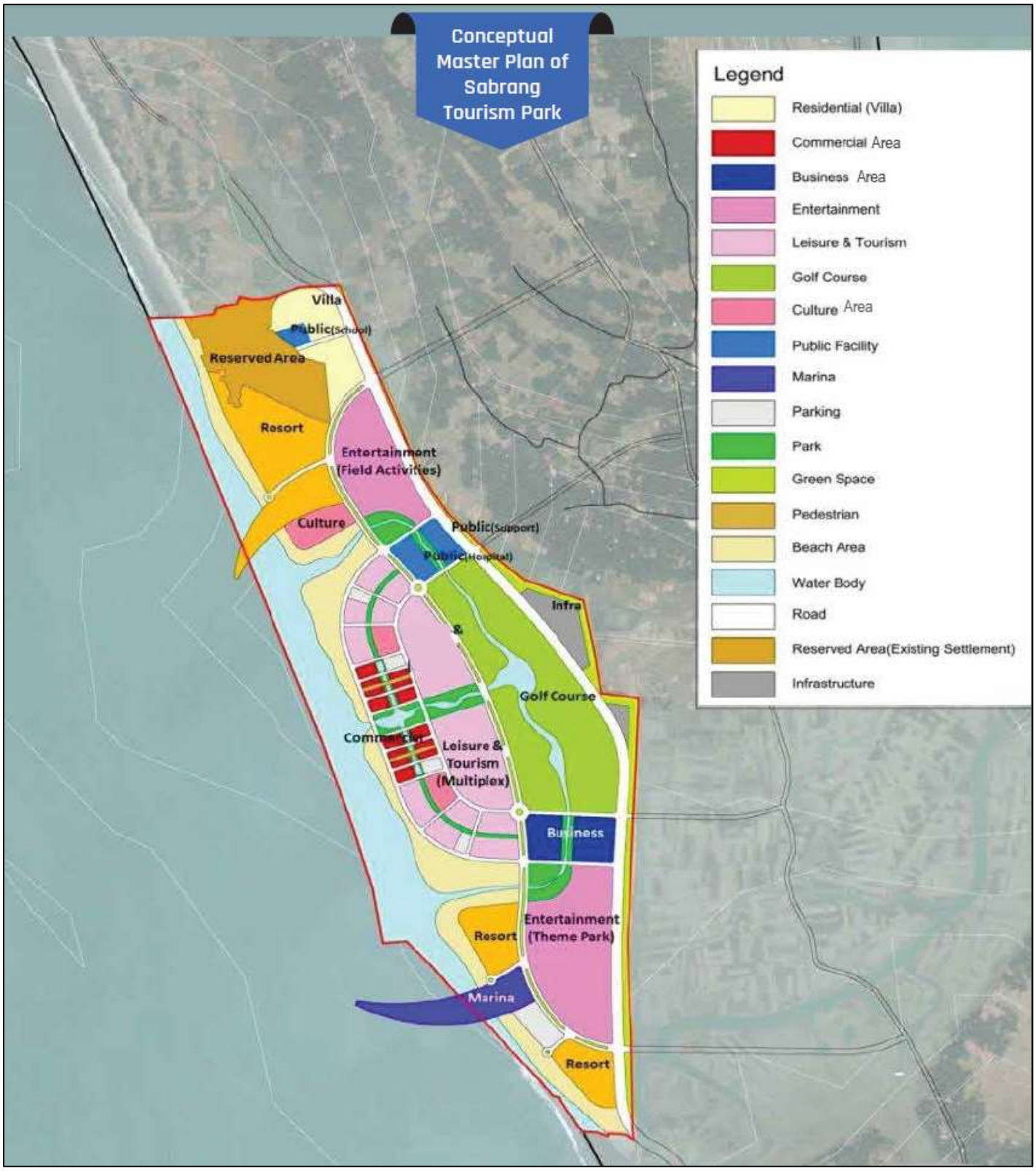


Figure 4.22: Sabrang Tourism Park master plan

Figure 4.23: Proposed Alignment of cable car

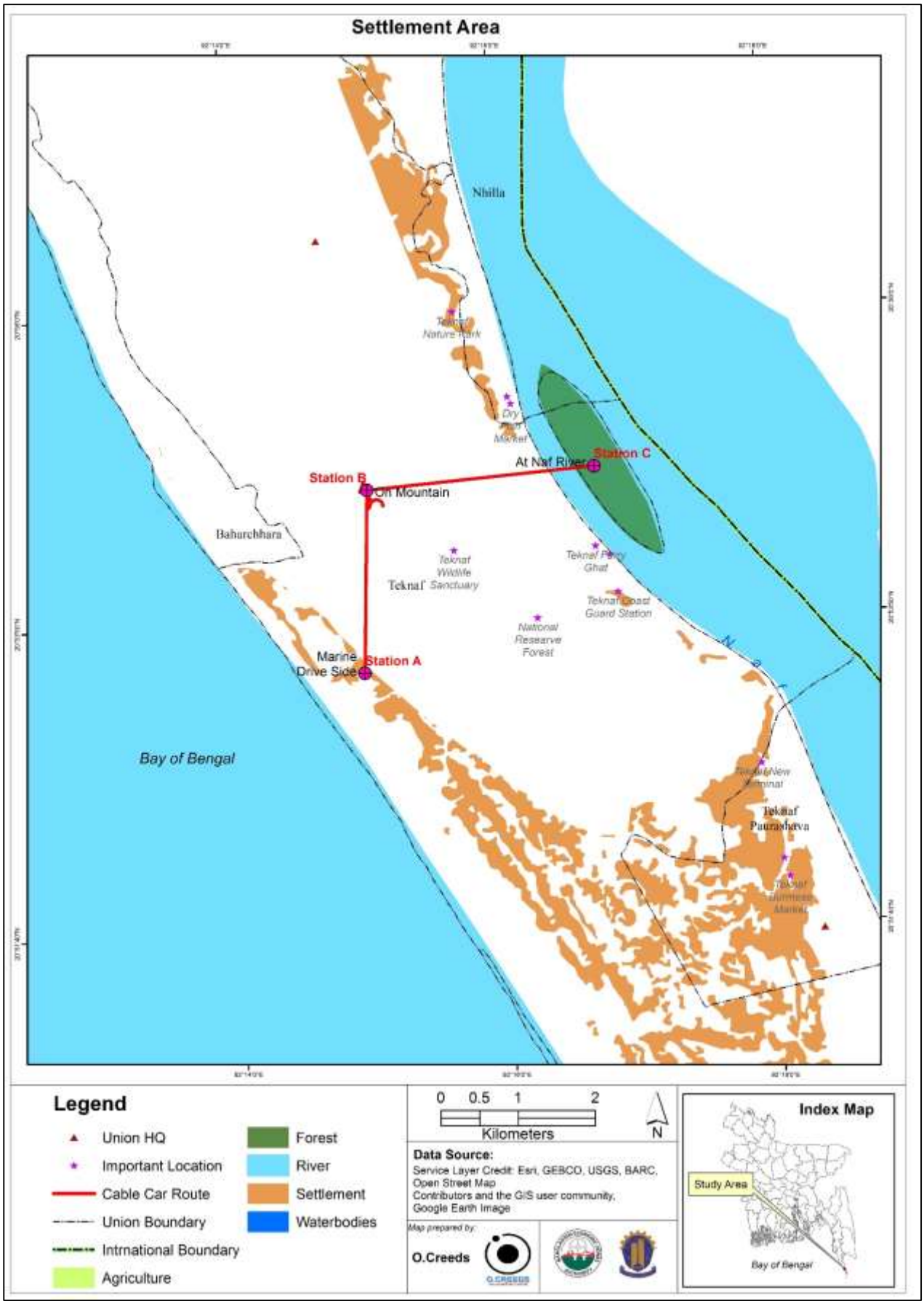


Figure 4.24: Settlement of the study Area

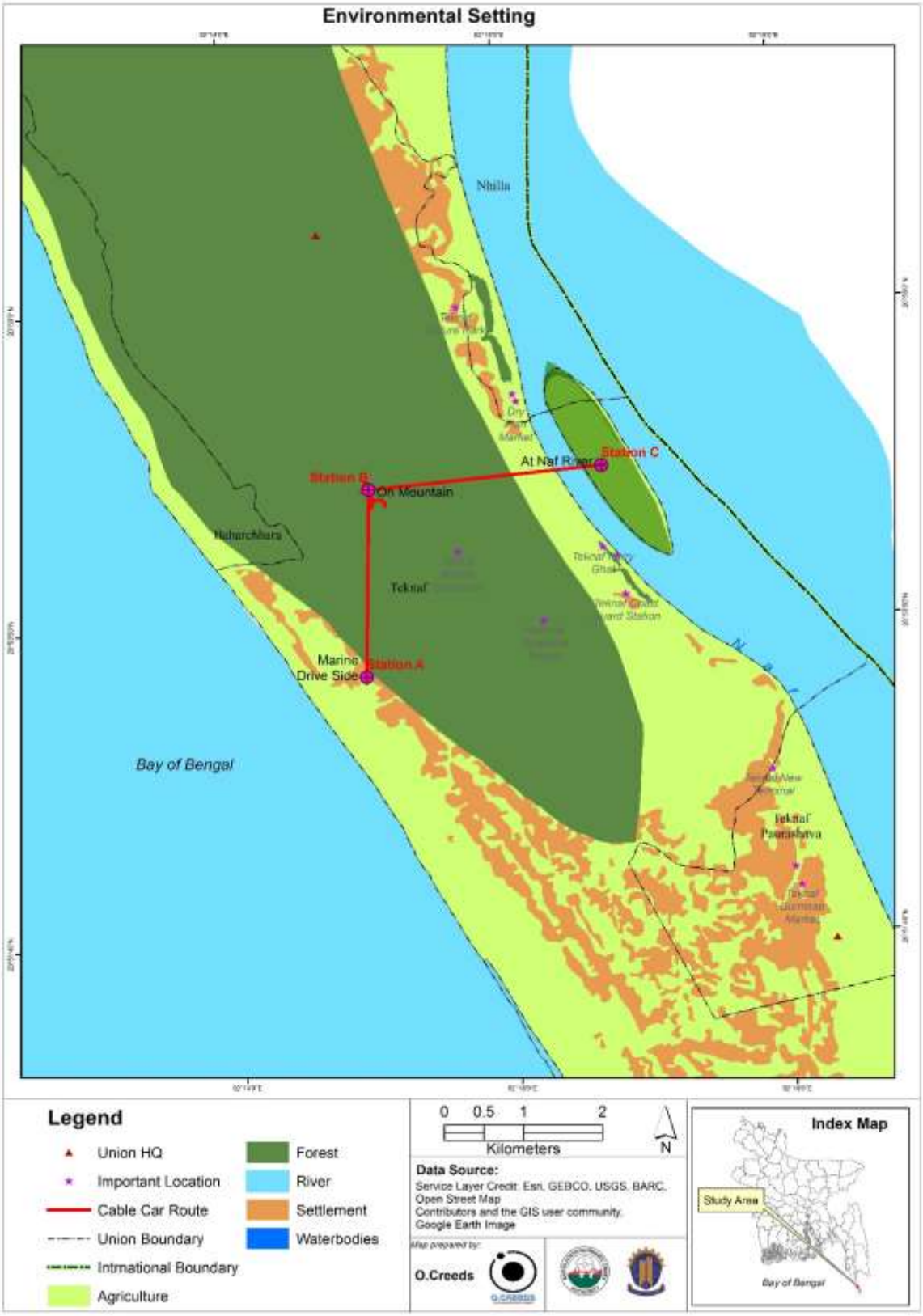


Figure 4.25: Environmental setting map of project location

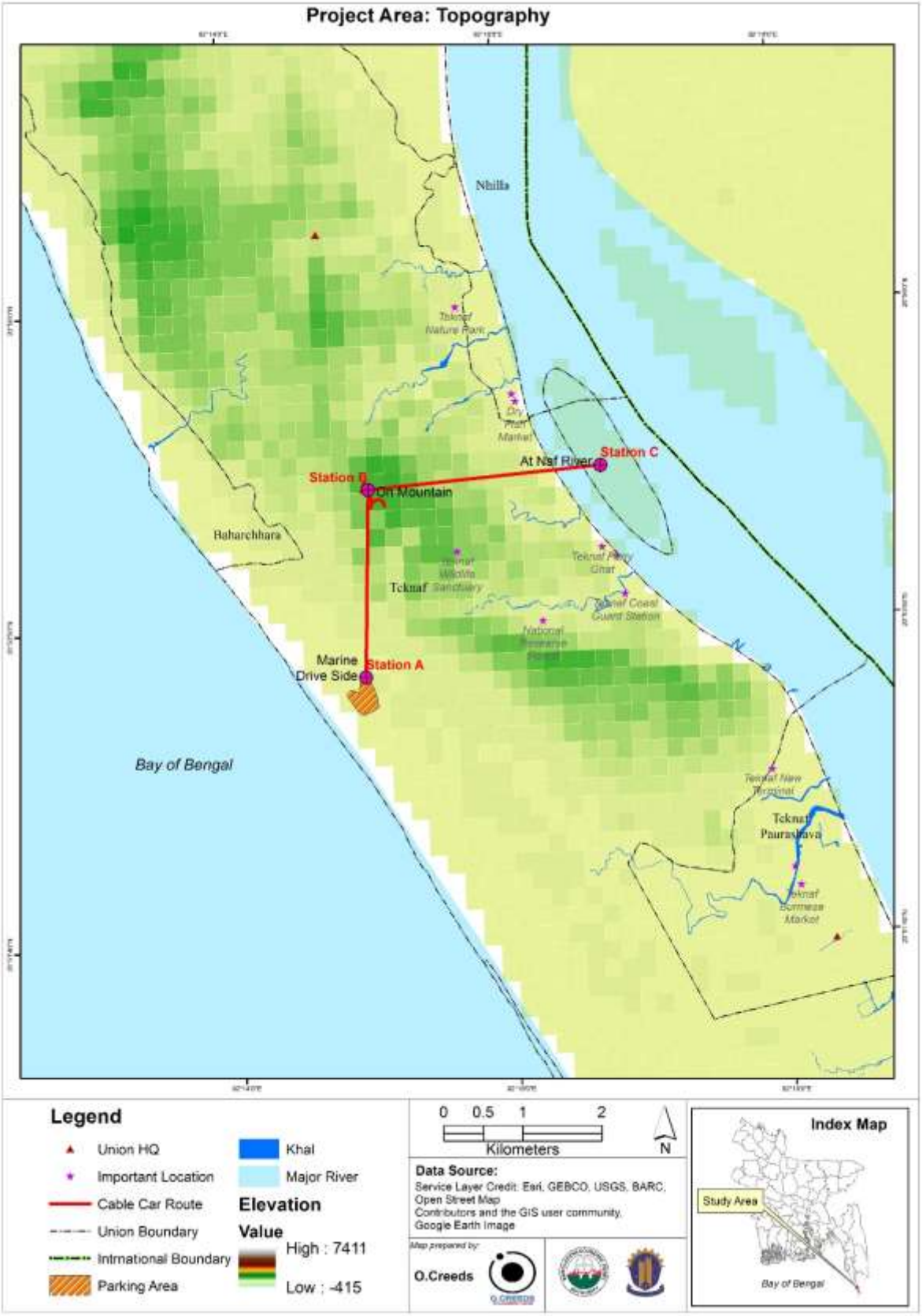


Figure 4.26: Topography map of project location

4.5 Geotechnical Investigation

Sub-soil investigations have been done for getting an idea of the geo-technical characteristics of the under laying soil where the structures are proposed to rest.

Figure 4.27: Soil Collection from point C

Figure 4.28: Excavation work before sampling

Before arriving to the field, determine the number and approximate location of soil samples. The excavation work consist of driving the shovel to a depth of 3 ft. and draw the soil sample to store it in a zip lock bag.

Figure 4.29: Excavation work before sampling

Figure 4.30: Soil Collection from point A

Soil texture is an important soil characteristic that could influence water retention capacity, aeration, drainage, and susceptibility to erosion which drive crop production and management. The texture of soil sample from **Point A** was found to be **sandy soil (68%)** and **silty soil (23%)** in nature. The texture of soil sample from **Point C** was found to be sandy soil (51%) and **silty soil (41%)** in nature.

CHAPTER 05: DEMAND ASSESSMENT

5.1. Background

Demand assessment is an important step in the feasibility study of a Cable Car. The Onushandhani Creeds Limited has carried out a feasibility study for the cable Car at Naf Tourism Park by measuring the ability and likelihood of the project successfully including all relevant factors. The economic impact of a fully developed and thriving Cable Car can be substantial boon to local and regional economies. Consequence of this a plan to build up a commercial park at Naf Tourism Park, Teknaf Upazila of Cox's Bazaar district has been finalized. This study should focus on the proposed plan of action and provide a detailed estimate of its costs and benefits.

5.2 Assessment Methodology

The methodology adopted for assessing tourism demand for the study area. The first step was to review relevant administrative and existing tourist in project area. Then for each administrative area the base year population estimated. In this study, census year of 2011 was used as the base year. Then, possible service areas in future years were determined based on a review of development pattern, review of relevant planning documents and studies, consultation with stakeholders, and site visits to different parts of the study area. Then several development scenarios were developed based on analyses of population growth rates for different areas, consideration of various consumption rates, and consideration of other demands. Then population projection was done for each scenario. Based on the estimate population and different consumption rates, the demand was estimated. Finally, the required production capacity was calculated for each scenario by factoring the estimated demands with the system loss rates.

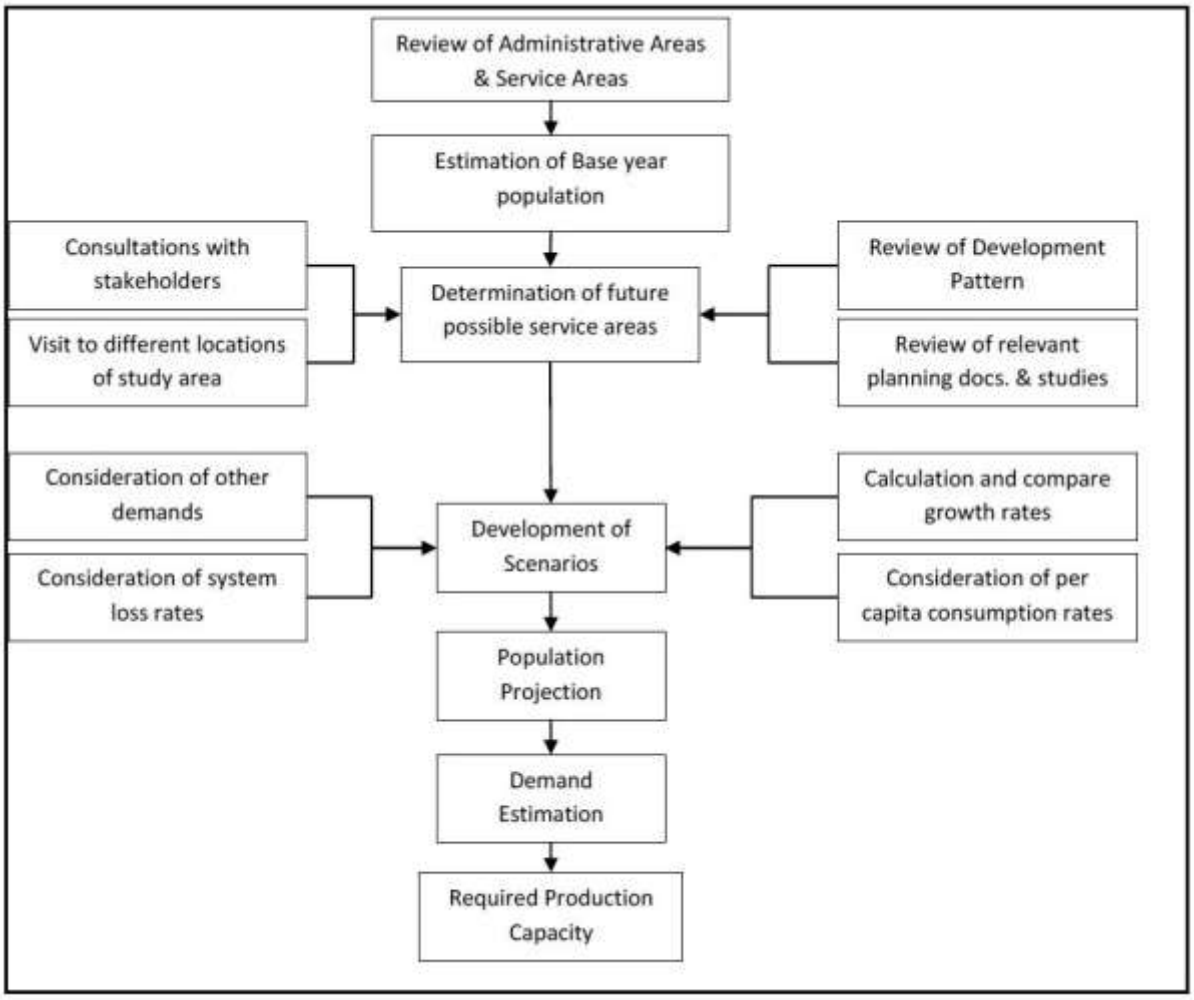


Figure 5.1: Demand assessment methodology

5.3 Review of Administrative Areas

5.3.1 Cox's Bazar District

Cox's Bazar is a city, fishing port, tourism centre and district headquarters in southeastern Bangladesh. It is famous mostly for its long natural sandy beach, and it is infamous for the largest refugee camp in the world. It is located 150 km (93 mi) south of the divisional headquarter city of Chittagong. Cox's Bazar is also known by the name Panowa, which translates literally as "yellow flower". Another old name was "Palongkee". The municipality covers an area of 6.85 km2 (2.64 sq mi) with 27 mahallas and 9 wards and as of 2012 had a population of 51,918.[2] Cox's Bazar is connected by road and air with Chittagong. Cox's Bazar is located 150 km (93 mi) south of the divisional headquarter city of Chittagong.Cox's Bazar town has an area of 6.85 km2 (2.64 sq mi), and is bounded by Bakkhali River on the north and East, Bay of Bengal in the West, and Jhilwanj Union in the south.

Figure 5.2: Beauty of longest sea beach of the world Cox's Bazar

The beach in Cox's Bazar has a gentle slope and with an unbroken length of 155 km (96 mi) it is often termed the "longest natural unbroken sea beach" in the world. Cox's Bazar lies on a coastal plain in the southeastern corner of Bangladesh. From above, the plain appears to bulge out into the Bay of Bengal. Along the shore is an extensive area of beach and dunes. Most of the city is built on a floodplain that is lower in elevation than the dunes, making it more susceptible to flooding due to cyclones and storm surges. The Cox's Bazar coastal plain was formed after the sea reached its present level around 6,500 years ago, with the area of the current floodplain originally forming a sediment sink that has since been gradually filled in by the Bakkhali River as well as smaller streams coming down from the hills.

5.3.2 Teknaf Upazila

Teknaf is an Upazila of Cox's Bazar District in the Division of Chittagong, Bangladesh. It forms the southern-most point in mainland Bangladesh (St. Martin's Island is the southern-most point). The name of the region comes from the Naf River which forms the Eastern boundary of the upazila. It shares the border with Myanmar. Tourist spot of teknaf is St. Matin's Island (It is located 12 km from the main land and is the only coral island of Bangladesh). St. Martin's Island is comprised with four islands such as Zinzira, Dakshin Para, Chhalchhira and Bechhadia. The total area of the island is 4.8 km).

Figure 5.3: Beauty of Naf River, Teknaf

Teknaf Upazila is the southern-most city on the mainland in Bangladesh, on the narrow strip running along the coast of Myanmar. It's a dusty featureless frontier town - this is remote Bangladesh and it feels like it. Electricity can be scarce, so having a flashlight for the dark evenings is wise. Teknaf Upazila (cox's Bazar district) area 388.68 sq km, located in between 20°23' and 21°09' north latitudes and in between 92°05' and 92°23' east longitudes. It is bounded by ukhia upazila on the north, the Bay of Bengal on the south, arakan state of Myanmar on the east, the Bay of Bengal on the west. Teknaf upazila, located on the south east extremity of Bangladesh, is 86 km on the south of Cox's Bazar Town.

5.4 Population Projections for Demand Assessment

Population projections are the calculations of future birth rate, death rate and migration of population based on their past and present conditions. They are neither predictions, nor forecasts, nor estimates. Rather they are in between predictions and forecasts. According to a UN Study, "Population projections are calculations which show the future course of fertility, mortality and migration. They are in general purely formal calculations, developing the implications of the assumptions that are made."

Arithmetic Method

In arithmetic projection method, it is assumed that the annual change (increase or decrease) in population remains the same throughout the projection period and the crude birth and death rates are taken. The formula for such linear interpolation is

$$P_p = P_t + \frac{n(P_1 - P_2)}{N}$$

Where,

P p =Population projection in the future;

P 1 = Present population as per the recent census;

P 2 = Size of population in the previous census;

n = Number of years between the projection year and the previous census; and

N= Total number of years between the recent and previous census.

Geometric Method:

In the geometric method of projection, the formula is

P p = P 1 (1 + r) ^n

Where,

P p = Projected population;

P 1 = Population as per the recent census;

r= Annual rate of increase or decrease of population; and

n = Number of years.

This formula is the basis of Malthus's population projection.

Exponential Growth

In the exponential growth method of projection, the formula is

P t = P 0 (e rt)

Where,

P 0 = Initial Population

P t = Population in "t" years

r = Annual Population Growth Rate

e = base of the natural logarithm

t= time (year)

Population Projections are important only when they are for a short period. The projections for long period are possible only in a static economy. When the economy is dynamic, and social, political and external factors affect it, the projections are rarely true.

5.5 Future Demand Estimation

Based on the above population analysis, a suitability assessment of tourist for the zone will be carry out. The above discussion shows that there is a significant level of suitability of the zone for establishing Cable car. Cable car is the best fit for Teknaf, considering its strong local

entrepreneurial and labor base. With the above background and understanding the Cable car project will be design for the zone.

5.6 Conclusions and Recommendations

The consultants will analyze data acquired from survey and will qualify and acquire data against the secondary data available in various national and international sources to maintain the realisticity of the analysis. The raw data will be compiled for each of the households surveyed, as appropriate. The findings of the survey will be presented below.

Availability of labour, access to raw materials, availability of energy and the low price of land are the main reasons for the interest of construction of cable car at Naf Tourism Park.

CHAPTER 06: PROJECT COST ESTIMATION

6.1 Basis of Estimation

This chapter presents the estimated construction and operation cost for Construction of Cable Car at Naf Tourism Park and associated works. These costs are presented as present day cost. The estimate also includes miscellaneous cost associated with project implementation, land acquisition & development including resettlement. Costs for the project will be estimated in million USD. Conversion rate has been considered as Tk. 85 per US$ 1.

6.1.1 Construction

The cost of civil works will be prepare by estimating the quantities of the principal construction items. The pricing of these civil works will base on the construction rate observed from current ongoing high quality construction works.

6.1.2 Equipment Cost

The cost of major equipment items will be based on the current ongoing project of similar nature & allowances were made to cover shipment, installation, associated minor equipment and handling contractors cost.

6.2 Summary of Estimated Capital Cost

Summary of estimated capital cost for the project works will be given in **Table 6.1**

Table 6.1: Summary of cable Car Supply and Installation

Summary of the cost of various component for cable car supply and installation				
Sl No.	**Name of the components**	**Estimated cost in BDT Crore**		**USD in Million**
1	M.E	417.00		52.1
2	Tower (50 NB)	30.00		3.8
3	Station Point 1	111.00		13.9
4	Station Point 2	13.00		1.6
5	Station Point 3	19.26		2.4
6	EE-1 (33 KV)	21.00		2.6
7	EE-2 (Comm/Security)	11.00		1.4
	Total:	**622.26**	**Total:**	**77.78**

6.3 Operation & Maintenance Costs

Annual operating & maintenance costs is 10% of total cost. Summary of estimated operation & maintenance cost will presented in the following table:

Table 6.2: Operation and Maintenance Cost

	Estimated cost in BDT Crore	USD in Million
Operation & Maintenance cost (10% of Total cost)	62.23	7.78

CHAPTER 07: FINANCIAL AND ECONOMIC ANALYSIS

7.1 The Project

Teknaf Upazila is the southern-most city on the mainland in Bangladesh, on the narrow strip running along the coast of Myanmar. Teknaf Upazila (cox's Bazar district) area 388.68 sq km, located in between 20°23' and 21°09' north latitudes and in between 92°05' and 92°23' east longitudes. It is bounded by ukhia upazila on the north, the Bay of Bengal on the south, arakan state of Myanmar on the east, the Bay of Bengal on the west. Teknaf upazila, located on the south east extremity of Bangladesh, is 86 km on the south of Cox's Bazar Town.

The project site is located at approximately 7 km from the center of Teknaf Upazila. The proposed EZ will be connected with the Marine Drive at the northern periphery, which will be used for access to the EZ. The proposed project is planned for Station-A to Station-B and Station-A to Station-B & Station-C on area of 16.84 acres and 19.52 acres respectively of which the Government land (Nal, Khila, Canal & River) 0.731 acres and 3.276 acres respectively and private land (Nal, Khila) 16.11 acres and 16.244 respectively. Highway Teknaf-Shahparirdwip Road (Z1099) runs parallel to the site at a distance of 5 KM. It connects the National Highway N1. The site is about 210 KM from Chittagong Railway Station and around 96 KM from Cox's Bazar Domestic Airport. A cable car connection will be constructed from Ne-Taung Hill to Naf Tourism Park (9.5km). A cable car route station B to station C is not considered to be feasible as a separate route, because station point B is on the top of the hill and station point C is on an island, which is situated in the middle of Naf river that divides Myanmer and Bangladesh.

7.2 Demand Assessment

The demand assessment estimated that the capacity at design level for cable car in Teknaf can accommodate 12,000 tourist-travelers daily for 8 hours duration. For the service area, in the later part of project life, the required capacity for cable car has been estimated and can also be extended to accommodate 20,000 tourist-travelers per day for 8 hours duration.

7.3 Methodology

The feasibility analysis will be done in two parts. Part I analyzes the financial feasibility of the project keeping in view ability of return the investment to the Government of Bangladesh. The financial feasibility enables us not only to assess the financial viability of the project, but also to guide any pricing and timing issues that may be able to influence the profitability of the project, and identify any requirements for public support. Part II analyzes the feasibility using economic analysis of projects where both direct and indirect net benefits (external effects) f the project are included. This analysis reveals economic feasibility of the project.

The methodology adopted for financial and economic analyses for this study will be outlined in **Figure 7.1**.

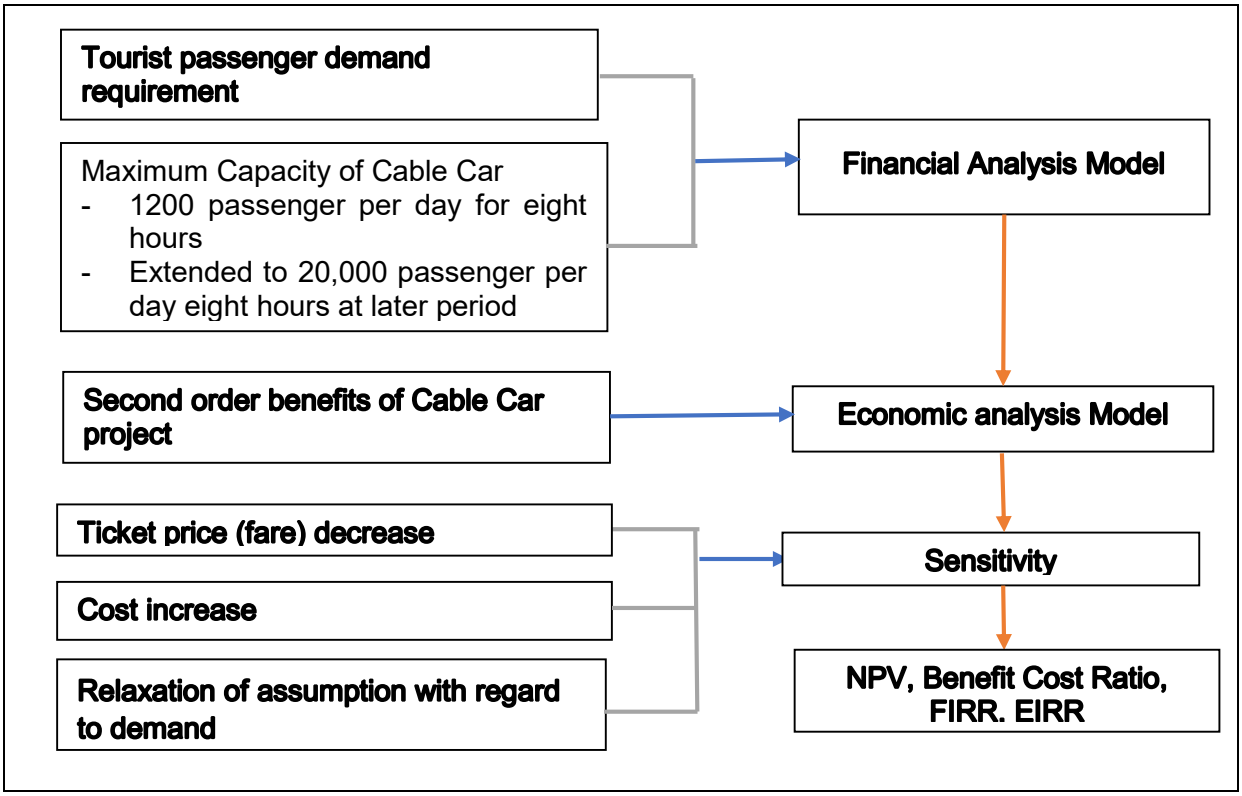


Figure 7.1: Financial and Economic Analysis Methodology

7.4 Financial Analysis

Financial analysis of a project is carried out to know the direct benefit received by an entrepreneur an individual. It doesn't analyze the indirect benefits received by the society and the country. A model was developed in a spreadsheet to calculate projected financial direct benefits (revenue streams) from tourist ticket fare of riding cable car, and capital and O&M costs, to enable the testing of a number of parameters for their effects on the finances of the cable car project in the Naf Tourism Park, Teknaf. The primary outputs of the model are estimates of the Financial Internal Rate of Return (FIRR) and Net Present Value (NPV) of the net benefits flow generated by the Cable Car Project along with Benefit-Cost ratio (BCR).

7.4.1 Key Assumptions of Financial and Economic Analysis Model

In order to carry out the Financial and Economic analysis, the following assumptions are made:

1) 7% of the annual tourists in Cox Bazar Districts will be in the project e, who will ride cable car, as the base case.
2) The cable car will operate only for 240 days in a year.
3) Per tourist ticket fare (price) is 1000 BDT and 1500 BDT per round trip for Station A to B1, and Station A to B1&B2 to Station C respectively, for cable car ride, as a base case.
4) All costs, benefits and revenues are expressed as on March, 2023 prices.
5) The implementation period of this project is three years covering all the interventions proposed within the project.

6) The project life for both financial and economic analysis is assumed to be 30 years.
7) The real opportunity cost of the capital investment adopted in this analysis is assumed as 12% per annum, which represents the social opportunity cost of capital (SOCC) for Bangladesh
8) The country will get more investments due to the tourist attractions, recreational facilities created by the Govt.
9) Local inflation at zero percent for the implementation period and during the operation period a 5% compound rate for every five years for O&M costs has been considered.
10) A Standard Conversion Factor (SCF) of 0.84 has been used for economic analysis in the study.
11) Service Revenue (Direct benefits) growth will be @5% per year.

7.4.2 Costs Estimates

Project costs include capital cost of the project for construction of Cable Car & its Accessories and land acquisition costs. The other component of the project cost is Operation and Maintenance of the project. This has included both O&M of the Cable Car and the distribution system.

7.4.2.1 Capital Cost of Project

The total capital cost for construction of cable car, its accessories and accessories' building including land acquisition cost with CD, IT and VAT is estimated to be BDT 66600.1 Lac and BDT 112153.1 Lac for Cable Car route station A to B1 and Cable Car route station A to B1 & B2 to station C respectively in terms of March 2023 prices excluding off-site costs for utility connection and other off-site infrastructure. The summary of capital cost for construction of Cable car project (BOQ with Tender Documents for Cable Car) is shown in Table 1.

Table 2A and Table 2B show not only the decomposition of capital costs for the Cable car project in terms of station wise but also inclusion of 8% of capital costs for physical contingency and 5% of capital costs for price contingency in the capital costs of the project for Cable Car route station A to B1 and Cable Car route station A to B1 & B2 to station C respectively. The capital cost of the cable car project stands at **BDT 75259 Lac** and **BDT 126733 Lac** for Cable Car route station A to B1 and Cable Car route station A to B1 & B2 to station C respectively, which has been considered in financial analysis.

7.4.2.2 Operation and Maintenance (O&M) Costs

Annual Operating and maintenance costs is assumed to be 10% of total project costs and then after every five years, O&M cost will increase @10%.

Alternative way of estimating O&M costs is as follows. Operation and Maintenance costs (O&M) regarding Cable car project are assumed for four areas — administration/staffing costs, promotion costs, provision of costs for operating and maintaining utility services, and provision of security services.

Administration costs are based on upper level managers, mid/low level officers, technical workers, and unskilled workers including security personnel initially. Annual marketing and promotion costs are set to Taka 50 Lac (35 Lac for cable route station A to B1 only), which will continue to increase @5% per year. Annual provision of O&M costs is assumed to be four per cent of capital costs initially and thereafter is growing @5% per year. Annual estimated O&M costs are provided in Table 3A and Table 3B respectively for cable car route A to B1 and cable car route A to B1&B2 to C. Annual O&M costs and Annual Estimated one are shown in Table 4A and Table 4B respectively for cable car route A to B1 and cable car route A to B1&B2 to C.

Table 7.1: Capital Costs for Construction of Cable Car at Naf Tourism Park

Part I: BOQ with Tender Documents for Cable Car

Construction of Cable Car including all materials, Price Estimation per March'2023

Items	Path A to B1 & Station **A & B**	Path A to B1 and B2 to C & Station A, B & C
Cost for Cable Car & its Accessories		
Construction of Cable Car Drive, Return, Parking & Line Equipment with Electrical Equipment, Acessoires & Shipping & L/C Commissoning with out CD & VAT.	€ 22,930,581.74	€ 45,095,210.76
N.B. ∈1 = Tk.118	**2,705,808,645**	**5,321,234,869**
CD & VAT (35%) for above item	**1,456,973,886**	**2,865,280,314**
Construction of Cable Car Drive, Return, Parking & Line Equipment with Electrical Equipment, Acessoires & Shipping & L/C Commissoning including CD & VAT.	**4,162,782,531**	**8,186,515,183**
SUMMARY of Land Qty. and its Valuation	**86,175,453**	**99,933,661**
Cost for Accesssories' Building		
Civil & Sanitary Works.	**989,078,845**	**1,215,065,063**
Electrical works .	**699,360,521**	**770,885,958**
Mechanical works (Fire Fighting & Fire protection, air Conditionning System and Lift & Escalator).	**373,048,869**	**518,221,696**
Accessories, Building including Civil Works, electrical works and Mechanical works (Fire Fighting & Fire protection, air Conditionning System and Lift & Escalator) Excluding **VAT & IT**	**2,061,488,235**	**2,504,172,718**
VAT (7.5%)	**180,832,301**	**219,664,273**
TAX (7%)	**168,776,815**	**205,019,989**
Accessories, Building including Civil Works, electrical works and Mechanical works (Fire Fighting & Fire protection, air Conditionning System and Lift & Escalator) including **VAT & IT**	**2,411,097,350**	**2,928,856,980**
Cost for Cable Car & its Accessories and Accesssories' Building		
Completion of the Project including Cable car works, Civil Works, electrical works and Mechanical works (Fire Fighting & Fire protection, air Conditionning System and Lift & Escalator) Excluding **VAT & IT**	**4,767,296,880**	**7,825,407,587**
CD & VAT (35%) and VAT(7.5%) & TAX (7%)	**1,806,583,002**	**3,289,964,576**
Completion of the Project including Cable car works, Civil Works, electrical works and Mechanical works (Fire Fighting & Fire protection, air Conditionning System and Lift & Escalator) Including **CD &VAT and VAT & IT**	**6,660,055,335**	**11,215,305,824**

Table 7.2A: Services for Construction of Cable Car at Naf Tourism Park (Path Station-A to Station-B).					
Part VI : BOQ with Tender Documents for All works (Path Station-A to Station-B).					
Construction of Cable Car including all materials, Price Estimation per March'2023					
Item	Station-A	Station-B1 & B2	Station-C	Sum	Unit
Construction of Cable Car Drive, Return, Parking & Line Equipment with Electrical Equipment, Acessoires & Shipping & L/C Commissoning. (€1 = TK.118)	---	---	---	**€ 22,930,581.74**	
				2,705,808,645	BDT
CD & VAT (35%) for above item				1,456,973,886	
Construction Cable Car Drive, Return, Parking & Line Equipment with Electrical Equipment, Acessoires & Shipping & L/C Commissoning including CD & VAT.				4,162,782,531	
SUMMARY of Land Qty. and its Valuation				86,175,453	
Accessories' Building Civil & Sanitary works.	879,569,812	109,509,032	-	989,078,844	BDT
Accessories' Building Electrical works.	672,592,757	26,767,764	-	699,360,521	BDT
Accessories' Building Mechanical works (Fire Fighting & Fire protection, air Conditionning System and Lift & Escalator).	227,876,041	145,172,828	-	373,048,869	BDT
Accessories' Building (Civil & Sanitary works + Electrical works + Mechanical works) without VAT & IT	1,780,038,610	281,449,624	-	2,061,488,234	BDT
VAT (7.5%)	156,143,738	24,688,564	-	180,832,301	BDT
Tax (7%)	145,734,155	23,042,659	-	168,776,814	BDT
Accessories' Building (Civil & Sanitary works + Electrical works + Mechanical works) including VAT & IT	2,081,916,503	329,180,847	-	2,411,097,350	
Project Cost Excluding CD, VAT & IT				4,853,472,332	
CD & VAT(35%) and VAT(7.5%) & IT(7%)				1,806,583,002	BDT
Project Cost With VAT & IT				**6,660,055,334**	
Physical Contingency (8%)				532,804,427	BDT
Price Contingency (5%)				333,002,767	BDT
Grant Total (Total Project Cost)				**7,525,862,527**	BDT
Grant Total (Total Project Cost) in Lac Unit				**75,259**	BDT

Table 7.2B: Services for Construction of Cable Car at Naf Tourism Park (Path Station-A to Station-B to Station C).					
Part VI : BOQ with Tender Documents for All works (Path Station-A to Station-B to Station-C).					
Construction of Cable Car including all materials, Price Estimation per March'2023					
Item	Station-A	Station-B1 & B2	Station-C	Sum	Unit
Construction Cable Car Drive, Return, Parking & Line Equipment with Electrical Equipment, Accessories & Shipping & L/C Commissioning. (€1 = TK.118)	---	---	---	€ 45,095,210.76	EURO
				5,321,234,869	BDT
CD & VAT (35%) for above item				2,865,280,314	
Construction Cable Car Drive, Return, Parking & Line Equipment with Electrical Equipment, Accessories & Shipping & L/C Commissioning including CD & VAT.				8,186,515,183	
SUMMARY of Land Qty. and its Valuation				99,933,661	
Accessories' Building Civil & Sanitary works.	879,569,812	109,509,032	225,986,218	1,215,065,062	BDT
Accessories' Building Electrical works.	672,592,757	26,767,764	71,525,437	770,885,958	BDT
Accessories' Building Mechanical works (Fire Fighting & Fire protection, air Conditioning System and Lift & Escalator).	227,876,041	145,172,828	145,172,828	518,221,697	BDT
Accessories' Building (Civil & Sanitary works + Electrical works + Mechanical works) without VAT & IT	1,780,038,610	281,449,624	442,684,483	2,504,172,717	BDT
VAT (7.5%)	156,143,738	24,688,564	38,831,972	219,664,273	BDT
Tax (7%)	145,734,155	23,042,659	36,243,174	205,019,989	BDT
Accessories' Building (Civil & Sanitary works + Electrical works + Mechanical works) including VAT & IT	2,081,916,503	329,180,847	517,759,629	2,928,856,979	
Project Cost Excluding CD, VAT & IT				7,925,341,247	
CD & VAT(35%) and VAT(7.5%) & IT(7%)				3,289,964,576	BDT
Project Cost With VAT & IT				11,215,305,823	
Physical Contingency (8%)				897,224,466	BDT
Price Contingency (5%)				560,765,291	BDT
Grant Total (Total Project Cost)				12,673,295,580	BDT
Grant Total (Total Project Cost) in Lac Unit				126,733	BDT

Table 7.3A: Annual O&M Costs Estimated for Cable Car Route A to B1

Year/Head	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Personnel														
Managerial			10	10	10	10	10	10	10	10	10	10	10	10
Technical			20	20	20	20	20	20	20	20	20	20	20	20
Unskilled (Security)			70	70	70	70	70	70	70	70	70	70	70	70
Personnel costs														
Managerial			60000	63000	66150	69457.5	72930.4	76577	80406	84426	88647	93079.7	97733.7	102620
Technical			40000	42000	44100	46305	48620.3	51051	53604	56284	59098	62053.1	65155.8	68413.6
Unskilled (Security)			20000	21000	22050	23152.5	24310.1	25526	26802	28142	29549	31026.6	32577.9	34206.8
TK. (Lakh)			392.0	411.6	432.2	453.8	476.5	500.3	525.3	551.6	579.2	608.1	638.5	670.5
Marketing (& Promotion Cost) in TK.(Lakh)			35	36.8	38.6	40.5	42.5	44.7	46.9	49.2	51.7	54.3	57.0	59.9
CPF + Graduity			19.6	20.6	21.6	22.7	23.8	25.0	26.3	27.6	29.0	1247	1309	1374
Operation and Maintenance Costs of the Project														
Year/Head	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Administration in Tk. (Lakhs) & Marketing			446.6	468.9	492.4	517.0	542.8	570.0	598.5	628.4	659.8	1,909	2,005	2,105
Electicity Cost in TK. (Lac)				577	606	636	668	701	736	773	812	852	895	940
Other Operation and Maintenance Costs of Cable Car														
4% of Capital Costs in Tk. (Lakhs)	0	0	0	5,008	5,259	5,522	5,798	6,088	6,392	6,712	7,047	7,400	7,770	8,158
Operation Of All utilities in TK.(Lakhs)				50.0	52.5	55.1	57.9	60.8	63.8	67.0	70.4	73.9	77.6	81.4
Total O&M Costs			**446.6**	**6,104**	**6,410**	**6,730**	**7,067**	**7,420**	**7,791**	**8,180**	**8,589**	**10,235**	**10,747**	**11,284**
Accessories' Building	A	B		C	KW SUM		days/yr.	hr./day		factor				
	453	394		204	847		365	off-peak	1	0.5				
Cable Car	A	B1	B2	C				peak	4	1.0				
	100	406	553	100	506		240	off-peak	2	1.1				
	Total KW				1353		240		57699730					
Electicity cost in Tk. (Lakhs)	577			Rate of increase per yr.			5%							
Payroll increase every yr.	5%													
Other Operation and Maintenance Costs		Start after 3yrs. 4% of Total Cost for 1st year. Thereafter O&M will increase@5% per year.												

Continued

Table 7.3A: Annual O&M Costs Estimated for Cable Car Route A to B1 Continued

2039	2040	2041	2042	2043		2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055
10	10	10	10	10		10	10	10	10	10	10	10	10	10	10	10	10
20	20	20	20	20		20	20	20	20	20	20	20	20	20	20	20	20
70	70	70	70	70		70	70	70	70	70	70	70	70	70	70	70	70
107751	113139	118796	124736	130972		137521	144397	151617	159197.9	167157.8	175516	184291.4	193506	203181	213340	224007	235208
71834	75426	79197.3	83157	87315		91681	96265	101078	106131.9	111438.5	117010	122861	129004	135454	142227	149338	156805
35917	37713	39598.6	41579	43657.5		45840	48132	50539	53065.95	55719.25	58505.2	61430.48	64502	67727.1	71113.5	74669.1	78402.6
704.0	739.2	776.1	814.9	855.7		898.5	943.4	990.6	1,040.1	1,092.1	1,146.7	1,204.0	1,264.2	1,327.5	1,393.8	1,463.5	1,536.7
62.9	66.0	69.3	72.8	76.4		80.2	84.2	88.4	92.9	97.5	102.4	107.5	112.9	118.5	124.4	130.7	137.2
1443	1515	1591	1671	1754		1842	1934	2031	2132	2239	2351	2468	2592	2721	2857	3000	3150
2039	2040	2041	2042	2043		2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055
2,210.0	2,320.5	2,436.5	2,558.3	2,686.2		2,821	2,962	3,109.7	3,265.1	3,428.4	3,599.8	3,779.8	3,968.8	4,167.2	4,375.6	4,594.4	4,824.1
987	1036	1088	1142	1200		1260	1322	1389	1458	1531	1607	1688	1772	1861	1954	2052	2154
8,566	8,994	9,444	9,916	10,412		10,933	11,479	12,053	12,656	13,289	13,953	14,651	15,383	16,153	16,960	17,808	18,699
85.5	89.8	94.3	99.0	103.9		109.1	114.6	120.3	126.3	132.7	139.3	146.3	153.6	161.3	169.3	177.8	186.7
11,848	**12,441**	**13,063**	**13,716**	**14,402**		**15,122**	**15,878**	**16,672**	**17,505**	**18,381**	**19,300**	**20,265**	**21,278**	**22,342**	**23,459**	**24,632**	**25,864**

Table 7.3B: Annual O&M Costs Estimated for Cable Car Route A to B1 & B2 to C Continued

Year/Head	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Personnel														
Managerial			15	15	15	15	15	15	15	15	15	15	15	15
Technical			30	30	30	30	30	30	30	30	30	30	30	30
Unskilled (Security)			100	100	100	100	100	100	100	100	100	100	100	100
Personnel costs														
Managerial			60000	63000	66150	69458	72930	76577	80406	84426	88647	93080	97733.7	102620
Technical			40000	42000	44100	46305	48620	51051	53604	56284	59098	62053	65155.8	68414
Unskilled (Security)			20000	21000	22050	23153	24310	25526	26802	28142	29549	31027	32577.9	34207
TK. (Lakh)			574.0	602.7	632.8	664.5	697.7	732.6	769.2	807.7	848.1	890.5	935.0	981.7
Marketing (& Promotion Cost) in TK.(Lakh)			50	52.5	55.1	57.9	60.8	63.8	67.0	70.4	73.9	77.6	81.4	85.5
CPF + Graduity			28.7	30.1	31.6	33.2	34.9	36.6	38.5	40.4	42.4	1825	1917	2013
Operation and Maintenance Costs of the project														
Year/Head	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Administration in Tk. (Lac)			652.7	685.3	719.6	755.6	793.4	833.0	874.7	918.4	964.3	2,793.5	2,933	3,080
& Marketing														
Electicity Cost in TK. (Lac)				887	931	978	1027	1078	1132	1188	1248	1310	1376	1444
Other Operation and Maintenance Costs of Cable Car														
4% of Capital Costs in Tk. (Lakhs)	0	0	0	5,008	5,259	5,522	5,798	6,088	6,392	6,712	7,047	7,400	7,770	8,158
Operation Of All utilities in TK.(Lakhs)				50.0	52.5	55.1	57.9	60.8	63.8	67.0	70.4	73.9	77.6	81.4
Total O&M Costs			**652.7**	**6,630.5**	**6,962.0**	**7,310**	**7,676**	**8,059**	**8,462**	**8,885.5**	**9,330**	**11,577**	**12,156**	**12,764**
Accessories' Building	A	B		C	KW SUM		days/yr.	hr./day		factor				
	453	394		204	1051		365	off-peak	1	0.5				
Cable Car	A	B1	B2	C				peak	4	1.0				
	100	406	553	100	1159		240	off-peak	2	1.1				
	Total KW				2210		240		88677850					
Electicity cost in Tk. (Lakhs)	887			Rate of increase per yr.			5%							
Payroll increase every yr.	5%													
Other Operation and Maintenance Costs		Start after 3yrs. 4% of Total Cost for 1st year. Thereafter O&M will increase@5% every year.												

Table 7.3B: Annual O&M Costs Estimated for Cable Car Route A to B1 Continued

2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055
15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
107751	113139	118796	124736	130972	137521	144397	151617	159198	167158	175515.6	184291	193506	203181	213340	224007	235208
71834	75426	79197	83157.1	87315	91680.7	96265	101078	106132	111439	117010.4	122861	129004	135454	142227	149338	156805
35917	37713	39599	41578.6	43657.5	45840.4	48132	50539	53066	55719.3	58505.21	61430.5	64502	67727.1	71113.5	74669.1	78402.6
1,030.8	1,082.4	1,136.5	1,193.3	1,253.0	1,315.6	1,381.4	1,450.5	1,523.0	1,599.1	1,679.1	1,763.1	1,851.2	1,943.8	2,041.0	2,143.0	2,250.2
89.8	94.3	99.0	103.9	109.1	114.6	120.3	126.3	132.7	139.3	146.3	153.6	161.3	169.3	177.8	186.7	196.0
2113	2219	2330	2446	2569	2697	2832	2973	3122	3278	3442	3614	3795	3985	4184	4393	4613
2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055
3,233.8	3,395.5	3,565.3	3,743.5	3,930.7	4,127.2	4,333.6	4,550.3	4,777.8	5,016.7	5,267.5	5,530.9	5,807.4	6,097.8	6,402.7	6,722.8	7,059.0
1517	1593	1672	1756	1844	1936	2033	2134	2241	2353	2471	2594	2724	2860	3003	3153	3311
8,566	8,994	9,444	9,916	10,412	10,933	11,479	12,053	12,656	13,289	13,953	14,651	15,383	16,153	16,960	17,808	18,699
85.5	89.8	94.3	99.0	103.9	109.1	114.6	120.3	126.3	132.7	139.3	146.3	153.6	161.3	169.3	177.8	186.7
13,402	**14,072**	**14,776**	**15,515**	**16,290**	**17,105**	**17,960**	**18,858.0**	**19,800.9**	**20,791.0**	**21,830.5**	**22,922.1**	**24,068.2**	**25,272**	**26,535**	**27,862**	**29,255**

Table 7.4A: Annual O&M Costs for Cable Car Route A to B1

Annual Operation and Maintenance Cost			Annual Estimated O&M Cost
Sl. No.	Fiscal Year	Total O&M Cost in Lac BDT	
0	2024-2025	0.00	0
1	2025-2026	0.00	0
2	2026-2027	0.00	446.6
3	2027-2028	7,525.86	6104.3
4	2028-2029	7,525.86	6409.5
5	2029-2030	7,525.86	6730.0
6	2030-2031	7,525.86	7066.5
7	2031-2032	7,525.86	7419.8
8	2032-2033	8,278.45	7790.8
9	2033-2034	8,278.45	8180.4
10	2034-2035	8,278.45	8589.4
11	2035-2036	8,278.45	10235.1
12	2036-2037	8,278.45	10746.9
13	2037-2038	9,106.29	11284.2
14	2038-2039	9,106.29	11848.4
15	2039-2040	9,106.29	12440.8
16	2040-2041	9,106.29	13062.9
17	2041-2042	9,106.29	13716.0
18	2042-2043	10,016.92	14401.8
19	2043-2044	10,016.92	15121.9
20	2044-2045	10,016.92	15878.0
21	2045-2046	10,016.92	16671.9
22	2046-2047	10,016.92	17505.5
23	2047-2048	11,018.62	18380.8
24	2048-2049	11,018.62	19299.8
25	2049-2050	11,018.62	20264.8
26	2050-2051	11,018.62	21278.0
27	2051-2052	11,018.62	22341.9
28	2052-2053	12,120.48	23459.0
29	2053-2054	12,120.48	24632.0
30	2054-2055	12,120.48	25863.6

Key Assumptions:
1. Project Year-30 years
2. After every five year, the O & M cost will increase @ 10%

Table 7.4B: Annual O&M Costs for Cable Car Route A to B1 & B2 to C

Annual Operation and Maintenance Cost			Annual Estimated O&M Cost
Sl. No.	Fiscal Year	Total O&M Cost in Lac BDT	
0	2024-2025	0.00	0
1	2025-2026	0.00	0
2	2026-2027	0.00	652.7
3	2027-2028	12,673.30	6630.5
4	2028-2029	12,673.30	6962.0
5	2029-2030	12,673.30	7310.1
6	2030-2031	12,673.30	7675.6
7	2031-2032	12,673.30	8059.4
8	2032-2033	13,940.63	8462.4
9	2033-2034	13,940.63	8885.5
10	2034-2035	13,940.63	9329.8
11	2035-2036	13,940.63	11577.2
12	2036-2037	13,940.63	12156.1
13	2037-2038	15,334.69	12763.9
14	2038-2039	15,334.69	13402.1
15	2039-2040	15,334.69	14072.2
16	2040-2041	15,334.69	14775.8
17	2041-2042	15,334.69	15514.6
18	2042-2043	16,868.16	16290.3
19	2043-2044	16,868.16	17104.8
20	2044-2045	16,868.16	17960.0
21	2045-2046	16,868.16	18858.0
22	2046-2047	16,868.16	19800.9
23	2047-2048	18,554.97	20791.0
24	2048-2049	18,554.97	21830.5
25	2049-2050	18,554.97	22922.1
26	2050-2051	18,554.97	24068.2
27	2051-2052	18,554.97	25271.6
28	2052-2053	20,410.47	26535.2
29	2053-2054	20,410.47	27861.9
30	2054-2055	20,410.47	29255.0

Key Assumptions:
1. Project Year-30 years
2. After every five year, the O & M costs will increase @ 10%

7.4.3 Benefit (Revenue) Estimates

Direct benefit from the cable car project that will accrue to the project owner cum operator is required to be estimated. Direct benefit or Revenue will mainly be generated from the selling of tourist ticket for riding the cable car of the project. The following issues and assumptions are considered to estimate direct financial benefits (revenue) from the cable car project:

1) The over 500 hotels, motels and guest houses at Cox's Bazar can accommodate around 160,000 tourists daily. With mounting pressure, though, the tourists tend to crowd the rooms.[1] Tourists in Cox's Bazar District are then 58400000 annually for 365 days. The cable car project will operate only for 240 days per year.
2) 7% of the annual tourists in Cox Bazar Districts will be in the project site, who will ride cable car, as the base case.
3) Per tourist ticket fare (price) is 1000 BDT and 1500 BDT per round trip for Station A to B1, and Station A to B1&B2 to Station C respectively, for cable car ride, as a base case.
4) 2% of project's revenue is to be paid as City Corporation's surcharge.
5) 5% growth of service revenue will occur per year.

Based on the above issues and assumptions, total amount of annual revenue generated from the Tourist Ticket Fare of riding cable car is estimated to be BDT 26342 Lac and BDT 39514 Lac, net of 2% of project revenue as surcharge by City Corporation, respectively for cable car route A to B1 and cable car route A to B1&B2 to C. Table 5A and Table 5B depict the estimated annual amount of project's revenue (direct financial benefits) for cable car route A to B1 and cable car route A to B1&B2 to C. This service revenue will continue to grow @5 % per year to estimate revenue streams over the life of project.

Table 7.5A: Financial Direct Benefit (Revenue) for Cable car route A to B1

Sl. No.	Items	Amount BDT in Lac	Comments and Assumptions
1	% of Tourists in the project Site	7%	For a base case scenario, assume **7% of the annual tourists** in Cox Bazer District will be in the project site, who will ride cable car.
2	Cable Car Ticket Fare in BDT	1000	Assume that **per tourist ticket fare is 1000 BDT per round trip** for cable car ride, for a base case scenario.
3	Revenue from the Tourist Ticket Fare (net of 2% of revenue as **city corporation charge/surcharge ---suggested by BEZA**)	26342	1. The over 500 hotels, motels and guest houses at Cox's Bazar can accommodate around 160,000 tourists daily With mounting pressure, though, the tourists tend to crowd the rooms. 2. Annual Tourists in Cox's Bazar District are 58400000 for 365 days. The cable car project operates only for 240 days per year. 3. Weblink: https://en.prothomalo.com/bangladesh/one-million-tourists-to-spend-eid-holidays-at-coxs-bazar#:~:text=The%20over%20500%20hotels%2C%20motels,tend%20to%20crowd%20the%20rooms.
4	**Direct Financial Benefit (Total Revenue)**	**26,342**	

[1] Weblink: https://en.prothomalo.com/bangladesh/one-million-tourists-to-spend-eid-holidays-at-coxs-bazar#:~:text=The%20over%20500%20hotels%2C%20motels.tend%20to%20crowd%20the%20room.

Table 7.5B: Financial Direct Benefit (Revenue) for Cable car route A to B1&B2 to C

Sl. No.	Items	Amount BDT in Lac	Comments and Assumptions
1	% of Tourists in the project Site	7%	For a base case scenario, assume **7% of the annual tourists** in Cox Bazer District will be in the project site, who will ride cable car.
2	Cable Car Ticket Fare in BDT	1500	Assume that **per tourist ticket fare is 1500 BDT per round trip** for cable car ride, for a base case scenario.
3	Revenue from the Tourist Ticket Fare (net of 2% of revenue as **city corporation charge/surcharge --suggested by BEZA**)	39514	1. The over 500 hotels, motels and guest houses at Cox's Bazar can accommodate around 160,000 tourists daily With mounting pressure, though, the tourists tend to crowd the rooms. 2. Annual Tourists in Cox's Bazar District are 58400000 for 365 days. The cable car project operates only for 240 days per year. 3. Weblink: https://en.prothomalo.com/bangladesh/one-million-tourists-to-spend-eid-holidays-at-coxs-bazar#:~:text=The%20over%20500%20hotels%2C%20motels,tend%20to%20crowd%20the%20rooms.
4	**Direct Financial Benefit (Total Revenue)**	**39,514**	

Table 6A and 6B provide financial analysis table showing indicators of financial viability of cable car project for cable car route A to B1 and cable car route A to B1& B2 to C respectively.

7.4.4 Summary Results of Financial Analysis for Base Case Scenario

Based on the estimated costs and revenues, the cable car project Internal Rates of Returns (IRRs) in the financial feasibility analysis stand at 26% and 23% respectively for cable car route A to B1 and cable car route A to B1&B2 to C. The above IRRs could be achieved by funding all capital expenditures through cash instead of debt. Key financial indicators of financial analysis for the cable car project are presented in Table 7 below in terms of BDT in lac including the NPV of the project, project's FIRR and BCR. As the project's NPV @ 12% (SOCC) is positive and BCR is greater than one, while the FIRR of the project is greater than social cost of capital of 12%, this implies that the cable car project is financially viable.

Table 7.6: Summary Results of Financial Analysis --NPV, FIRR, and BCR of Cable Car Project at Naf Tourism Park

Base Case (7% of tourists and Price of cable car riding – Tk. 1500/1000)	Situation of O&M Cost	Financial Analysis for Cable Car Route A to B1 (Price of cable car riding –Tk. 1000)	Financial Analysis for Cable Car Route A to B1&B2 to C (Price of cable car riding – Tk. 1500)
Project's NPV @12% (SOCC) BDT in Lac	O&M Costs in %	130,653.6	173,884.9
	O&M Cost Estimated	121,948.0	194,851.3
FIRR	O&M Costs in %	26%	23%
	O&M Cost Estimated	26%	26%
BCR	O&M Costs in %	2.09	1.86
	O&M Cost Estimated	1.95	2.07

Table 7.7A1: Financial Analysis with Annual O&M Costs (10% of project Cost) for Cable Car Route A to B1

All Costs and Revenue are in Lac BDT							
Fiscal Year	Capital Investment	O&M Expenses	Financial Cost of the Project	Financial Benifit of the Project	Discounted Financial Cost of the Project	Discounted Financial Benefit of the Project	Net Financial Benefits of the Project
2024-2025	15051.73	0.00	15051.73	0.00	15051.73	0.00	-15051.73
2025-2026	37629.31	0.00	37629.31	0.00	33597.60	0.00	-37629.31
2026-2027	22577.59	0.00	22577.59	0.00	17998.71	0.00	-22577.59
2027-2028		7525.86	7525.86	26342.40	5356.76	18750.00	18816.54
2028-2029		7525.86	7525.86	27659.52	4782.82	17578.13	20133.66
2029-2030		7525.86	7525.86	29042.50	4270.38	16479.49	21516.63
2030-2031		7525.86	7525.86	30494.62	3812.84	15449.52	22968.76
2031-2032		7525.86	7525.86	32019.35	3404.32	14483.93	24493.49
2032-2033		8278.45	8278.45	33620.32	3343.53	13578.68	25341.87
2033-2034		8278.45	8278.45	35301.34	2985.29	12730.02	27022.89
2034-2035		8278.45	8278.45	37066.40	2665.44	11934.39	28787.95
2035-2036		8278.45	8278.45	38919.72	2379.86	11188.49	30641.27
2036-2037		8278.45	8278.45	40865.71	2124.87	10489.21	32587.26
2037-2038		9106.29	9106.29	42908.99	2086.93	9833.63	33802.70
2038-2039		9106.29	9106.29	45054.44	1863.33	9219.03	35948.15
2039-2040		9106.29	9106.29	47307.17	1663.69	8642.84	38200.87
2040-2041		9106.29	9106.29	49672.52	1485.43	8102.66	40566.23
2041-2042		9106.29	9106.29	52156.15	1326.28	7596.25	43049.86
2042-2043		10016.92	10016.92	54763.96	1302.60	7121.48	44747.03
2043-2044		10016.92	10016.92	57502.16	1163.03	6676.39	47485.23
2044-2045		10016.92	10016.92	60377.26	1038.42	6259.12	50360.34
2045-2046		10016.92	10016.92	63396.13	927.16	5867.92	53379.20
2046-2047		10016.92	10016.92	66565.93	827.82	5501.18	56549.01
2047-2048		11018.62	11018.62	69894.23	813.04	5157.35	58875.61
2048-2049		11018.62	11018.62	73388.94	725.93	4835.02	62370.33
2049-2050		11018.62	11018.62	77058.39	648.15	4532.83	66039.77
2050-2051		11018.62	11018.62	80911.31	578.71	4249.53	69892.69
2051-2052		11018.62	11018.62	84956.87	516.70	3983.93	73938.26
2052-2053		12120.48	12120.48	89204.72	507.48	3734.94	77084.24
2053-2054		12120.48	12120.48	93664.95	453.10	3501.50	81544.48
2054-2055		12120.48	12120.48	98348.20	404.56	3282.66	86227.72
Sum	**75258.63**				**120106.50**	**250760.12**	**130653.62**
						NPV(12%,J8:J37)+J7	**130653.62**
						FIRR	**26%**
						BCR	**2.09**

Table 7.7A2: Financial Analysis Estimated O&M Costs for Cable Car Route A to B1							
All Costs and Benefits are in Lac BDT							
Fiscal Year	Capital Investment	O&M Expenses Estimated	Financial Cost of the Project	Financial Benifit of the Project	Discounted Financial Cost of the Project	Discounted Financial Benefit of the Project	Net Financial Benefit of the Project
2024-2025	15051.73	0.00	15051.73	0.00	15051.73	0.00	-15051.73
2025-2026	37629.31	0.00	37629.31	0.00	33597.60	0.00	-37629.31
2026-2027	22577.59	446.60	22577.59	0.00	17998.71	0.00	-22577.59
2027-2028		6104.32	6104.32	26342.40	4344.93	18750.00	20238.08
2028-2029		6409.53	6409.53	27659.52	4073.37	17578.13	21249.99
2029-2030		6730.01	6730.01	29042.50	3818.79	16479.49	22312.49
2030-2031		7066.51	7066.51	30494.62	3580.11	15449.52	23428.11
2031-2032		7419.84	7419.84	32019.35	3356.36	14483.93	24599.52
2032-2033		7790.83	7790.83	33620.32	3146.58	13578.68	25829.49
2033-2034		8180.37	8180.37	35301.34	2949.92	12730.02	27120.97
2034-2035		8589.39	8589.39	37066.40	2765.55	11934.39	28477.01
2035-2036		10235.10	10235.10	38919.72	2942.35	11188.49	28684.62
2036-2037		10746.85	10746.85	40865.71	2758.45	10489.21	30118.85
2037-2038		11284.20	11284.20	42908.99	2586.05	9833.63	31624.80
2038-2039		11848.41	11848.41	45054.44	2424.42	9219.03	33206.04
2039-2040		12440.83	12440.83	47307.17	2272.89	8642.84	34866.34
2040-2041		13062.87	13062.87	49672.52	2130.84	8102.66	36609.66
2041-2042		13716.01	13716.01	52156.15	1997.66	7596.25	38440.14
2042-2043		14401.81	14401.81	54763.96	1872.81	7121.48	40362.15
2043-2044		15121.90	15121.90	57502.16	1755.76	6676.39	42380.25
2044-2045		15878.00	15878.00	60377.26	1646.02	6259.12	44499.27
2045-2046		16671.90	16671.90	63396.13	1543.14	5867.92	46724.23
2046-2047		17505.49	17505.49	66565.93	1446.70	5501.18	49060.44
2047-2048		18380.77	18380.77	69894.23	1356.28	5157.35	51513.46
2048-2049		19299.81	19299.81	73388.94	1271.51	4835.02	54089.14
2049-2050		20264.80	20264.80	77058.39	1192.04	4532.83	56793.59
2050-2051		21278.04	21278.04	80911.31	1117.54	4249.53	59633.27
2051-2052		22341.94	22341.94	84956.87	1047.69	3983.93	62614.94
2052-2053		23459.03	23459.03	89204.72	982.21	3734.94	65745.68
2053-2054		24631.99	24631.99	93664.95	920.82	3501.50	69032.97
2054-2055		25863.58	25863.58	98348.20	863.27	3282.66	72484.62
Sum	75258.63				128812.12	250760.12	**121948.00**
						NPV(12%,J8:J37)+J7	**121948.00**
						FIRR	**26%**
						BCR	**1.95**

Table 7.7B1: Financial Analysis with Annual O&M Costs (10% of project Cost) for Cable Car Route A to B1&B2 to C							
All Costs and Benefits are in Lac BDT							
Fiscal Year	Capital Investment	O&M Expenses	Financial Cost of the Project	Financial Benifit of the Project	Discounted Financial Cost of the Project	Discounted Financial Benefit of the Project	Net Financial Benefits of the Project
2024-2025	25346.59	0.00	25346.59	0.00	25346.59	0.00	-25346.59
2025-2026	63366.48	0.00	63366.48	0.00	56577.21	0.00	-63366.48
2026-2027	38019.89	0.00	38019.89	0.00	30309.22	0.00	-38019.89
2027-2028		12673.30	12673.30	39513.60	9020.60	28125.00	26840.30
2028-2029		12673.30	12673.30	41489.28	8054.11	26367.19	28815.98
2029-2030		12673.30	12673.30	43563.74	7191.17	24719.24	30890.45
2030-2031		12673.30	12673.30	45741.93	6420.69	23174.29	33068.64
2031-2032		12673.30	12673.30	48029.03	5732.76	21725.89	35355.73
2032-2033		13940.63	13940.63	50430.48	5630.38	20368.02	36489.85
2033-2034		13940.63	13940.63	52952.00	5027.13	19095.02	39011.38
2034-2035		13940.63	13940.63	55599.60	4488.51	17901.58	41658.98
2035-2036		13940.63	13940.63	58379.58	4007.60	16782.74	44438.96
2036-2037		13940.63	13940.63	61298.56	3578.21	15733.81	47357.94
2037-2038		15334.69	15334.69	64363.49	3514.31	14750.45	49028.80
2038-2039		15334.69	15334.69	67581.67	3137.78	13828.55	52246.98
2039-2040		15334.69	15334.69	70960.75	2801.59	12964.26	55626.06
2040-2041		15334.69	15334.69	74508.79	2501.42	12154.00	59174.10
2041-2042		15334.69	15334.69	78234.23	2233.41	11394.37	62899.54
2042-2043		16868.16	16868.16	82145.94	2193.53	10682.22	65277.78
2043-2044		16868.16	16868.16	86253.23	1958.51	10014.58	69385.08
2044-2045		16868.16	16868.16	90565.90	1748.67	9388.67	73697.74
2045-2046		16868.16	16868.16	95094.19	1561.31	8801.88	78226.03
2046-2047		16868.16	16868.16	99848.90	1394.03	8251.76	82980.74
2047-2048		18554.97	18554.97	104841.34	1369.13	7736.03	86286.37
2048-2049		18554.97	18554.97	110083.41	1222.44	7252.53	91528.44
2049-2050		18554.97	18554.97	115587.58	1091.46	6799.24	97032.61
2050-2051		18554.97	18554.97	121366.96	974.52	6374.29	102811.99
2051-2052		18554.97	18554.97	127435.31	870.11	5975.90	108880.34
2052-2053		20410.47	20410.47	133807.07	854.57	5602.40	113396.61
2053-2054		20410.47	20410.47	140497.43	763.01	5252.25	120086.96
2054-2055		20410.47	20410.47	147522.30	681.26	4923.99	127111.83
	126732.96				202255.24	376140.18	**173884.94**
						NPV(12%,J8:J37)+J7	**173884.94**
						FIRR	**23%**
						BCR	**1.86**

Table 7.7B2: Financial Analysis with Estimated O&M Cost for Cable Car Route A to B1 & B2 to C							
All Costs and Benefits are in Lac BDT							
Fiscal Year	Capital Investment	O&M Expenses Estimated	Financial Cost of the Project	Financial Benifit of the Project	Discounted Financial Cost of the Project	Discounted Financial Benefit of the Project	Net Financial Benefit of the Project
2024-2025	25346.59	0.00	25346.59	0.00	25346.59	0.00	-25346.59
2025-2026	63366.48	0.00	63366.48	0.00	56577.21	0.00	-63366.48
2026-2027	38019.89	652.70	38019.89	0.00	30309.22	0.00	-38019.89
2027-2028		6630.50	6630.50	39513.60	4719.46	28125.00	32883.10
2028-2029		6962.03	6962.03	41489.28	4424.50	26367.19	34527.25
2029-2030		7310.13	7310.13	43563.74	4147.96	24719.24	36253.61
2030-2031		7675.64	7675.64	45741.93	3888.72	23174.29	38066.29
2031-2032		8059.42	8059.42	48029.03	3645.67	21725.89	39969.61
2032-2033		8462.39	8462.39	50430.48	3417.82	20368.02	41968.09
2033-2034		8885.51	8885.51	52952.00	3204.20	19095.02	44066.49
2034-2035		9329.78	9329.78	55599.60	3003.94	17901.58	46269.82
2035-2036		11577.20	11577.20	58379.58	3328.17	16782.74	46802.38
2036-2037		12156.06	12156.06	61298.56	3120.16	15733.81	49142.50
2037-2038		12763.86	12763.86	64363.49	2925.15	14750.45	51599.63
2038-2039		13402.05	13402.05	67581.67	2742.33	13828.55	54179.61
2039-2040		14072.16	14072.16	70960.75	2570.93	12964.26	56888.59
2040-2041		14775.77	14775.77	74508.79	2410.25	12154.00	59733.02
2041-2042		15514.55	15514.55	78234.23	2259.61	11394.37	62719.67
2042-2043		16290.28	16290.28	82145.94	2118.38	10682.22	65855.66
2043-2044		17104.80	17104.80	86253.23	1985.98	10014.58	69148.44
2044-2045		17960.04	17960.04	90565.90	1861.86	9388.67	72605.86
2045-2046		18858.04	18858.04	95094.19	1745.49	8801.88	76236.15
2046-2047		19800.94	19800.94	99848.90	1636.40	8251.76	80047.96
2047-2048		20790.99	20790.99	104841.34	1534.12	7736.03	84050.36
2048-2049		21830.54	21830.54	110083.41	1438.24	7252.53	88252.88
2049-2050		22922.06	22922.06	115587.58	1348.35	6799.24	92665.52
2050-2051		24068.16	24068.16	121366.96	1264.08	6374.29	97298.80
2051-2052		25271.57	25271.57	127435.31	1185.07	5975.90	102163.74
2052-2053		26535.15	26535.15	133807.07	1111.01	5602.40	107271.92
2053-2054		27861.91	27861.91	140497.43	1041.57	5252.25	112635.52
2054-2055		29255.00	29255.00	147522.30	976.47	4923.99	118267.29
Sum	126732.96				181288.92	376140.18	**194851.26**
						NPV(12%,J8:J37)+J7	**194851.26**
						FIRR	**26%**
						BCR	**2.07**

7.5 Economic Analysis

Economic analysis of a project is carried out to find out the benefit of the project accrued to the society and the country. Thus the analysis is done for indirect benefit received by the society and the country.

7.5.1 Environmental Aspects

Environmental aspects of the project were also analyzed. This analysis has been used to develop appropriate mitigation strategy for the project during construction and operation of the project as well as the recommended environmental management plan for the plant too.

7.5.2 Indirect Net Economic Benefits of the Project

Indirect Net Economic Benefits from Cable car to these areas include

- Second-order benefits to the economy and/or society arising from sources of induced income growth outside the project itself;
- indirect benefits accrued to the people due to better transportation system;
- Economic benefits due to increased business opportunities.

Apportionment of all on-site project costs into net of relevant taxes and 'para-tariffs' (such as supplementary duties and the like), and government's tax yield has been done, with the latter being added to the government revenue from the implementation of the Cable car project in question.

Let us now worked out indirect net economic benefit resulting from Cable car project:

1) Bangladesh loses $14 billion/15091048.00 lac a year due to air pollution, says a report from Greenpeace Southeast Asia and Center for Research on Energy and Clean Air published recently.[2]
2) Let us assume that there will be demerit of the project @0.05% (Pollution cost) for polluting fresh air a bit. Hence environmental pollution cost will be BDT 15091048 x 0.0005 = 7545.52 lac in BDT.
3) Due to increase of tourism facilities people will travel in greater number in the country instead of going outside the country. Let us assume that there will be some saving of opportunity cost for travelling other country, which may be taken @ 5% of the project revenue.
4) Due to development of tourism sector there will be indirect local business development in many other sectors, which is assumed to be 25% of the project revenue.
5) Due to development of tourism sector, there will be indirect income from transport sectors, which is assumed to be 10% of the project's revenue.

Indirect benefits could not be quantified in this study using primary data because it was beyond the scope of this study. As such, benefit transfer method has been used to monetize the indirect benefits. Based on the above issues and assumptions regarding second order benefit to the economy and the society, total amount of annual indirect net economic benefits is estimated to be BDT 2991.4 Lac and BDT 8259.9 Lac, respectively for cable car route A to B1 and cable car route A to B1&B2 to C. Table 8A and Table 8B show the estimated annual amount of indirect net economic benefits of the project for cable car route A to B1 and cable car route A to B1&B2 to C respectively. This indirect benefits will continue to grow @5 % per year to estimate indirect net benefits streams over the life of project.

[2] Web Link: https://www.tbsnews.net/environment/bangladesh-loses-14bn-year-air-pollution-44359

Table 7.8A: Total Indirect Net Economic Benefits for Cable Car Route A to B1			
Sl. No.	Items	Amount BDT in Lac	Comments and Assumptions
1	Environmental Pollution	**-7545.52**	1. Bangladesh loses $14 billion/15091048.00 lac a year due to air pollution, says a report from Greenpeace Southeast Asia and Center for Research on Energy and Clean Air published recently. 2. Web Link: https://www.tbsnews.net/environment/bangladesh-loses-14bn-year-air-pollution-44359 3. Let us assume that there will be demerit of the project 0.05% (Pollution cost) for polluting fresh air a bit.
2	Revenue from the Tourist Ticket Fare (net of 2% of revenue as city corporation charge/surcharge ---suggested by BEZA)	26342	Derived from Sl # 3 of Table 5A regarding estimation of Direct financial benefits of cable car project.
3	Saving of Opportunity Cost of Travelling Other Country	**1317**	Due to increase of tourism facilities people will travel in greater number in the country instead of going outside the country. Let us assume that there will be some saving for not going outside the country which may be taken @ 5% of the project's revenue.
4	Indirect Local Business Development	**6585.6**	Due to development of tourism sector, there will be indirect development in many other sectors which is assumed to be 25% of the project's revenue.
5	Income from Transport Sector	**2634.24**	Due to development of tourism sector, there will be indirect income from transport sectors, which is assumed to be 10% of the project's revenue.
6	**Total Indirect Net Economic Benefits** (sum of Amounts in Column 3 of SL # 1, 3, 4 and 5)	**2991.44**	

Table 7.8B : Total Indirect Net Economic Benefits for Cable Car Route A to B1&B2 to C			
Sl. No.	Items	Amount BDT in Lac	Comments and Assumptions
1	Environmental Pollution	**-7545.52**	1. Bangladesh loses $14 billion/15091048.00 lac a year due to air pollution, says a report from Greenpeace Southeast Asia and Center for Research on Energy and Clean Air published recently, 2. Web Link: https://www.tbsnews.net/environment/bangladesh-loses-14bn-year-air-pollution-44359 3. Let us assume that there will be demerit of the project @0.05% (Pollution cost) for polluting fresh air a bit.
2	Revenue from the Tourist Ticket Fare (net of 2% of revenue as **city corporation charge/surcharge ---suggested by BEZA**)	39514	Derived from Sl # 3 of Table 5B regarding estimation of Direct financial benefits of cable car project.
3	Saving of Opportunity Cost of Travelling Other Country	**1976**	Due to increase of tourism facilities people will travel in greater number in the country instead of going outside the country. Let us assume that there will be some saving for not going outside the country which may be taken @ 5% of the project's revenue
4	Indirect Local Business Development	**9878.4**	Due to development of tourism sector, there will be indirect development in many other sectors which is assumed to be 25% of the project's revenue.
5	Income from Transport Sector	**3951.36**	Due to development of tourism sector, there will be indirect income from transport sectors, which is assumed to be 10% of the project's revenue.
6	**Total Indirect Net Economic Benefits** (sum of Amounts in Column 3 of SL # 1, 3, 4 and 5)	**8259.92**	

Table 9A and 9B provide economic analysis table showing indicators of economic viability of cable car project for cable car route A to B1 and cable car route A to B1& B2 to C respectively

Table 7.9A1: Economic Analysis with Annual O&M Costs (10% of Project Costs) for Cable Car Route A to B1

All costs are bin Lac BDT

Fiscal Year	Project Cost and O&M Cost	Project Financial Benefit	Net Economic Indirect Benefits for Project incl. Vat & Tax Transfer Payments	Project Benefit	Economic Cost of the Project	Economic Benefit of the Project	Discounted Economic Cost of the Project	Discounted Economic Benefit of the Project	Net Economic Benefit of the Project
2024-2025	15051.7		361.32	361.32	12643.45	303.51	12643.45	303.51	-12339.94
2025-2026	37629.3		903.29	903.29	31608.62	758.76	28221.98	677.47	-30849.86
2026-2027	22577.5		541.97	541.97	18965.17	455.26	15118.92	362.93	-18509.91
2027-2028	7525.86	26342.40	2991.44	29333.84	6321.72	24640.42	4499.68	17538.57	18318.70
2028-2029	7525.86	27659.52	3141.01	30800.53	6321.72	25872.44	4017.57	16442.41	19550.72
2029-2030	7525.86	29042.50	3298.06	32340.55	6321.72	27166.07	3587.12	15414.76	20844.34
2030-2031	7525.86	30494.62	3462.96	33957.58	6321.72	28524.37	3202.78	14451.33	22202.64
2031-2032	7525.86	32019.35	3636.11	35655.46	6321.72	29950.59	2859.63	13548.12	23628.86
2032-2033	8278.45	33620.32	3817.91	37438.23	6953.90	31448.12	2808.56	12701.37	24494.22
2033-2034	8278.45	35301.34	4008.81	39310.15	6953.90	33020.52	2507.64	11907.53	26066.63
2034-2035	8278.45	37066.40	4209.25	41275.65	6953.90	34671.55	2238.97	11163.31	27717.65
2035-2036	8278.45	38919.72	4419.71	43339.44	6953.90	36405.13	1999.08	10465.60	29451.23
2036-2037	8278.45	40865.71	4640.70	45506.41	6953.90	38225.38	1784.89	9811.50	31271.49
2037-2038	9106.29	42908.99	4872.73	47781.73	7649.29	40136.65	1753.02	9198.28	32487.36
2038-2039	9106.29	45054.44	5116.37	50170.81	7649.29	42143.48	1565.20	8623.39	34494.20
2039-2040	9106.29	47307.17	5372.19	52679.35	7649.29	44250.66	1397.50	8084.43	36601.37
2040-2041	9106.29	49672.52	5640.80	55313.32	7649.29	46463.19	1247.76	7579.15	38813.90
2041-2042	9106.29	52156.15	5922.84	58078.99	7649.29	48786.35	1114.08	7105.46	41137.06
2042-2043	10016.9	54763.96	6218.98	60982.94	8414.22	51225.67	1094.18	6661.36	42811.45
2043-2044	10016.9	57502.16	6529.93	64032.09	8414.22	53786.95	976.95	6245.03	45372.74
2044-2045	10016.9	60377.26	6856.43	67233.69	8414.22	56476.30	872.27	5854.72	48062.08
2045-2046	10016.9	63396.13	7199.25	70595.37	8414.22	59300.11	778.82	5488.80	50885.90
2046-2047	10016.9	66565.93	7559.21	74125.14	8414.22	62265.12	695.37	5145.75	53850.90
2047-2048	11018.6	69894.23	7937.17	77831.40	9255.64	65378.38	682.95	4824.14	56122.74
2048-2049	11018.6	73388.94	8334.03	81722.97	9255.64	68647.29	609.78	4522.63	59391.66
2049-2050	11018.6	77058.39	8750.73	85809.12	9255.64	72079.66	544.45	4239.96	62824.02
2050-2051	11018.6	80911.31	9188.27	90099.57	9255.64	75683.64	486.11	3974.97	66428.01
2051-2052	11018.6	84956.87	9647.68	94604.55	9255.64	79467.82	434.03	3726.53	70212.19
2052-2053	12120.4	89204.72	10130.06	99334.78	10181.20	83441.22	426.28	3493.62	73260.02
2053-2054	12120.4	93664.95	10636.57	104301.52	10181.20	87613.28	380.61	3275.27	77432.08
2054-2055	12120.4	98348.20	11168.40	109516.60	10181.20	91993.94	339.83	3070.57	81812.74
							100889.4	235902.4	**135,013**
								NPV(12%, K7:K36)+K6	**135,013**
								EIRR	**29%**
								BCR	**2.34**

Table 7.9A2: Economic Analysis with Estimated O&M cost for Cable Car Route A to B1									
All costs are in Lac BDT									
Fiscal Year	Project Cost and O&M Cost	Project Financial Benefit	Net Economic Indirect Benefits for Project incl. Vat & Tax Transfer Payments	Project Benefit	Economic Cost of the Project	Economic Benefit of the Project	Discounted Economic Cost of the Project	Discounted Economic Benefit of the Project	Net Economic Benefit of the Project
2024-2025	15051.7		69.9	69.9	12643.4	58.7	12643.4	58.7	-12584.7
2025-2026	37629.3		174.8	174.8	31608.6	146.8	28222.0	131.1	-31461.8
2026-2027	23024.2		104.9	104.9	19340.3	88.1	15418.0	70.2	-19252.2
2027-2028	6104.3	26342.4	2991.4	29333.8	5127.6	24640.4	3649.7	17538.6	19512.8
2028-2029	6409.5	27659.5	3141.0	30800.5	5384.0	25872.4	3421.6	16442.4	20488.4
2029-2030	6730.0	29042.5	3298.1	32340.6	5653.2	27166.1	3207.8	15414.8	21512.9
2030-2031	7066.5	30494.6	3463.0	33957.6	5935.9	28524.4	3007.3	14451.3	22588.5
2031-2032	7419.8	32019.4	3636.1	35655.5	6232.7	29950.6	2819.3	13548.1	23717.9
2032-2033	7790.8	33620.3	3817.9	37438.2	6544.3	31448.1	2643.1	12701.4	24903.8
2033-2034	8180.4	35301.3	4008.8	39310.1	6871.5	33020.5	2477.9	11907.5	26149.0
2034-2035	8589.4	37066.4	4209.3	41275.7	7215.1	34671.5	2323.1	11163.3	27456.5
2035-2036	10235.1	38919.7	4419.7	43339.4	8597.5	36405.1	2471.6	10465.6	27807.6
2036-2037	10746.9	40865.7	4640.7	45506.4	9027.4	38225.4	2317.1	9811.5	29198.0
2037-2038	11284.2	42909.0	4872.7	47781.7	9478.7	40136.7	2172.3	9198.3	30657.9
2038-2039	11848.4	45054.4	5116.4	50170.8	9952.7	42143.5	2036.5	8623.4	32190.8
2039-2040	12440.8	47307.2	5372.2	52679.4	10450.3	44250.7	1909.2	8084.4	33800.4
2040-2041	13062.9	49672.5	5640.8	55313.3	10972.8	46463.2	1789.9	7579.2	35490.4
2041-2042	13716.0	52156.2	5922.8	58079.0	11521.4	48786.4	1678.0	7105.5	37264.9
2042-2043	14401.8	54764.0	6219.0	60982.9	12097.5	51225.7	1573.2	6661.4	39128.1
2043-2044	15121.9	57502.2	6529.9	64032.1	12702.4	53787.0	1474.8	6245.0	41084.6
2044-2045	15878.0	60377.3	6856.4	67233.7	13337.5	56476.3	1382.7	5854.7	43138.8
2045-2046	16671.9	63396.1	7199.2	70595.4	14004.4	59300.1	1296.2	5488.8	45295.7
2046-2047	17505.5	66565.9	7559.2	74125.1	14704.6	62265.1	1215.2	5145.7	47560.5
2047-2048	18380.8	69894.2	7937.2	77831.4	15439.8	65378.4	1139.3	4824.1	49938.5
2048-2049	19299.8	73388.9	8334.0	81723.0	16211.8	68647.3	1068.1	4522.6	52435.5
2049-2050	20264.8	77058.4	8750.7	85809.1	17022.4	72079.7	1001.3	4240.0	55057.2
2050-2051	21278.0	80911.3	9188.3	90099.6	17873.5	75683.6	938.7	3975.0	57810.1
2051-2052	22341.9	84956.9	9647.7	94604.6	18767.2	79467.8	880.1	3726.5	60700.6
2052-2053	23459.0	89204.7	10130.1	99334.8	19705.6	83441.2	825.1	3493.6	63735.6
2053-2054	24632.0	93665.0	10636.6	104301.5	20690.9	87613.3	773.5	3275.3	66922.4
2054-2055	25863.6	98348.2	11168.4	109516.6	21725.4	91993.9	725.1	3070.6	70268.5
							108501.2	234818.6	**126,317**
								NPV(@12%,k7:k36)+K6	**126,317**
								EIRR	**28.9%**
								BCR	**2.16**

Table 7.9B1: Economic Analysis with Annual O&M Costs (10% of Project Costs) for Cable Car Route A to B1&B2 to C									
All costs and benefits are in Lac BDT									
Fiscal Year	Project Cost and O&M Cost	Project Financial Benifit	Net Economic Indirect Benefits for Project incl. Vat & Tax Transfer Payments	Project Benefit	Economic Cost of the Project	Economic Benefit of the Project	Discounted Economic Cost of the Project	Discounted Economic Benefit of the Project	Net Economic Benefit of the Project
2024-2025	25347		658	658	21291	553	21291	553	-20738
2025-2026	63366		1645	1645	53228	1382	47525	1234	-51846
2026-2027	38020		987	987	31937	829	25460	661	-31108
2027-2028	12673	39514	8260	47774	10646	40130	7577	28564	29484
2028-2029	12673	41489	8673	50162	10646	42136	6765	26778	31491
2029-2030	12673	43564	9107	52670	10646	44243	6041	25105	33597
2030-2031	12673	45742	9562	55304	10646	46455	5393	23536	35810
2031-2032	12673	48029	10040	58069	10646	48778	4816	22065	38132
2032-2033	13941	50430	10542	60972	11710	51217	4730	20686	39507
2033-2034	13941	52952	11069	64021	11710	53778	4223	19393	42068
2034-2035	13941	55600	11623	67222	11710	56467	3770	18181	44756
2035-2036	13941	58380	12204	70583	11710	59290	3366	17044	47580
2036-2037	13941	61299	12814	74112	11710	62254	3006	15979	50544
2037-2038	15335	64363	13455	77818	12881	65367	2952	14980	52486
2038-2039	15335	67582	14127	81709	12881	68635	2636	14044	55754
2039-2040	15335	70961	14834	85794	12881	72067	2353	13166	59186
2040-2041	15335	74509	15575	90084	12881	75671	2101	12344	62789
2041-2042	15335	78234	16354	94588	12881	79454	1876	11572	66573
2042-2043	16868	82146	17172	99318	14169	83427	1843	10849	69258
2043-2044	16868	86253	18030	104284	14169	87598	1645	10171	73429
2044-2045	16868	90566	18932	109498	14169	91978	1469	9535	77809
2045-2046	16868	95094	19878	114973	14169	96577	1312	8939	82408
2046-2047	16868	99849	20872	120721	14169	101406	1171	8380	87237
2047-2048	18555	104841	21916	126757	15586	106476	1150	7857	90890
2048-2049	18555	110083	23012	133095	15586	111800	1027	7366	96214
2049-2050	18555	115588	24162	139750	15586	117390	917	6905	101804
2050-2051	18555	121367	25371	146737	15586	123259	819	6474	107673
2051-2052	18555	127435	26639	154074	15586	129422	731	6069	113836
2052-2053	20410	133807	27971	161778	17145	135894	718	5690	118749
2053-2054	20410	140497	29370	169867	17145	142688	641	5334	125543
2054-2055	20410	147522	30838	178360	17145	149823	572	5001	132678
							169894	384453	**214,558**
								NPV(12%, K7:K36)+K6	**214,558**
								EIRR	**28.4%**
								BCR	**2.26**

Table 7.9B2: Economic Analysis with Estimated O&M Costs for Cable Car Route A to B1&B2 to C									
All costs are in Lac BDT									
Fiscal Year	Project Cost and O&M Cost	Project Financial Benifit	Net Economic Indirect Benefit for Project incl. Vat & Tax Transfer Payments	Project Benefit	Economic Cost of the Project	Economic Benefit of the Project	Discounted Economic Cost of the Project	Discounted Economic Benefit of the Project	Net Economic Benefit of the Project
2024-2025	25347		658	658	21291	553	21291	553	-20738
2025-2026	63366		1645	1645	53228	1382	47525	1234	-51846
2026-2027	38673		987	987	32485	829	25897	661	-31656
2027-2028	6631	39514	8260	47774	5570	40130	3964	28564	34560
2028-2029	6962	41489	8673	50162	5848	42136	3717	26778	36288
2029-2030	7310	43564	9107	52670	6141	44243	3484	25105	38103
2030-2031	7676	45742	9562	55304	6448	46455	3267	23536	40008
2031-2032	8059	48029	10040	58069	6770	48778	3062	22065	42008
2032-2033	8462	50430	10542	60972	7108	51217	2871	20686	44108
2033-2034	8886	52952	11069	64021	7464	53778	2692	19393	46314
2034-2035	9330	55600	11623	67222	7837	56467	2523	18181	48630
2035-2036	11577	58380	12204	70583	9725	59290	2796	17044	49565
2036-2037	12156	61299	12814	74112	10211	62254	2621	15979	52043
2037-2038	12764	64363	13455	77818	10722	65367	2457	14980	54645
2038-2039	13402	67582	14127	81709	11258	68635	2304	14044	57378
2039-2040	14072	70961	14834	85794	11821	72067	2160	13166	60247
2040-2041	14776	74509	15575	90084	12412	75671	2025	12344	63259
2041-2042	15515	78234	16354	94588	13032	79454	1898	11572	66422
2042-2043	16290	82146	17172	99318	13684	83427	1779	10849	69743
2043-2044	17105	86253	18030	104284	14368	87598	1668	10171	73230
2044-2045	17960	90566	18932	109498	15086	91978	1564	9535	76892
2045-2046	18858	95094	19878	114973	15841	96577	1466	8939	80736
2046-2047	19801	99849	20872	120721	16633	101406	1375	8380	84773
2047-2048	20791	104841	21916	126757	17464	106476	1289	7857	89012
2048-2049	21831	110083	23012	133095	18338	111800	1208	7366	93462
2049-2050	22922	115588	24162	139750	19255	117390	1133	6905	98135
2050-2051	24068	121367	25371	146737	20217	123259	1062	6474	103042
2051-2052	25272	127435	26639	154074	21228	129422	995	6069	108194
2052-2053	26535	133807	27971	161778	22290	135894	933	5690	113604
2053-2054	27862	140497	29370	169867	23404	142688	875	5334	119284
2054-2055	29255	147522	30838	178360	24574	149823	820	5001	125248
							152720	384453	**231,733**
								NPV(12%,k7:k36)+K6	**231,733**
								EIRR	**30.5%**
								BCR	**2.52**

7.5.3 Summary Results of Economic Analysis for Base Case Scenario

Based on the estimated costs and direct and second order revenues, the cable car project Economic Internal Rates of Returns (EIRRs) in the financial feasibility analysis stand at 29.2% and 28.4% respectively for cable car route A to B1 and cable car route A to B1&B2 to C. Key economic indicators of ecomic analysis for the cable car project are presented in Table 10 below in terms of BDT in lac including the NPV of the project, project's EIRR and BCR. As the project's NPV @ 12% (SOCC) is positive and BCR is greater than one, while the EIRR of the project is greater than social cost of capital of 12%, this implies that the cable car project is economically viable too.

Table 7.10: Summary of Results of Economic Analysis --NPV, EIRR, and BCR of Cable Car Project at Naf Tourism Park

Base Case (7% of tourists and Price of cable car riding – Tk. 1500/1000)	Situation of O&M Cost	Economic Analysis for Cable Car Route A to B1 (Price of cable car riding –Tk. 1000)	Economic Analysis for Cable Car Route A to B1&B2 to C (Price of cable car riding – Tk. 1500)
Project's NPV @12% (SOCC) BDT in Lac	O&M Costs in %	135,013.0	214,558.5
	O&M Cost Estimated	126,317.4	231,733.1
FIRR	O&M Costs in %	29.2%	28.4%
	O&M Cost Estimated	28.9%	30.5%
BCR	O&M Costs in %	2.34	2.26
	O&M Cost Estimated	2.16	2.52

7.6 Sensitivity Analysis

The assumptions of the feasibility study are its foundation. These will be selected based on review of relevant literature. However, it is also important to understand whether the analysis is robust if these assumptions change, cost increase and also cable car riding price decrease take place. As such feasibility analyses for these parameters were done.

In order to make the project resistant to cost escalation and to avoid the sensitivity analysis to cost increase, the cost more than 10% increase (8% for physical contingency and 5% for price contingency) is already included in the capital costs of the project. Table 11A and Table 11B show sensitivity analysis of cable car riding price along with reduction of per cent of tourists in the project side for riding the cable car for cable car route A to B1 and route A to B1 & B2 to C respectively.

The net present value (NPV) of the project at the social cost of capital (SOCC) of 12% is positive, the benefit cost ratio is greater than 1, and the FIRR (EIRR) is greater than 12% in the worst case scenario of sensitivity analysis with a cable car riding price (fare) decrease of more than 10% and a reduction in tourists at the project site of more than 28%. As a result, the project is both financially and economically viable.

Table 7.11A: Sensitivity Analysis of Cable Car Price for Cable Car Route A To B1

Option	% of Tourists	Price for Riding Cable Car- (TK.)	Condition of O&M Cost	Financial Analysis			Economic Analysis		
				NPV	**FIRR**	**BCR**	**NPV**	**EIRR**	**BCR**
I *(Base Case)*	7%	1000	O&M Cost in %	130,653.6	26%	2.09	135,013.0	29.2%	2.34
			O&M Cost in Estimated	121,948.0	26%	1.95	126,317.4	28.9%	2.16
II	7%	900	O&M Cost in %	105,577.6	24%	1.88	105,523.6	25.9%	2.05
			O&M Cost in Estimated	96,872.0	24%	1.75	96,828.0	25.5%	1.89
III	7%	800	O&M Cost in %	80,501.6	21%	1.67	76,034.2	22.4%	1.75
			O&M Cost in Estimated	71,796.0	21%	1.56	67,338.6	21.9%	1.62
IV	6%	1000	O&M Cost in %	94,830.8	23%	1.79	92,885.3	24.4%	1.92
			O&M Cost in Estimated	86,625.1	23%	1.67	84,189.7	24.0%	1.78
V	6%	900	O&M Cost in %	73,337.0	20%	1.61	67,608.7	21.4%	1.67
			O&M Cost in Estimated	64,631.4	20%	1.50	58,913.1	20.0%	1.54
VI	6%	800	O&M Cost in %	51,843.3	18%	1.43	42,332.1	18.1%	1.42
			O&M Cost in Estimated	43,137.7	18%	1.33	33,636.4	17.4%	1.31
VII	5%	1000	O&M Cost in %	59,007.9	19%	1.49	50,757.6	19.2%	1.50
			O&M Cost in Estimated	50,302.3	19%	1.39	42,062.0	18.6%	1.39
VIII	5%	900	O&M Cost in %	41,096.4	17%	1.34	29,693.8	16.4%	1.29
			O&M Cost in Estimated	32,390.8	16%	1.25	20,998.1	15.5%	1.19
IX *(Worst Case)*	5%	800	O&M Cost in %	23185.0	15%	1.19	8,629.0	13.4%	1.09
			O&M Cost in Estimated	14,479.4	14%	1.11	6,572.0	12.0%	1.00

Table 7.11B: Sensitivity Analysis Of Cable Car Price
For Cable Car Route A To B1 & B2 To C

Option	% of Tourists	Price for Riding Cable Car- (TK.)	Condition of O&M Cost	Financial Analysis			Economic Analysis		
				NPV	FIRR	BCR	NPV	EIRR	BCR
I *(Base Case)*	7%	1500	O&M Cost in %	173,884.9	23%	1.86	214,558.5	28.4	2.26
			O&M Cost in Estimated	194,851.3	26%	2.07	231,733.1	30.5	2.52
II	7%	1400	O&M Cost in %	148,808.9	22%	1.74	185,069.1	26.4	2.09
			O&M Cost in Estimated	169,775.3	24%	1.94	202,243.7	28.5	2.32
III	7%	1300	O&M Cost in %	123,732	20%	1.61	155,579.7	24.4%	1.92
			O&M Cost in Estimated	144,699.2	23%	1.80	172,754.3	26.5%	2.13
IV	6%	1500	O&M Cost in %	120,150.6	20%	1.59	151,366.9	24.1%	1.89
			O&M Cost in Estimated	141,117.0	22%	1.78	168,541.6	26.2%	2.10
V	6%	1400	O&M Cost in %	98,656.9	19%	1.49	126,090.3	22.3%	1.74
			O&M Cost in Estimated	119,623.2	21%	1.66	143,265.0	24.3%	1.94
VI	6%	1300	O&M Cost in %	77,163.2	17%	1.38	100,813.7	20.4%	1.59
			O&M Cost in Estimated	98,129.5	19%	1.54	117,988.3	22.4%	1.77
VII	5%	1500	O&M Cost in %	66,416.3	17%	1.33	88,175.4	19.5%	1.52
			O&M Cost in Estimated	87,382.6	19%	1.48	105,350.0	21.5%	1.69
VIII	5%	1400	O&M Cost in %	48,504.9	16%	1.24	67,111.5	17.8%	1.40
			O&M Cost in Estimated	69,471.2	17%	1.38	84,286.2	19.8%	1.55
IX *(Worst Case)*	5%	1300	O&M Cost in %	30,593.4	14%	1.15	46,047.7	16.1%	1.29
			O&M Cost in Estimated	51,559.8	16%	1.28	63,222.3	18.0%	1.41

7.7 Conclusion and Recommendation

To test the question of feasibility, the study team chose the cable car alignment. This service was recommended by the study team for several reasons. Due to its short length and three-station arrangement of this proposed service would be an economically attractive demonstration system with relatively low capital and operating costs. Technological risks related to climate control would be mitigated by short trip lengths. From a markets perspective, this project serves clearly established markets related to parking demand, entertainment, and cultural activities tapping into several reliable and substantial sources of tourist-passenger demand. The project's return like, NPV is positive and BCR is greater than one, and especially the IRR is greater than 12%. Indeed, the cost more than 10% increase (8% for physical contingency and 5% for price contingency) is already included in the capital costs of the project to make the project resistant to cost escalation and to avert the sensitivity analysis to cost increase. In case of sensitivity analysis with cable car riding price (fare) more than 10% decrease and also with more than 28% reduction in % of tourists in the project site for riding the cable car for worst case scenario, the net present value (NPV) of the project is still positive, benefit cost ratio is greater than one, and FIRR (EIRR) is more than 12%. Hence, the project is both economically and financially viable. It is, therefore recommended for implementation of the project.

CHAPTER 08: ENVIRONMENTAL REVIEW

The environmental and social baseline is the existing status of environment and society around the proposed project site. It has been analyzed through assessment of environmental components like air, water, land, noise, soil, etc. and environmental characteristics like physical, biological and socio-economic status of the study area within the 5 km radial zone of the project site. Physical environment includes topography, land, soil, meteorology, air, water, noise, etc. and the biological environment includes flora and fauna. Socio-economic environment of the study area includes demography, ethnicity, religion, education and employment opportunity, occupation, income, poverty, social relations, etc. Baseline environmental conditions are based on the data collected from various related agencies and the secondary documents from published sources and websites. The baseline provides the basis for assessment of impact (potential changes in the baseline conditions) due to the development of proposed Cable Car Project. The site is located at Teknaf Upazila of Cox's Bazar District.

This section describes the existing environmental baseline of the study area, which include the proposed Project site, and in a 5 km radial area around the proposed project site. This includes relevant components of physical, biological and socio-economic environment.The purposes of describing the environmental settings of the study area are:

- To understand the project needs and environmental characteristics of the area; and
- To assess the quality of the existing environment, as well as the environmental impacts of the future developments being studied.

8.1 Meteorology

Bangladesh is located in the tropical monsoon region and its climate is characterized by high temperature, heavy rainfall, often excessive humidity and fairly marked seasonal variations. From the climatic point of view, three distinct seasons can be recognized in Bangladesh- the cool dry season from November to February, the pre-monsoon hot season from March to May and the rainy monsoon season which lasts from June to September.

Bangladesh is located in sub-tropical monsoon climate zone. Based on the analysis of pressure, rainfall and temperature following four seasons are present in Bangladesh viz.

- Winter or Northeast Monsoon (December-February)
- Summer or Pre-Monsoon (March - May)
- Southwest Monsoon (June - September); and
- Autumn or Post-Monsoon (October - November)

Climatic sub-regions of Bangladesh are presented in **Figure 8.1**.Teknaf Upazila falls in the South Eastern Zone. To assess the climatic conditions of the area, climatology data has been obtained from Teknaf Station (at an aerial distance of 50 km from the site) of Bangladesh Meteorological Department (BMD) for the period 2008-2017.

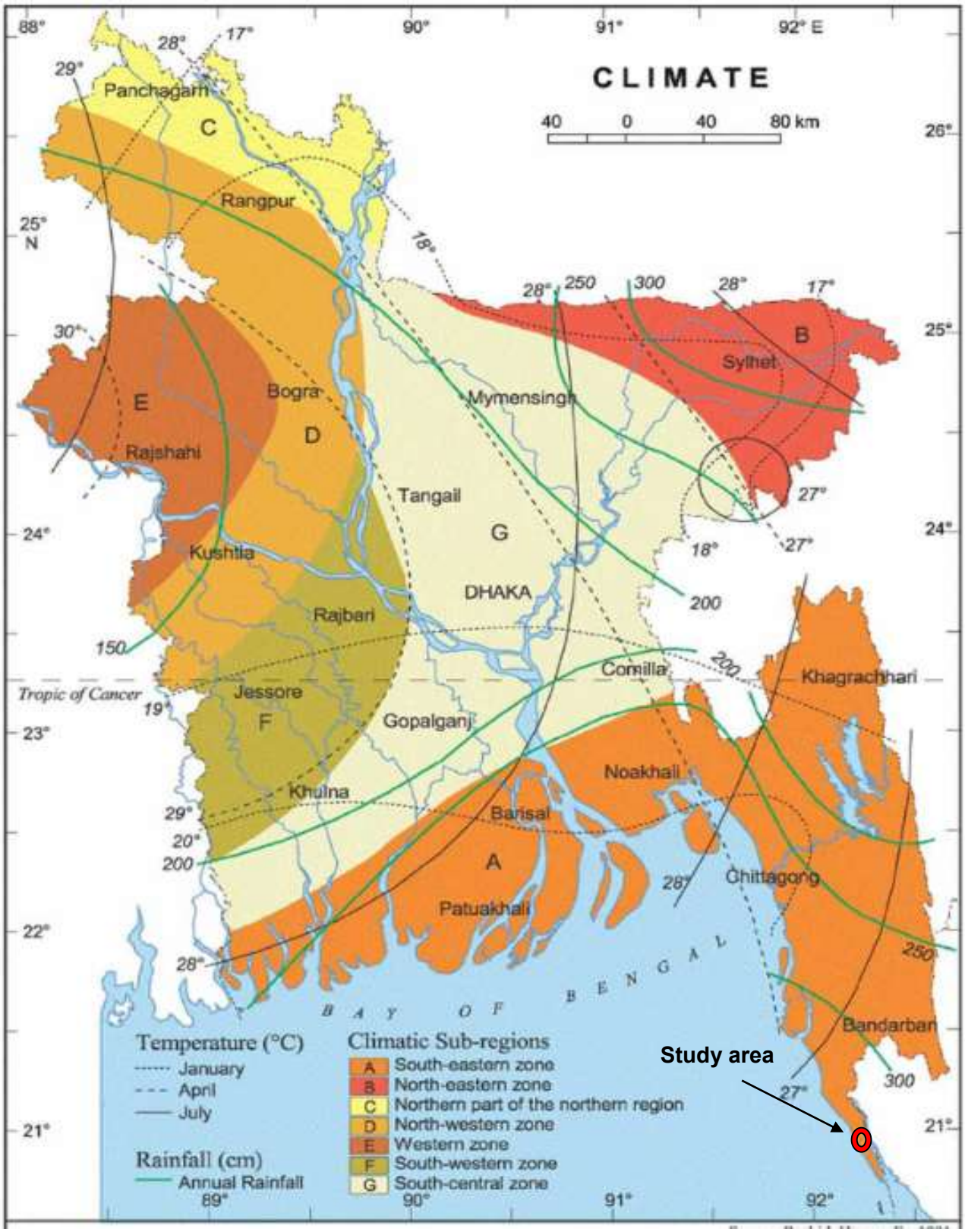


Figure 8.1: Climatic sub-region map Bangladesh [3]

[3] https://www.researchgate.net/figure/Climate-zone-map-of-Bangladesh_fig1_320067184

Climatic conditions of the study area were collected from the Bangladesh Meteorological Department at Teknaf station. Rainfall, temperature, relative humidity and wind speed are described in the following sections.

Temperature: The maximum, minimum and average temperatures recorded at the Teknaf station are presented below in

Figure 8.2 The data analysis of 10 years (2009- 2020) shows that monthly maximum temperature varies from 32°C to 25°C whereas monthly minimum temperature varies from 27°C to 16°C. The warmest month (with the highest average high temperature) is April (33°C). The month with the lowest average high temperature is January (16°C).

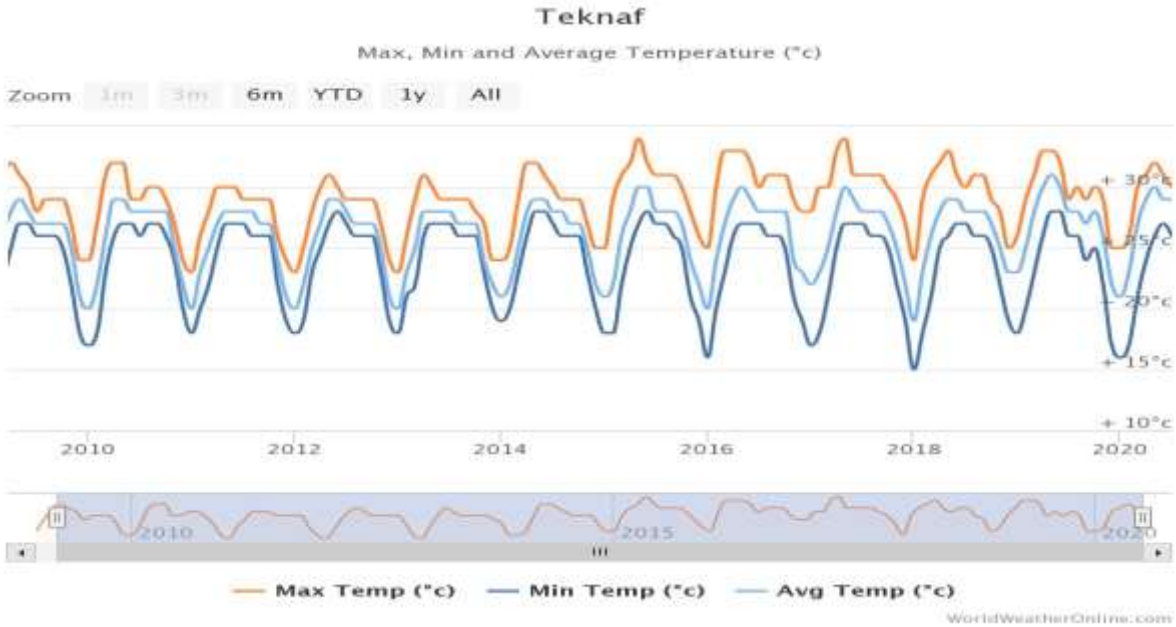


Figure 8.2: Monthly Maximum, Minimum and Average Temperatures (2009-2020)

Source: *https://www.worldweatheronline.com/teknaf-weather-averages/bd.aspx*

Humidity: Due to heavy rainfall and proximity to Bay of Bengal, the humidity levels in Bangladesh remains high. Analysis of 10 years (2008-2017) relative humidity data of Teknaf station indicate that monthly average relative humidity was recorded above 80% during most of the months of the year.

Rainfall: The last 10 years' (2010-2020) rainfall data of Teknaf meteorological station shows that the annual average of total rainfall is recorded as 1966.08 mm.

Wind Speed and Direction: Wind speed data analyzed for 2 years (2016-2017) for the Cox's Bazar station of BMD. Wind speed varied from 0.00 m/s to 3.09 m/s. In general, the average wind speeds were found to be higher during pre-monsoon season (March-April) and lower during the winter season (Nov-January). Monthly variation of wind speeds is presented at the figure below.

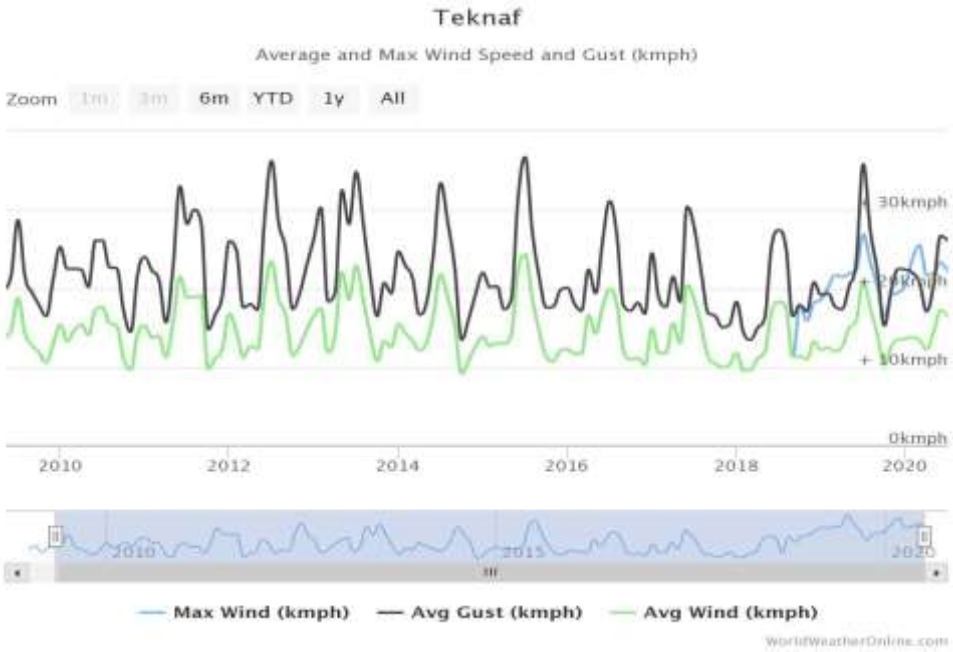


Figure 8.3: Monthly Variation of Wind Speed (2016-2017)

Sun Shine Hours: Sunshine duration or sunshine hours is a climatological indicator, measuring duration of sunshine in a given period (usually, a day or a year) for a given location on Earth, typically expressed as an averaged value over several years. It is a general indicator of cloudiness of a location, and thus differs from in solution, which measures the total energy delivered by sunlight over a given period.

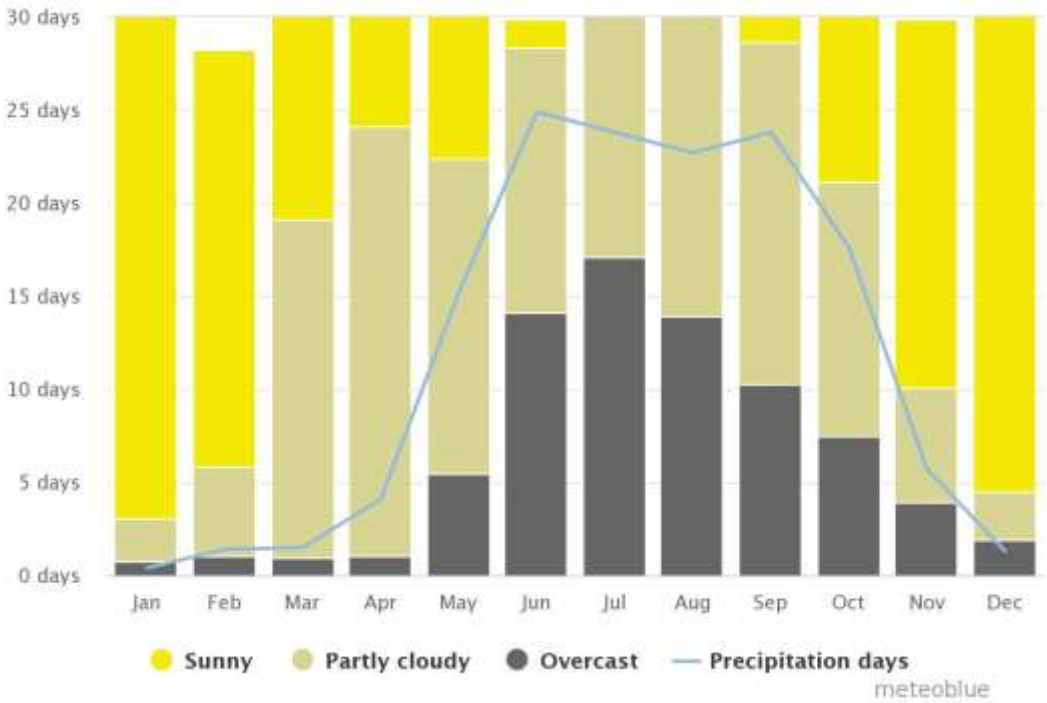


Figure 8.4: Average Monthly Sunshine Hours in the Project Area[4]

[4]https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/n%c4%81r%c4%81yanganj_bangladesh_1185155

Sunshine duration is usually expressed in hours per year, or in (average) hours per day. In the project area, June is the sunniest, followed by July and September. January and February have the lowest amount of sunshine. The average monthly sunshine hours at the project has been given in the following figure.

8.2 Air Quality and Noise

8.2.1 Ambient Air Quality

Teknaf Upazila is not heavily industrialized. The present ambient air quality of the concerned area, as a result, is not much contaminated. There is no major industrial activity is reported or observed in the study area. The air quality monitoring locations were selected based on the locations of settlements within the study area. Logistic factors such as consent of villagers, mainly the house owners, power connection, accessibility, security etc. were also taken into account in finalizing the monitoring stations. Monitoring was conducted in respect of the following parameters:

a. Total Suspended Particulate Matter (SPM)

b. Oxides of Sulphur (SOx)

c. Oxides Nitrogen (NOx)

The existing ambient air quality of the study area was monitored at two (2) locations during the monitoring period (September 2020) as part of the baseline study. Instrument used for air quality monitoring is ambient air quality sampler Haz-Scanner- HIM 6000

The monitoring parameters included Particulate Matter (Suspended Particulate Matter (SPM), PM10 and PM2.5, Sulphur Dioxide (SO2), Oxides of Nitrogen (NOx) and Carbon Monoxide (CO). SPM and CO were monitored for eight hour whereas rest of the parameters were monitored on 24-hourly during the duration of the study

All the above-mentioned pollutants were monitored at the station. Summary of the monitored air quality results are given below in the following table. All the air quality parameters were within the acceptable range prescribed by Environmental Conservation Rules (ECR), 1997.

Suspended Particulate Matter

The recorded concentration of SPM in the study area varies from 9 to 7μg/m^3. The recorded concentrations were within the National Ambient Air Quality Standard for SPM (200 μg/m^3). The results are shown in the figure below.

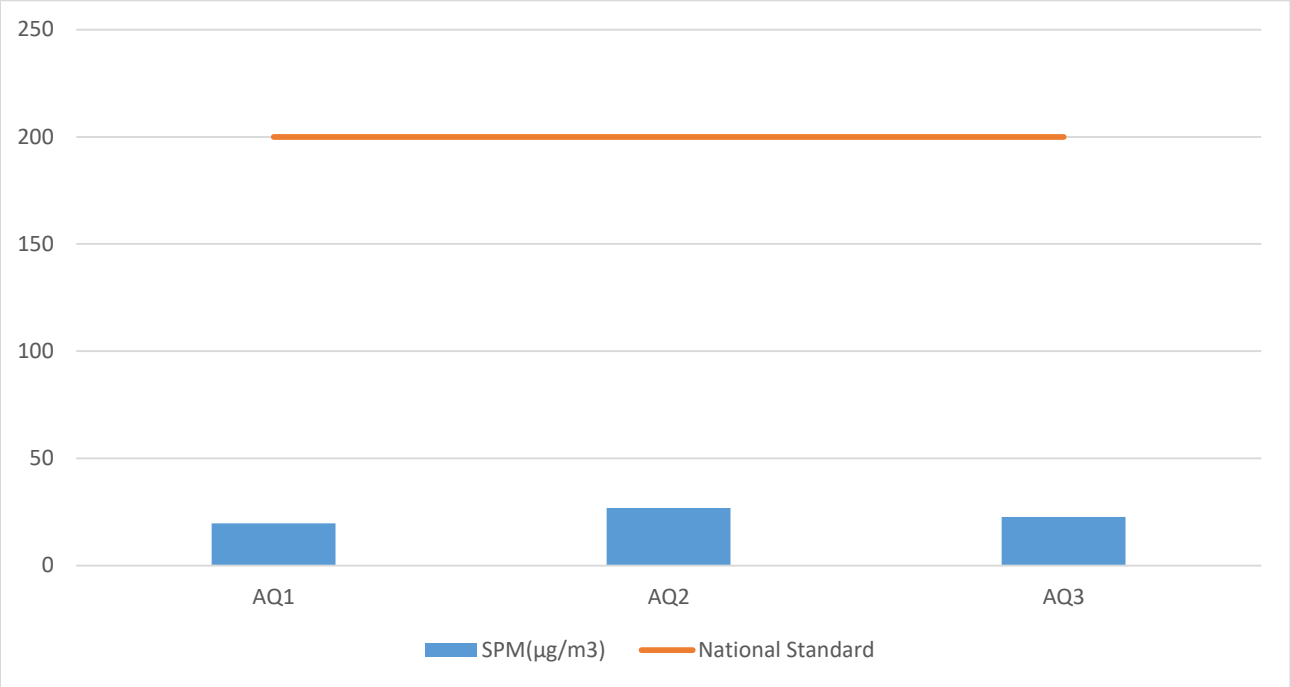


Figure 8.5: SPM Values recorded in the study area

Particulate Matter (PM_{10})

The recorded concentration of PM_{10} in both of the study area was 17 µg/m^3. The concentrations were within the National Ambient Air Quality Standard for PM_{10} (150 µg/m^3). The results are shown in the figure below.

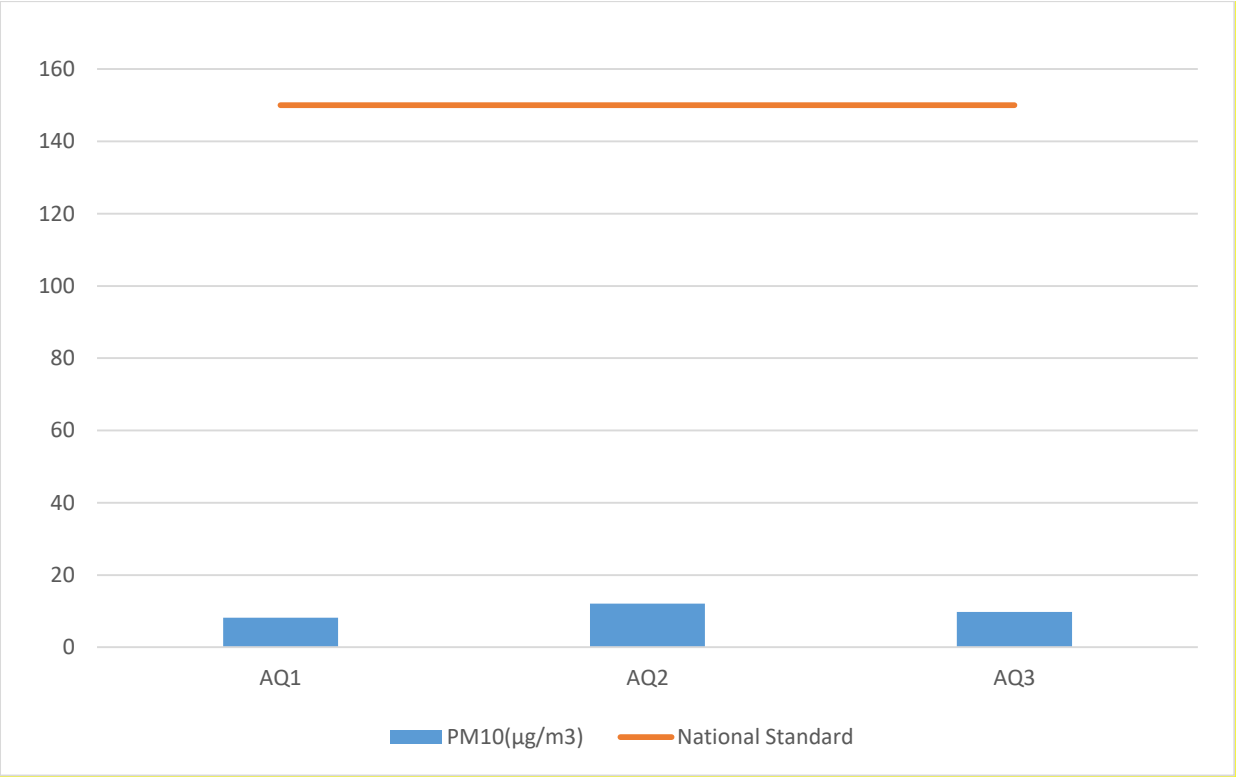


Figure 8.6: PM10 Values recorded in the study area

Particulate Matter ($PM_{2.5}$)

The recorded concentration of $PM_{2.5}$ in the study area varies from 14 to 17 µg/m^3. The concentrations were within the National Ambient Air Quality Standard for $PM_{2.5}$ (65 µg/m^3). The results are shown in the figure below.

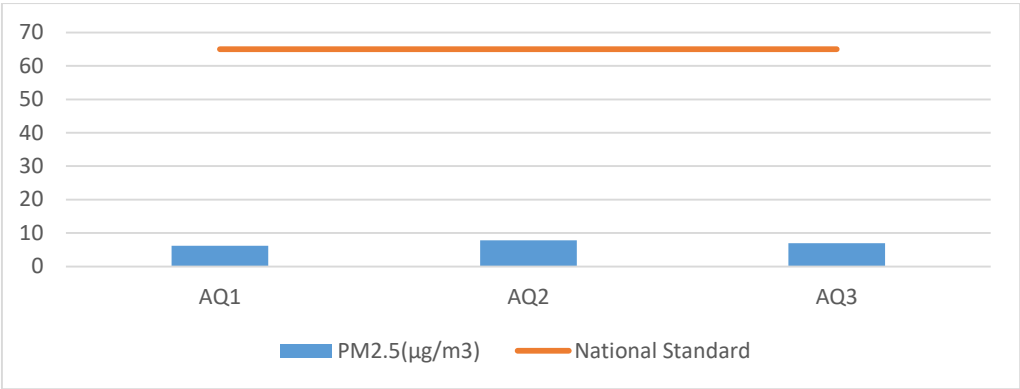


Figure 8.7: PM2.5 Values recorded in the study area

Sulphur Di Oxide (SO_2)

The concentration of SO_2 in the study area varies from 2.90 to 2.36 µg/m^3. The concentrations were within the National Ambient Air Quality Standard for SO_2 (365 µg/m^3). The results are shown in the figure below.

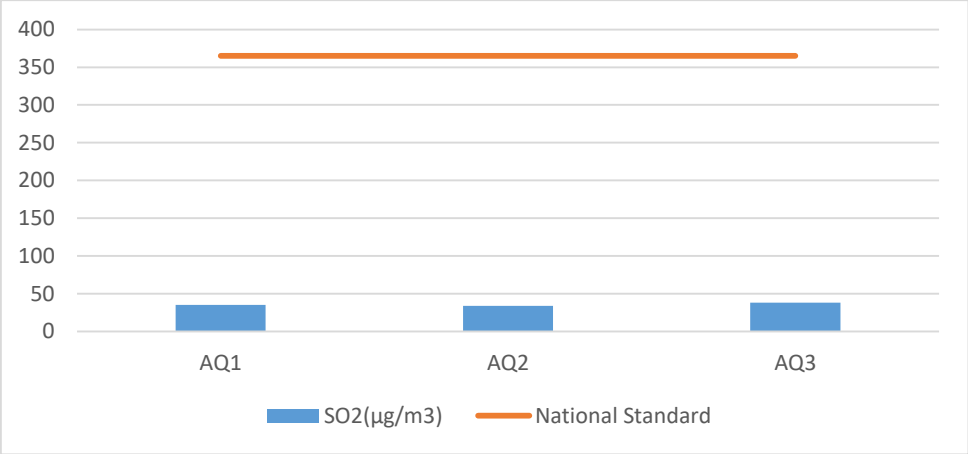


Figure 8.8: SO2 Values recorded in the study area

Oxides of Nitrogen (NOx)

The concentration of NOx in the study area varies from 15.12 to 11.84 µg/m^3. The concentrations were within the National Ambient Air Quality Standard for NOx (100 µg/m^3). The results are shown in the figure below.

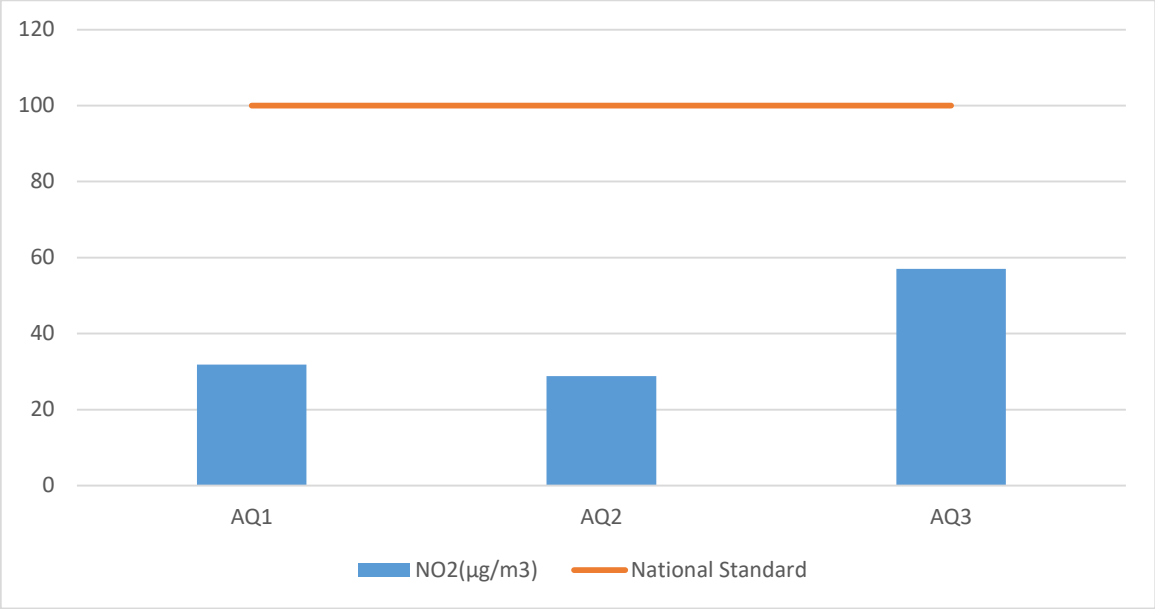


Figure 8.9: NOx Values recorded in the study area

Carbon Mono-oxide (CO)

The concentration of CO in the study area varies from 0.27 to 0.10 ppm. The concentrations were within the National Ambient Air Quality Standard for CO (9 ppm). The results are shown in the figure below.

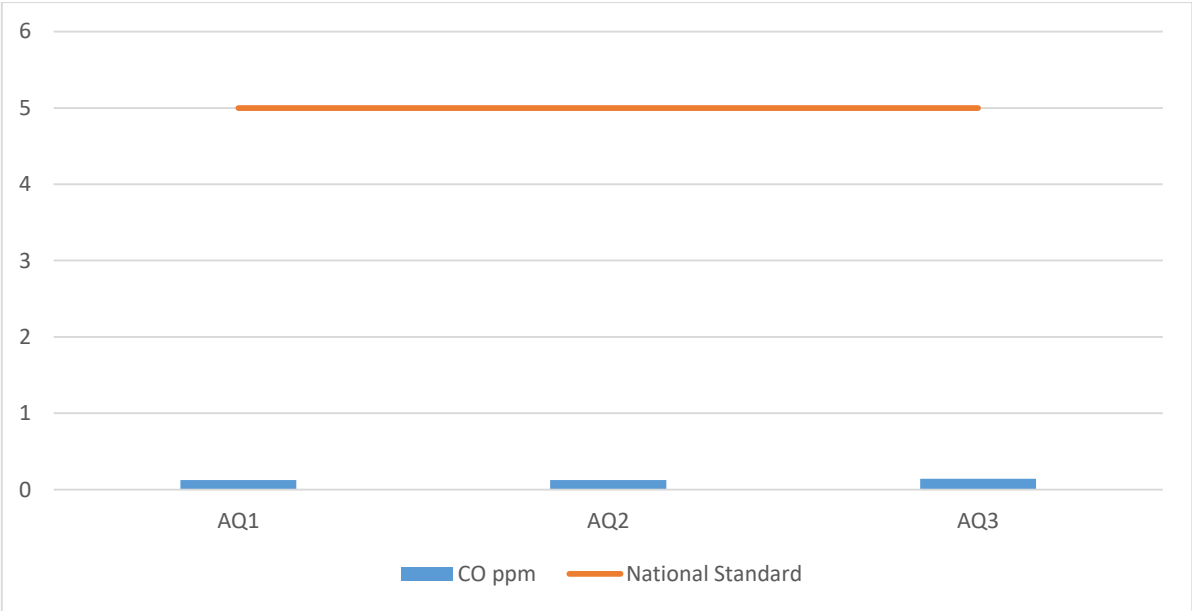


Figure 8.10: CO Values recorded in the study area

The monitored result of the particulate matters SPM, PM_{10} and $PM_{2.5}$ and CO were found to be in compliance to the WHO Ambient Air Quality Guideline Values (2005 and 2000) values. However, the concentration of SO_2 was higher than the WHO Guideline Value. The concentration of NOx in the study area was exceeding than the WHO guidelines value at AQ3. High NOx value could be primarily attributed to the use of wood as cooking medium in the area.

8.2.2 Ambient Noise Level

Data indicates that the existing noise levels in proposed area are within the range of Bangladesh Environmental Quality Standard as well as WB General EHS Guidelines, 2007 for residential zone.

Noise levels were recorded at two (2) locations in the study area during the monitoring period September 2020. The purpose of ambient noise level measurement was to determine sound intensity at the monitoring locations located in proximity to the proposed project footprint areas. Noise levels were measured in the form of sound pressure levels with the help of a digital sound level meter. Noise levels were recorded in the form of A-weighted equivalent continuous sound pressure levels using Tekcoplus Data Logger SLM – 25 noise measuring instrument.

Noise level monitoring was carried out for 24 hours during monitoring period with 1-min equivalent sound pressure levels. At each location, day time Leq has been computed from the hourly sound pressure level values measured between 0600 to 2100 hours and night time Leq has been computed from the hourly sound pressure level values measured between 2100 to 0600 hours.

The baseline noise environment in the project area was within the range accepted by Bangladesh Environmental Quality Standard (Noise Pollution (Control) Rules, 2006).

8.2.3 Air Pollution and Noise Sources from Existing and Known Sources

Existing and known sources of Noise: Noise attenuation is typically described as a set reduction in decibel level per doubling of distance from the source. Depending on the nature of the noise source, sound propagates at different rates. Measures of sound level from a source should specify the distance from the source. The standard reference distance for sound levels at the source is 50 feet. Natural factors such as topography, vegetation, and temperature can further reduce noise over distance. The two most common types of noise are point source and line source. Point source noise is associated with noise that remains in one place for extended periods of time, such as with construction activities. Line source noise is generated by moving objects along a linear corridor. Highway traffic is the best example of line source noise. The standard reduction for point source noise is 6 dB per doubling of distance from the source while for a line source it is 3 dB per doubling of distance from the source.

Construction Noise: One of the easiest things to identify and one of the hardest things to quantify is noise associated with the actual construction of the project. How much noise construction activities will generate, how often will it occur, and how long will it last are all questions that should be answered in the assessment. Construction is usually performed in a series of steps or phases, and noise associated with different phases can vary greatly. However, similarities in noise sources allow typical construction equipment to be placed into one of three categories: heavy equipment, stationary equipment, or impact equipment.

Heavy equipment: Heavy equipment can be defined as earth-moving equipment, such as excavating machinery like excavators, backhoes, and front loaders, as well as handling equipment like graders, pavers, rollers, and dump trucks. Noise levels at 50 feet from heavy equipment range from about 72 to 97 dB. During the phase of construction using heavy equipment, noise is generated more or less at a constant level. Therefore, noise levels can be equated to an average hourly level.

Stationary Equipment: Stationary equipment such as pumps, power generators, and air compressors, Effluent treatment plant (ETP) etc., generally run continuously at relatively constant power and speed. Noise levels at 50 feet from stationary equipment can range from 68 to 88 dB, with pumps typically in the quieter range. An averaged noise level may be assumed for stationary equipment because of its fixed location and constant noise pattern.

Existing and known sources of Air pollutants: There are several sources of air pollutants like emissions from vehicles, emissions from landfill discharge, emissions from natural gas use, emissions from electricity consumption etc.

8.3 Water Resources

Surface Water System: The nearest River of the project site is Naf River. Naf River is a river that starts in Myanmar and flows into the Bay of Bengal. The lower part of the river marks the border of Bangladesh and Myanmar. It starts in the Arakan hills. Its width varies from 1.61 km to 3.22 km. The Naf River's average depth is 128 feet (39 m) and maximum depth is 400 feet (120 m).

Water quality Analysis: Water sampling and analysis were undertaken to understand the overall baseline water quality characteristics of the surface and groundwater in the project area. The surface water sampling was based on the identification of the major surface water body and its interaction with the project. Ground water sampling locations were selected to obtain representative water samples from various zones within the project area. The samples were collected from existing tube well (Hand pump being used by the villagers). Surface water & Ground water were monitored at two different locations from the study area. Samples were collected to understand the potential impact due to proposed project activities. The samples were analyzed for parameters covering physical, chemical and bacteriological characteristics as mentioned in the scope of works. Water samples were collected randomly in pre-washed sterile glass bottles. The surface water quality was compared with the Bangladesh ECR, 1997 standard for best practice classification criteria.

Tropical Cyclones and Tidal Flooding: Natural hazards can be categorized into three broad categories in Bangladesh, like exogenic hazards caused by the earth surface processes (flood, riverbank erosion, coastal erosion, landslide, soil erosion and groundwater contamination); endogenic hazards caused by internal earth processes (earthquake and volcanic eruption); and, atmospheric hazards caused by atmospheric processes (storm, cyclone, northwester, tornado, hurricane, drought, etc.). On many occasions there are overlaps between these different events. Natural hazards can be profiled against seven basic criteria such as event magnitude, frequency of occurring, duration and areal extent, speed of onset, spatial dispersion and temporal spacing.

80% area of Bangladesh are floodplain (the project area is also included), and it has an extensive sea coastline, rendering the nation very much at risk of periodic widespread damage. But, the cyclone risk map shows the location of project is in The High Risk Area. Devastating cyclones hit the coastal areas of Bangladesh almost every year usually accompanied by high-speed winds, sometimes reaching 250 km/hr or more and 3-10m high waves, causing extensive damage to life, property and livestock. Because of the funnel shaped coast, Bangladesh repeatedly becomes the landing ground of cyclones formed in the Bay of Bengal. These cyclones occur in two seasons, April-May and October-November – i.e.

before and after the monsoon. The flood prone map of Bangladesh shows that proposed project falls in Flood High Risk Area.

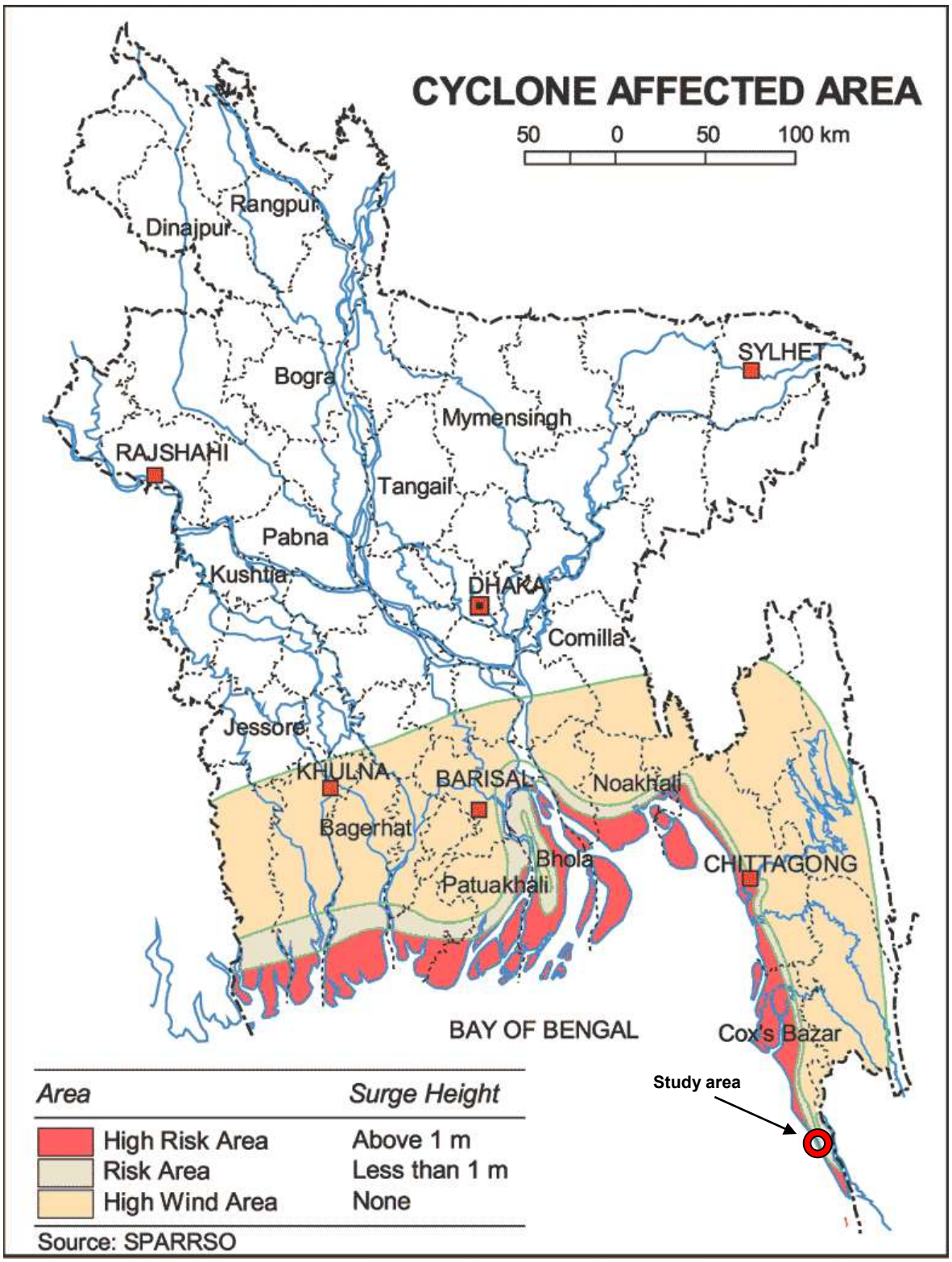


Figure 8.11: Cyclone Affected Area Map of Bangladesh [5]

[5] Bangladesh Space Research and Remote Sensing Organization (SPARRSO)]

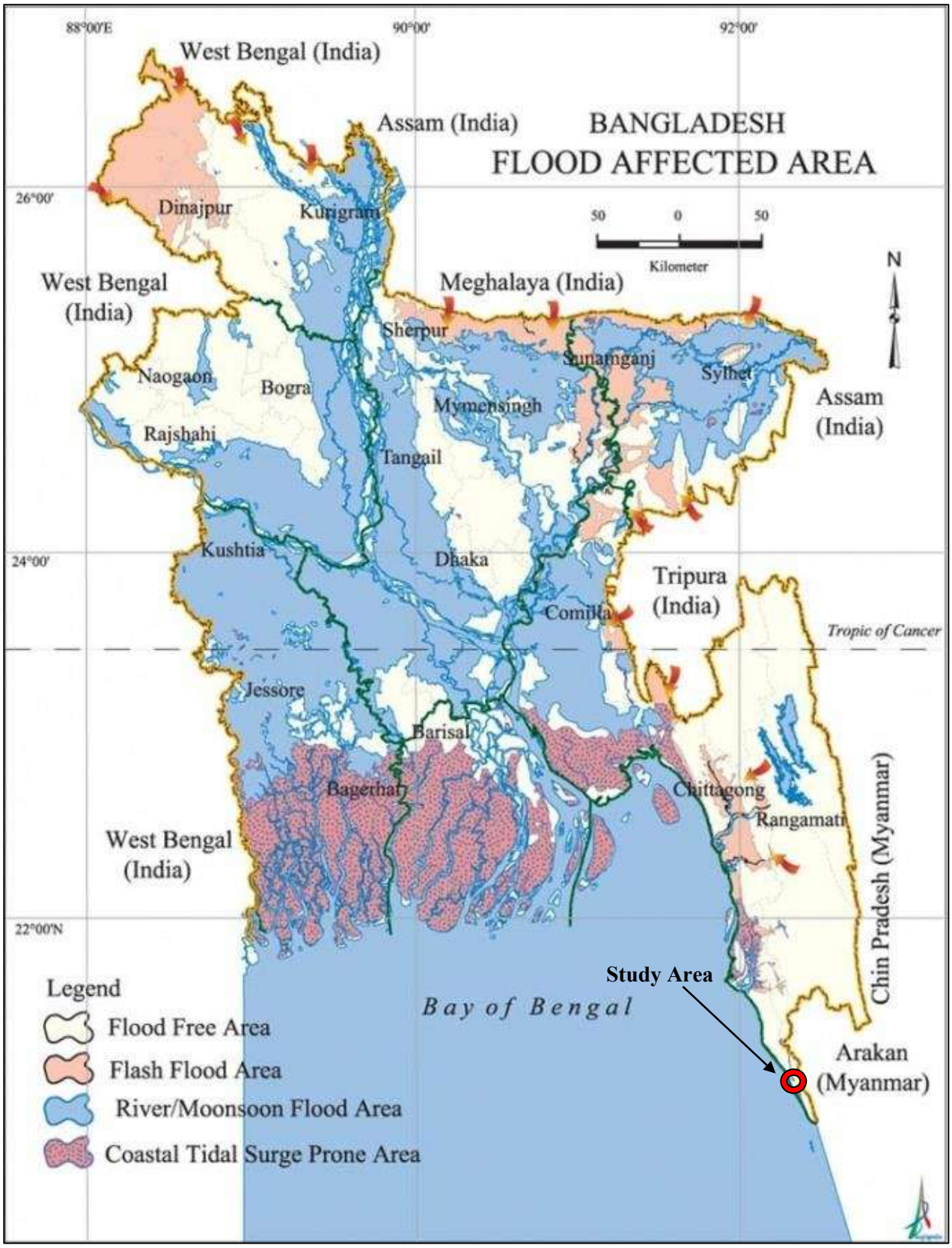


Figure 8.12: Flood Affected Areas of Bangladesh [6]

[6] Bangladesh Water Development Board

Salinity: Salinity issues are mainly associated with coastal regions in Bangladesh. The figure given below shows the saline zones of Bangladesh which clearly indicates that the proposed project site is in low salinity to medium salinity zone. The surface water of rivers are non-saline.

Figure 8.13: Salinity Zones of Bangladesh Indicating the Project Site[7]

[7] http://en.banglapedia.org/images/6/6c/SalineSoil.jpg

Drainage Congestion and water logging: The proposed project site has several natural drainage systems. The proposed project area is located in the flood plain of the Naf River. Naf River is a perennial River which is originated from Tso Lamho River of North Sikkim Himalaya. A number of tributaries meet the Naf River at the upstream direction of the project area and the main tributary of Naf River is Rangit River. Main course of Naf River flows within the study area from northwest to south east at a nearest distance of 0.7 km east of the project site. A natural stream (offshoot from the Naf River) passes through eastern portion of the Site. Per local residents, this stream is seasonal and carries water during rainy season interm ittently for 3-4 months. However, only surface runoff within its catchment is carried in the Stream and not the water from Naf River , as an embankment has been constructed upstream of the Site (1,200 m from Site) across the stream disconnecting it from Naf River . According to local residents, up to 6 inches of water inundates the stream during rainy season which drains swiftly (from few hours to couple of days after rainfall event). Maximum water level observed in the stream was up to 1.5 m deep approximately 12 – 15 years ago (2005-06). Much of the stream has been encroached by local farmers for cultivation of crops. Small pockets of water-logged areas were observed within the stream along the stretches within the Site and off-Site. There is no possibility of water logging in that site. It will be developed proper drainage system for the site and preserved the natural water bodies. So, it is unlikely that the area would face drainage congestion and water logging.

Erosion and sedimentation: Millions of people of the country are affected by riverbank erosion every year that damages standing crops, farmland and homestead land. During monsoon, extensive overbank spills, bank erosion and bank-line shifts have become typical. The unpredictable shifting behavior of the rivers and encroachments not only affect the rural floodplain population but also the urban growth centers and infrastructures. From the above table it is evident that the project area is free from river bank erosion.

Table 8.1: River Erosion during 2008-2011 in Various Upazila of Cox's Bazar[8]

Upazila	2008	2009	2010	2011
Chakaria	Yes	Yes	Yes	Yes
Cox's Bazar Sadar	No	No	No	No
Kutubdia	No	No	No	No
Moheshkhali	No	No	No	No
Pekua	No	No	No	No
Ramu	No	No	No	No
Teknaf	**No**	**No**	**No**	**No**
Ukhia	No	No	No	No

Ground Water System: Hydro-stratigraphy is mainly reliant on the aquifer materials and its geometry which is the lateral and vertical extent of the aquifer. Generally subsurface geological cross section, multi-log section is satisfactory way in determining the location of the aquifers, aquifer geometry and variability of aquifer materials (Mukherjee et al., 2007). The lithology of bore logs consists of nine major types of unconsolidated sediments: clay, silty clay, very fine to fine sand, fine to medium sand, fine to medium sand with gravel, fine to coarse

[8] BBS District Statistics Cox's Bazar, 2011

sand with gravel, medium to coarse sand, coarse sand, gravel. From the hydro-stratigraphic point of view, sand and gravel are considered as aquifer and clay and silty clay as aquitard.

8.4 Land Resources

Agro-ecological regions: Agro-ecological Zones are land areas categorized on the basis of four elements such as physiography, soils, land levels in relation to flooding and agro-climatology. Physiography forms the primary element in defining and delineating the agro ecological regions in Bangladesh. Soils form the second element in defining and differentiating agro ecological zones as soil conditions determine important properties for plant growth, moisture supply, root aeration and nutrient supply. The third factor is land level in relation to flooding. The last one is related to different agricultural products for different climatic conditions of the regions.

It is considered in identifying agro ecological zones in Bangladesh comprises the four climatic zones of the country. Agro-ecological zone indicates an area characterized by homogeneous agricultural and ecological characteristics. This homogeneity is more prominent in the sub-region and unit levels. The agro-ecological zones of Bangladesh have been divided in thirty regions. The Project falls under Northern and Eastern hills region.

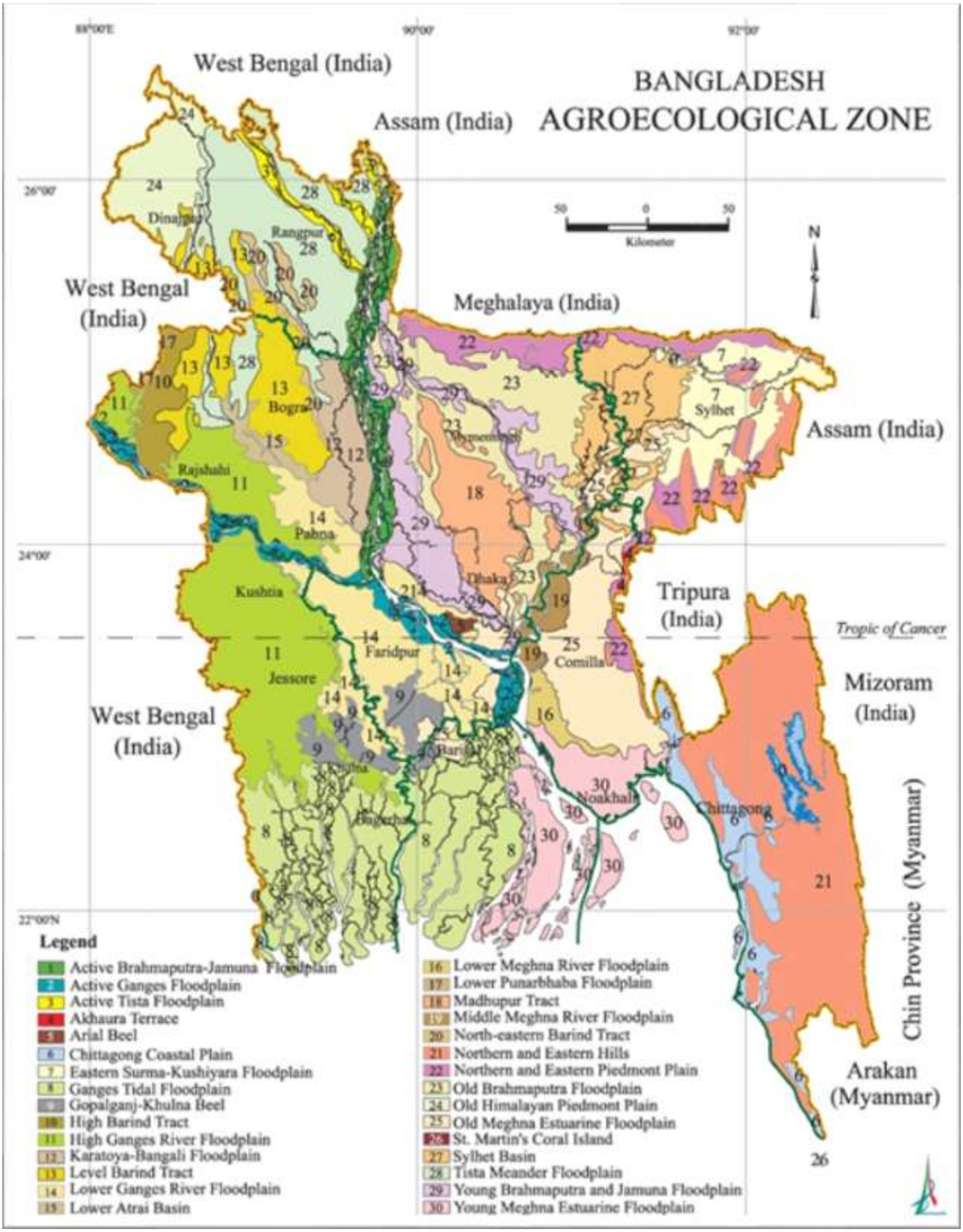


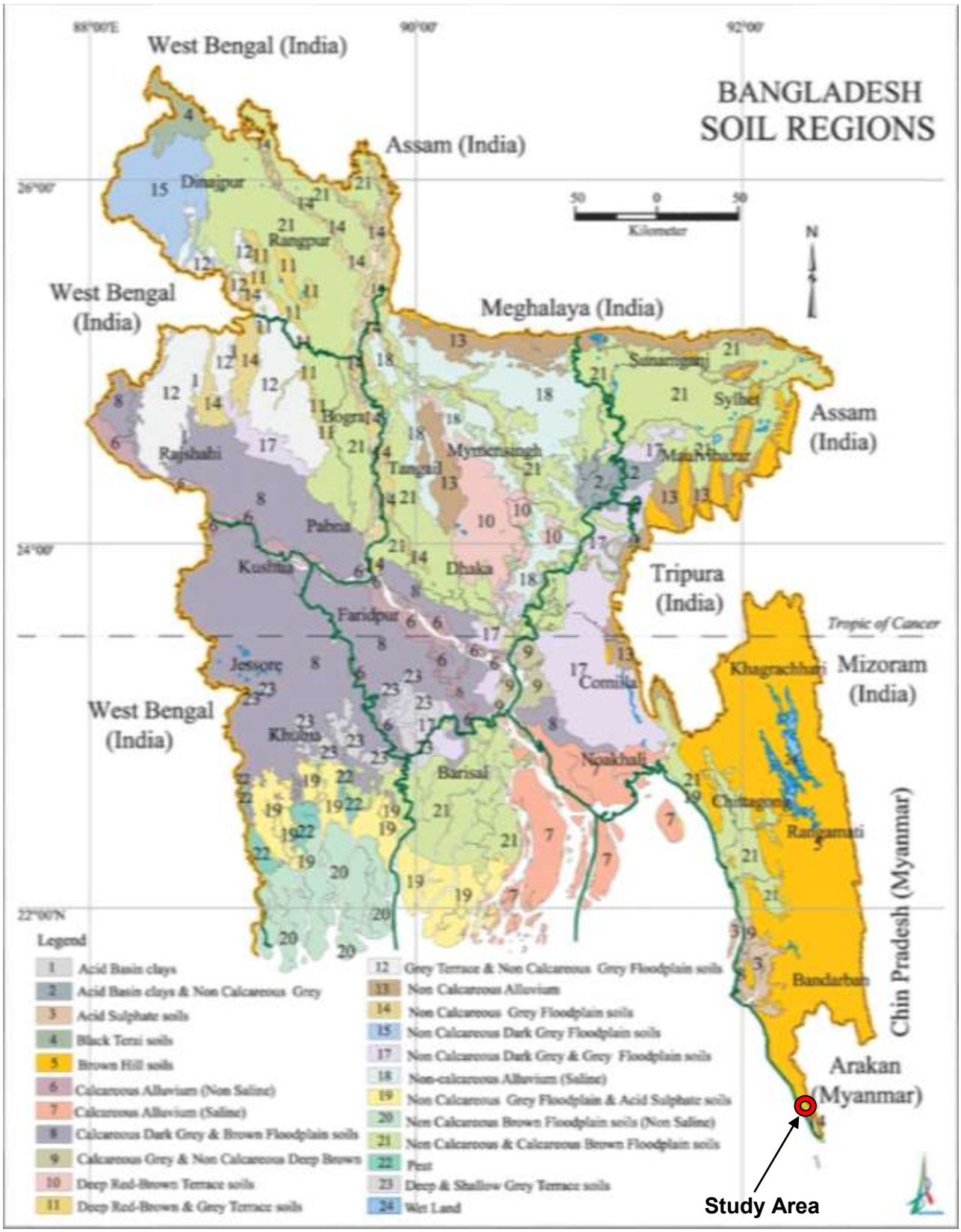
Figure 8.14: Agro-ecological Regions of Bangladesh including the Project[9]

[9] http://en.banglapedia.org/images/f/f2/AgroecologicalZone.jpg

Land Types: Based on depth of inundation during monsoon season, land type of Bangladesh has been classified. In terms of depth of flooding, five classes of land type are recognized, these are high land (above flood level), medium highland (flooding depth 0-90 cm), medium lowland (flooding depth 90-180 cm), low land (flooding depth 90-270 cm) and very lowland (flooding depth >270 cm). The general type of soil found in the project area are Brown Hill Soil, a soil characterized by slight or no leaching of clay and iron. The profile is always decalcified, at least in the upper horizons. Alternatively, brown hill soils are drained soils with a yellow-brown to strong brown Dystric Cambisols. The texture is generally sandy loam or silty loam, but may be more clayey in eroded soils over shales. The organic matter contents range from low (<1.5%) under grassland to moderate (2-5%) under forest.

Soil Texture: Soil texture is known as a qualitative classification instrument used both in the field and laboratory for agricultural soils to determine classes based on physical texture. While classes are distinguished in the field and the class is then used to determine crop suitability and to approximate the soils responses to environmental and management conditions such as drought or calcium (lime) requirements. As a qualitative rather than a quantitative tool it is a fast, simple and effective means to assess a soil's physical characteristics.

The soil classification map of Bangladesh shows that the soil texture of the project area is Brown Hill soils. The figure given above represents the broad soil classification of the project area. Brown hill soils are drained soils with a yellow-brown to strong brown Dystric Cambisols. The texture is generally sandy loam or silty loam, but may be more clayey in eroded soils over shales. The organic matter contents range from low (<1.5%) under grassland to moderate (2-5%) under forest. The agricultural potentiality of these soils is generally low or very low for field crops, but low to high for tree crops. Major limitations include very steep slopes, heavy monsoon rainfall, erodibility of most soils, and difficulty of making terrace, generally low soil fertility and rapid permeability. Usually more acidic as compared to Brown Floodplain soils and contains broken rock or little mottled sand in the substratum in comparison to Red-Brown Terrace soils. There are about 156,472 ha Brown Hill Soils occupying the gentle to very steep slopes in the Northern and Eastern Hills of Bangladesh i.e., in the Sylhet and Chittagong region. The soils consist of hard red clay with a mixture of fine sand of the same colour and nodules containing a large percentage of sesquioxides. The soils are moderately to strongly acidic. The soils are highly leached and have a low natural fertility. Hills are mainly under natural and plantation forests. Shifting cultivation is practiced in some places.



[10]Figure 8.15: Soil regions of Bangladesh including the Project

[10] http://en.banglapedia.org/images/4/46/SoilDetail.jpg

8.4.1 Land Use

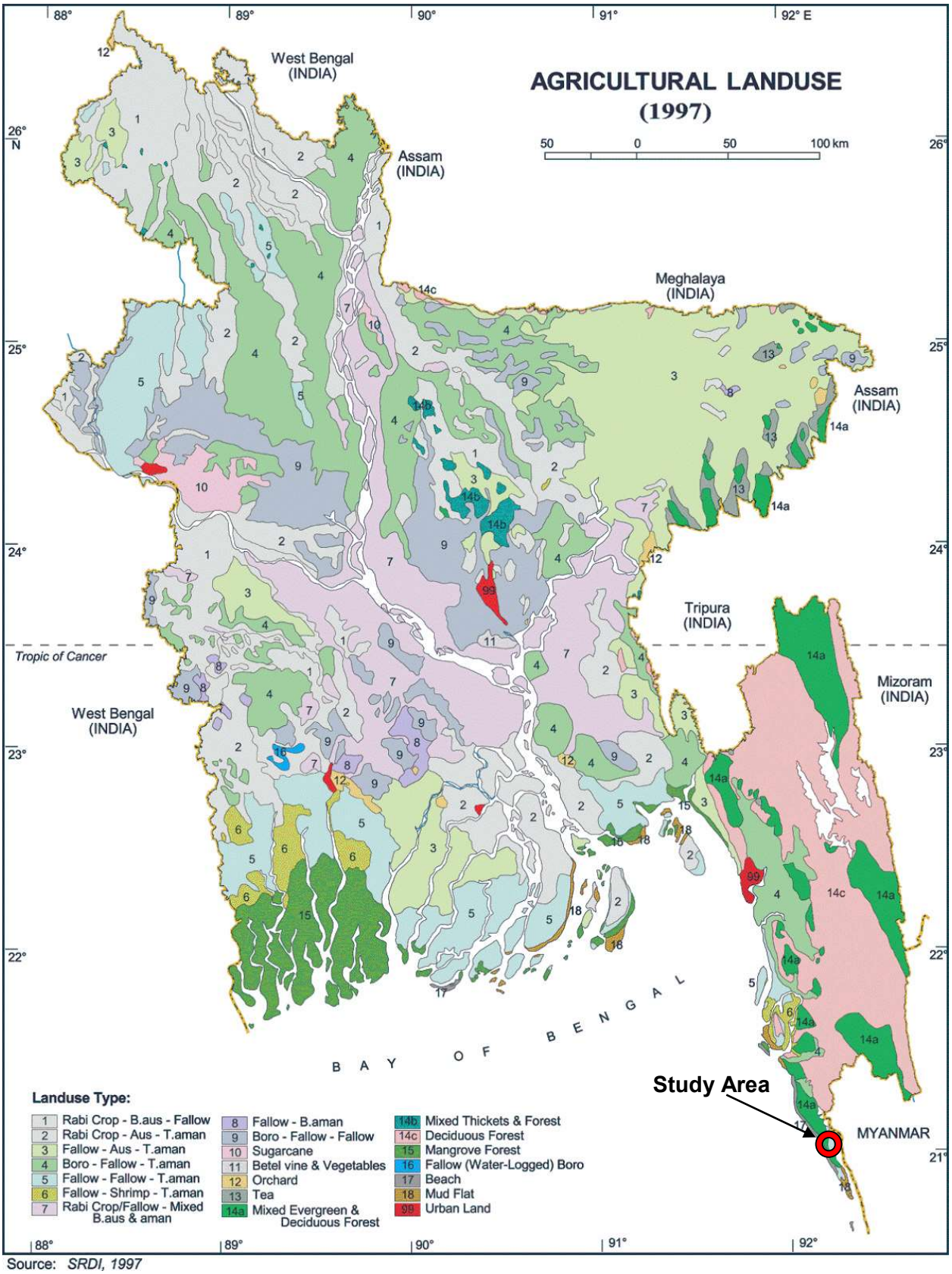
The land use/land cover pattern shows that agricultural land (65.09%) occupies most of the area within the 5km study area. The River and River bed of Naf River occupies 27.77% of the land whereas settlement with homestead vegetation inhibits about 4.48%. Naf River canal occupies 1.02% of the study area and water bodies cover 1.27% of the study area. Road network including the LGED road covers 0.12% of the study area.

Table 8.2: Land use-land cover within the study area of Project Site

Land use category	Area in Sq.km	Percentage
Agriculture	79.48	65.09
River and River Bed	33.91	27.77
Settlement	5.48	4.48
Waterbody	1.55	1.27
Canal	1.25	1.02
Road Network	0.14	0.12
Stream	0.30	0.24
Total	**122.10**	**100.00**

8.5 Agricultural Resources

Farming Practice: Farmers cultivate crops using their perception and indigenous knowledge about the environment, especially the duration and magnitude of flood. The project area has a diversified farming practice like Betel leaf, Betel Nut, Rice, paddy, pulses, potato, corn, vegetables etc. The following figure represent the land use types at the project site, respectively.



Source: *SRDI, 1997*

Figure 8.16: Agricultural Land use Map of Bangladesh[11]

[11] https://www.thebangladesh.net/agricultural-landuse-of-bangladesh.html

Cropping Pattern and Intensity: Cropping systems are highly diverse, intensive and complex in Bangladesh. The predominant cropping patterns are annual double- or triple crops of rice-rice, rice-wheat, rice-maize, potato-rice-rice, wheat-rice–rice, wheat-mungbean–rice, mustard-rice-rice and rice-rice-rice. Rice is grown in annual single-, double-, and triple-cropping patterns in the

boro, aus, and aman seasons depending on inundation and land topography. The major cropping patterns of agriculture118 in Bangladesh mostly consist of rice based cereal crops. More than 60% of the total cropped areas are covered by Boro-Fallow-T. The pattern of cultivating is two or more crops in a cropping season. Four types of 3-crop combination are found in 21 districts. The cropping intensity of Chittagong district is 139% while the national cropping intensity is about 191%.

Cropped Area: Presents the status of agricultural land utilization. The net cropped area of the Chittagong region is 655,870 ha. Crops occupied the particular land for round the year were considered under annual crops. The major annual crops reported in the region were pineapple, sugarcane, banana, papaya, betel leaf, ginger and turmeric. The annual crops area in different upazilas ranged from zero to 1,610 ha. The annual crops area accounted only 1.71 % of the net cropped area (NCA) in the region. At a glance, the region occupied 28% single cropped area (SCA), 49% double cropped area (DCA), 20% triple cropped area (TCA). The quadruple cropped area was also seen as a very negligible area (0.08%) and is limited in only two upazilas viz Raipur of Lakshmipur and Chakaria of CoxBazar district

There is some cropped area within the project site. The project will not hamper the agricultural practices and development; rather the farmers could be benefited indirectly by promotion of economic growth of the area by the project.

Crop Production: The major crops in the project area are Betel leaf, Betel Nut, rice, paddy, pulses, potato, corn, vegetables etc.

Crop Damage: Crop productions are damaged by different climatic threats like flood, rainstorm, heavy rainfall, untimely rainfall, river bank erosion etc. Among the threats, excessive rainfall and seasonal flood are the main causes of crop damage in the project area. Flooding is beneficial only within certain limits of timing, duration and magnitude. The Aus and Aman rice crop suffers damage due to sudden rain and seasonal flood. The project will not be a reason for crop

Main Constraints of Crop Damage: Economic, environmental and other factors can constrain crop production in different ways. Economic demotivation and financial problem can cause initial pessimism in production decision. Environmental hostile factors like disasters and unwanted conditions can cause harms in latter stage of production. Main constraints of crop production in the project area are-

- Irregular irrigation facilities during winter season;
- Flood water submerged the land during rainy season;
- Lack of training for suitable cultivation and overcoming the loss of crop to the farmers
- Non-introducing the new high yielding varieties and new technologies;

- Lack of open market sell of seeds and fertilizer, quality seed and other inputs as demanded by farmers.

8.6 Livestock and Poultry

Livestock and poultry has been playing significant role in the economy, as in the agricultural share of economy of Bangladesh. Along with agriculture, it is an essential part of integrated farming system. Livestock provides supports for cultivation like threshing and crushing of oil seeds; cow dung as a source of manure and fuel; a ready source of funds; and meat, milk and eggs for household consumption. Agricultural by-products can be used as fodder and feed of Livestock and poultry. There are 22777 Cow and buffalo, 18386 goat and 736 sheep in the Teknaf Upazila. Moreover, there are also 208340 hen and cock, 12552 duck in the Teknaf Upazila.

Most of the households in the project area have poultry and livestock, a practice that helps to reduces poverty through generating alternative income and employment. The common livestock and Poultry found in the Project area is Cow/bullock, Buffalo, Goat, Sheep, Duck, Chicken etc.

Feed and Fodder Shortage: Fodders and feed is the most important input of livestock rearing. Crop residues and naturally grown grasses alongside roads, river bank, char lands, etc. are the main feed for the cattle in Bangladesh. Shortage of fodder and high price of feed ingredients are affecting the small holders significantly. Dairy units are running off due to shortage of fodder or grazing land/ high price of feed ingredients. The pasture land has reduced significantly all over the country due to cultivation of High Yielding Varieties (HYV) of rice to meet the demand of growing population. Climate change is causing unusual behavior in temperature, rainfall, flooding pattern etc., and affecting either in natural growth or damaging the pasture grasses. Besides, adulteration of commercial feed by the miller; Inadequate or no quality control system of commercial feed is traceable.

Livestock/Poultry Diseases: Parasites and diseases cause serious losses in the livestock and poultry production. Compounding factors make the control of health problems difficult and they include:

- General low level of nutrition
- Large livestock population
- Warm humid climate
- Congestion of animals during annual flooding
- Difficult communications impede implementing control programs.

The government has estimated that losses due to internal parasites are far greater than losses caused by diseases but both are serious. Mainly, adequate levels of nutrition would significantly reduce production losses caused by parasites. The most frequently reported diseases among cattle and buffaloes are anthrax, black quarter and foot and mouth disease. Newcastle disease, fowl pox, fowl cholera and duck plague are common among poultry. The most crucial period is between July and October (rainy season) for outbreak of livestock and poultry diseases. The duck plague generally occurs in summer. However, some diseases prevail throughout the year. During monsoon season, the wet condition of the animal shelter

promotes various kinds of diseases to the bullocks and cows. The unhygienic condition of the courtyards during this season may also spread the diseases to the poultry birds.

8.7 Fisheries

The inhabitants along the banks of the Naf River live on more or less fishing, but only a few exclusively fishing communities appear to exist in the district. From the public consultation with the local people it was observed that the number of fisherman in the project area did not change significantly compared with the past. The village ponds within the site are reportedly used for fish culture, which is consumed by the villagers. No commercial fish culture was identified at the village ponds. Common species reported from the fish ponds include *Labeo rohita, Clarias batrachus, Cyprinus carpio, Heteropneustes fossilis, Hypopohthalmicthys molistrix* etc.

The Naf is the main habitat for a large number of species of fishes in the project area. Varieties of fresh water fishes are available in the Naf River of the Teknaf district. These are chapila (Gudusia chapra) phassa (Setipinna phasa), chital (Notopterus chitala), pholoi (Notopterus notopterus), ruhi (Labeo rohita), ghonia (Labeo gonius), kalibous (Labeo calbasu), mrigel (Cirrhinus mrigala), katal (Catla catla), sharputi (Puntius sarana), mohashol (Barbus tor), boal (Wallago attu), airh (Mystus aor), tengra (Mystus vittatus), pabda (Ompok pabda), bacha (Eutropichthys vacha), magur (Clarias batrachus), singi (Heteropneustes fossilis), gojar (Channa marulius), shoil (Channa striatus), chanda (Mene muculata), koi (Anabas testudineus), baim (Mastacembelus armatus) etc.

Figure 8.17: Fish market at teknaf

Problems and Issues: Fish biodiversity is affected by morphological changes of River, disruption of ecology, intensive agriculture, indiscriminate fishing, and loss of River-khal connectivity for filling wetlands and water regulatory structures on khals on the project area. The key fisheries problems and issues identified during baseline survey are as follows:

- Unplanned and indiscriminate fishing using monofilament gill net, and overexploitation of fishes by using huge number of narrow meshed estuarine set bag nets for fishing;
- Interrupting fish migration and movement due to improper management and mal-functioning of the water regulatory structures along with encroachment and barriers;
- Lack of quality fish seed and feed for the improved aquaculture practices;
- Insufficient loan facilities for aquaculture practices;
- Lacking of extension services and updated information;
- Poor market facility;
- Prevalence of fish diseases;
- Lack of technical knowledge on pond management; and
- Insufficiently trained farmers in the project area

Habitat Description: On the basis of habitat of fisheries of the study area are classified under two broad categories: capture fisheries and culture fisheries. Rivers and internal khals are considered under capture fish habitat; whereas the ponds: homestead ponds and commercial ponds are classified under culture fisheries. Fish habitat in rivers and internal khals is generally the open source of fisheries for local people like non-commercial professional and household level fishermen. It also enriches the inland closed water commercial and private culture of fisheries like ponds, leased beels, etc. especially during rainy season.

Fish Production and Effort: The annual fish production of Teknaf in the fiscal year of 2009-10 was 8597 Metric Ton (BBS Cox's Bazar). Number of production of fish in Teknaf was 860 metric ton in the year of 2010-11. Aquaculture is expanding gradually in the area by converting the cultivated land, as well as the medium low lands of the area. Teknaf is famous for its fish assets. Especially, different native variety fishes are caught here.

Fish Biodiversity: Fishes are abundant being represented by the members of all the major families found elsewhere in Bangladesh. However, their number is decreasing due to widespread use of insecticides and pesticides for agricultural purposes and also due to over catching. The following is a list of the principal fishes found in the rivers and ponds of Teknaf district.

8.8 Ecological Resources

Bio-ecological Zones:

As per IUCN classification based on physiographic and biological diversity, the study area falls under Northen – Eastern Hills. Major physiographic units of this area are Northern- Eastern Hills and Chittagong Hill Tracts. Rainfall of this zone average 2673 mm. Brown Hill Soils predominate in this zone.

8.8.1 Common Flora and Fauna

Floral diversity of the project area: In general terms an ecological system can be defined as an assemblage of organisms (plant, animal and other living organisms - also referred to as a biotic community) living together with their environment (or biotope), functioning as a loose unit. That is, a dynamic and complex whole, interacting as an "ecological unit". Ecosystems are functional units of interacting biotic, biotic and cultural (anthropogenic) components. All natural ecosystems are open systems where energy and matter are transferred in and out through the complex interactions of energy, water, carbon, oxygen, nitrogen, phosphorus, sulphur and other cycles. The project site is located in rural area. However, appropriate mitigation program should be undertaken to protect the existing ecosystem from the proposed Project.

Terrestrial Flora: Terrestrial plants found during survey in and around the project area, on homesteads, roadside and agricultural lands have been listed. The project area provides the following major species of natural plants including herbs, shrubs, grasses and plants which are important both economically as well as for environmental sustainability of the area.

Herbs & Shrubs: Mango (Mangifera indica), Jackfruit (Artocarpus heterophyllus), Litchi (Litchi chinensis)

Trees:Chaplish (Artocarpus chaplasha), Garjan (Dipterocarpus spp.), Syzigium species, Jarul (Legarstromia speciosa), Gamar (Gmelina arborea), Koroi (Albizzia spp), Civit (Swintonia floribunda), Toon (Cedrela toona), Bandorhola (Duabanga grandiflora), Telsur (Hopea odorata), Uriam (Mangifera sylyatica), Dhakijam (Syziqium grande).

Source: District Statistics 2011, Teknaf , Bangladesh Bureau of Statistics (BBS) Statistics and Informatics Division

Terrestrial Faun: The terrestrial fauna including mammals, birds, reptiles and amphibians around the project site are as follows

Mammals: chita (Panthera pardus), gecho bagh (Neofelis nebulosa), marbled cat (Felis marmorata), chita biral (Prionailurus bengalensis), mechi bagh (Prionailurus viverrinus), ban biral (Felis chaus), bengal fox (Vulpes bengalensis), pati shial (Canis aureus),

Birds: kat mayur (Pavo cristatus), kalo mayur (Lophura leucomelana), ban murag (Gallus gallus murghi), white checked partridge (Arborophila atrogularis), pahari titir (Arborophila rufogularis), bans titir (Bambusicola fytchii), manipur bush quail (Perdicula manipuricensis), blue breasted quail (Coturnix chinesis)

Reptiles: pahari kasim (Manouria emys), halud pahari kasim (Indotestudo elongata)

Amphibians: gecho bang (Rhacophorus maculatus), kuno bang (Bufo melanostictus) and bhawa bang (Rana tigerina)

Source: District Statistics 2011, Teknaf , Bangladesh Bureau of Statistics (BBS) Statistics and Informatics Division

8.9 Potential Environmental Impacts and Mitigation Measures

Environmental Impacts

1. Impact on noise level, visual intrusion, etc.
2. Impact on flora & fauna, natural environment, geological conditions, etc.
3. Impact on micro environment, air, noise, surface water, etc.

Mitigation Measures

1. Control of soil erosion, air pollution, disposal of waste to protect human health
2. Considerations for land use & ecology, air/water/noise pollution, visual impacts, etc.
3. Protection of water qualities, water bodies, natural slopes, etc.
4. Protection of natural environment
5. Provisions to avoid air /noise pollution in such areas.

CHAPTER 09: SOCIAL REVIEW

9.1 Socio-economic Condition

The key parameters that are required to establish a baseline socio-economic profile of population within the project's area of influence includes gender, ethnicity, social structure, employment patterns, sources of income, local tenure and property rights arrangements, use of community and natural resources. Primary information gathered from the surveys, FGD's and other stakeholder interaction along with the secondary information has been analyzed to establish the socio-economic baseline. The project area of influence comprises of the Teknaf Upazilla and the Sabrang Mouza where the project is proposed to be developed. The Socio-Economic profile of Teknaf upazilla is represented in the below table:

Table 9.1: Demographic Conditions of the Project Area

Indicators	Quantity
Area (Sq.Kms)	388.66
Union/Wards (No.)	6
Mouzas/Mahallas (No.)	12
Villages (No.)	146
Households (No.)	46,328
Population (No.)	2,64,389
Population density (per Sq. Km)	680
Male (%)	50.34
Female (%)	49.65
Sex Ratio (Females/ 1000 males)	101
Number of Child Birth (No.)	9,533
Literacy (7+)	
Overall (%)	26.7
Males (%)	29.7
Females (%)	23.6
Religious Institutions	
Mosques	183
Temples	7

Source: District Statistics 2011, Cox's Bazar

9.2 Education

The educational system in Teknaf upazilla has improved gradually from the last 10 years. The list of educational institutes that are there in Teknaf upazila include:

- 4 government colleges;
- 17 non-government colleges;
- 6 government high schools;
- 107 non-government high schools;

- 8 junior high schools;
- 150 Madrassas;
- 376 government primary schools;
- 235 non-government high schools;
- 22 NGO operated primary schools;
- 1 primary teacher's training institutes.

9.4 Religion and Ethnic Minority Groups

Islam is the dominant religion followed by the people of Teknaf upazilla with Bengali as the predominat language for communication. Overall in Bangladesh, about 87% of the population are Muslims, followed by 12% Hindu, 1% Buddhist and 0.5% Christians. While in Teknaf of the total population of 2, 64,389 and 2, 58,245 are Muslims, 2,967 are Hindus, 3,089 are Buddhist, 9 are Christians and 79 are categorized as others.

The ethnic minorities in Bangladesh comprise of Khasi, The Jaintia, Chamkas, Marmas, Santals, Garos, Manipuri, Tripuri, Tanchangya and the Mros. The ethnic minorities in Bangladesh are prevalent in the regions of Chittagong Hill Tract, Sylhet) and are not found in the Teknaf upazilla. The ethnic minorities are neither present in the project area nor in the adjacent areas.

9.5 Source of Income at Teknaf

The primary source of income for the inhabitants of Teknaf upazilla include: fishing, agriculture and salt farming. The sale of fish in the local as well as markets in Dhaka, Chittagong and Cox's Bazar serves the main means of livelihood for the local people of Sabrang Maouza of Teknaf.

The cultivation of beetle leaves and supari and selling them in local markets and markets of Dhaka and Cox's Bazar also serves as alternate source of income.In Sabrang mouza of Teknaf, salt production by evaporating sea water over beds on land also substantially contributes to the source of livelihood. The viability of the salt production is attributable to the high salinity of the sea water, ease of access and lengthy stretch of flat sea shore.

Table 9.2: Source of Livelihood Profile of Teknaf Upazila

Indicators	Quantity
Source of Livelihood (in %)	
Agriculture	44.95
Non Agricultural Labors	6.51
Commerce	21.88
Transport and Communications	1.96
Service	4.27
Construction	0.79
Religious Services	0.36
Rent and Remittance	2.64

Others	16.82

Source: District Statistics 2011, Cox's Bazar

9.6 Demographic Details of Teknaf Upazila

The following sections presents the demographic details of the Teknaf Upazila within which falls the site where the development has been planned. The demography and the sex ratio has been compiled based on the secondary data available from Bangladesh Bureau of Statistics Census Data, 2011.

Table 9.3: Demographic profile of the Unions under Teknaf Upazila

Union	Area in Acres	Households	Population Total	Sex		Sex Ration (Male/Female)*100
				Male	Female	
Teknaf	25,018	8,467	47,708	24,076	23,632	012
Baharchhara	3783	4,832	28,805	14,481	14,324	101
Sabrang	16486	9970	58,358	29,126	29,232	100
Whykong	31,582	8,867	50,863	25,296	25,567	99
Nhilla	17,125	8,271	46,896	23,360	23,536	99
St.Martins Dwip	835	1169	6,703	3471	3232	107

Source: Bangladesh Bureau of Statistics, Census 2011

Demographic profile of all the unions under Teknaf Upazila is represented in the below table. As evident from the table, there are 46,328 households with a total population of 2,64,389 comprising of 1,33,106 males and 1,31,106 females with the sex ratio being 101 males for every 100 females. The average number of people per household for the Teknaf Upazila works out to be 6.0. The lower sex ratio indicates the absence of gender bias which augurs well with the planned development and the skill upgradation programmes which are planned as an integral component of the proposed project.

9.7 Literacy Rate

The literacy rates in all the 6 unions in the Teknaf Upazilla, sourced from the Bangladesh Bureau of Statistics, Census 2011 ranges between 12.7% and 34.4%. The maximum difference of literacy rate between male and female was observed at St Martins Dwip Union while the minimum was noted at Whykong Union. The below table represents the union wise literacy rates in Teknaf.

As observed in the statistics the literacy rate for the Sabrang Union is languishing at 20.1% for males and at 13.7% for the females. The divide in the literacy rate between males and females also suggest the lower women empowerment in the region. The lower literacy rates further necessitates the allied development activities through the project such as the skill development, vocational training and awareness campaigns for enrolment in the primary education. The allied benefits through the economic zone with the proposed skill development programmes, training needs assessment will help alleviate the literacy rate in the region in line with the Bangladesh national skill development strategy.

Figure 9.1: Madrasa Students of hatiarguna

Table 9.4: Literacy Rates Segregated by Unions in Teknaf (Census 2011)

Name of the Union	Area (Acres)	Populations		Literacy Rate (%)	
		Male	Female	Male	Female
Teknaf	25,018	24,076	23,632	34.4	27.9
Baharchhara	3783	14,481	14,324	24.1	21.2
Sabrang	16486	29,126	29,232	20.1	13.7

Whykong	31,582	25,296	25,567	29.3	26.6
Nhilla	17,125	23,360	23,536	30.6	26.5
St. Martins Dwip	835	3471	3232	24.1	12.7

Source: Bangladesh Bureau of Statistics, Census 2011

9.8 On-Going Social Development Programmes

In Bangladesh to support the socio-economic developments, government has launched multiple programmes which benefits the people in need. The programmes has supported people of different sectors primarily the marginalized groups to get opportunities for employment and earning livelihood. The country's skills development strategy also strongly targets marginalized groups. Closely linked with other policies, including the second National Strategy for Accelerated Poverty Reduction, it emphasizes varied types of training needs and recognizes the importance of linking microfinance and skills development for those in rural communities.

9.9 Recommendations

a) Environmental Management and Monitoring Plan should be developed and followed strictly for both during construction and operation phases of the Project;

b) Zero Discharge Plan (ZDP) should be developed and maintain during operation phase of the project.

c) IFC PS-3 (Resource Efficiency and Pollution Prevention) should be followed for Occupational Health and Safety (OHS) Management during construction and operation phases of the Project;

d) All infrastructures should be built based on the seismic design consideration to avoid potential hazard risk;

e) To avoid hazard due to any disaster, warning system, emergency evacuation system, and provision of emergency equipment should be considered;

f) Proper training regarding EHS should be provided to Project Management Unit as well as work forces during construction and operation phases;

g) Development of a green belt surrounding the area should be considered with due importance;

h) A social census can be carried out on land owner before land acquisition so as to determine their actual loss, and prepare right compensation plan by BEZA;

i) Eligible local people should be considered on priority basis that will be helpful for minimizing the socio-economic disruption.

CHAPTER 10: STAKEHOLDER DISCUSSIONS

10.1 Key Informant Interview (KII)

A meeting with Tajul Islam was held in the Premises of his house at Damdamia of Nila Union. He possesses the designation of President at Tourism Business Committee. The outcome of the meeting is described as follows:

- People will be benefited by this project in many ways
- There will be new job opportunities
- There will be more business options
- This project have positive socio-economic impact
- Enhancement of security have to be ensured to keep peace in the vicinity

Figure 10.1: Key Informant interview with Tajul Islam

A meeting with Mohammad Yunus was held in the Premises of his house at Hatiarguna of Teknaf Sadar Union. He possesses the designation of Princple and Khatif at karachipara Madrasa. The outcome of the meeting is described as follows:

- This project have positive socio-economic impact
- Local culture should not be hampered because of the project
- Enhancement of law enforcement and security should be checked
- Local people should get privilege for job opportunities in the project

Figure 10.2: Key Informant interview with Mohammad Yunus

A meeting with Jahed Hossain was held in the Premises of Parjatan Bazar of Teknaf Sadar Union. He possesses the designation of Bazar Committee President. The outcome of the meeting is described as follows:

- Assurance of tourist discipline
- Enhancement of law enforcement and security
- There will be more business opportunity for the locals as this project will attract tourist
- By this project the socio-economic condition will improve drastically.

Figure 10.3: Key Informant interview with Jahed Hossain

A meeting with Rafiq Rana was held in the Premises of his house of at Damda Mia of Nila Union. He possesses the designation of Member at School Managing Committee. The outcome of the meeting is described as follows:

- This project have positive socio-economic impact
- Enhancement of law enforcement and security
- There will be more business options
- Local people should get privilege for job opportunities in the project

CHAPTER 11: FINDINGS & RECOMMENDATIONS

Teknaf is an upazila of Cox's Bazar district under Chittagong division. The upazila is situated on the bank of Naf River and the hilly areas of Cox's Bazar. The scenic and enchanting beauty of Naf River, hills, forests and sea beach of Teknaf attract the tourists. Tourists can enjoy the river from the top of the hill which is the entrance of the town. Teknaf Sea Beach is one of the longest sandy beach ecosystems (80 km) in the world which is also very attractive for its blue and clear water. There is Mangrove forest also. Teknaf has also a reserved forest named "Teknaf Nature Park". Tourism business is already introduced in Teknaf construction of Cable Car at Naf Tourism Park will create opportunity for the tourism and economic development of the area. In addition, the existing tourist places will get a boost once the Cable car is constructed in Teknaf.

The local Tourism business association expects positive impact on the socio-economic development in the area as a result of the development of the Cable Car project. They also expect that the Cable car would improve communication and transportation facilities in the locality and overall socio-economic conditions of the local communities. It was also perceived that the project would adequately contribute to the increase in employment and income opportunities of the people by various means, thereby alleviating poverty in this region. New livelihood opportunities will be available to the people during the construction and commissioning phases of the project. Direct employment opportunities for the local people (especially construction workers and unskilled labours) are expected to increase.

To construct the cable car at Naf Tourism Park the following points are important:

Strong: Availability of labor, low price of land, available, and business oriented people, tourism opportunity, and local support.

Weak points: Accommodation, transport and communication & cultural change of locals

Opportunity: Expansion of business, employment creation, tourism attraction;

It is important to note that this report has covered the benchmarking of the project, market assessment and demand forecast to comply with the ToR. Social and environmental review has also been covered. Also the economic and financial analysis has been done.

The project's return like IRR, NPV and BCR is positive. So the project is both economically and financially viable. It is, therefore recommended for implementation of the project.

ANNEXURES

ANNEXURE 1: FOCUS GROUP DISCUSSION QUESTIONNAIRE

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Focus Group Discussion on Cable Car Installation and Preparation at Naf Tourism Park

Public representatives of Teknaf

Focus Group Discussion

Greetings!
My name is Simoon Mostafa, and I am working with '**Cable Car Installation and Preparation at Naf Tourism Park**'. We are conducting a survey and would appreciate your participation. I would like to ask your views about the Naf Tourism Park. This information will help to install a cable car at the tourism Park. The discussion session usually takes 60 minutes to complete. Whatever information you provide will be kept strictly confidential and will not be shown to other persons. Personal information that identifies you or your house will be blackened out by the field teams after we have left the village.

Participation in this survey is voluntary and you can choose not to answer any individual question or all the question. You may terminate the interview at any time. However, we hope that you will participate in this survey since your views are important. Will you participate in this survey?

At this time, do you want to ask me anything about the survey?

Area:	Hafiarguna, Karachi para
Number of participants:	
Union:	Teknaf Sadar
Latitude and Longitude:	20.[illegible], 92.263636
Date:	03/09/2020
FGD Conducted By:	Ishraque, Simoon
Venue:	Madrasa

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Processing Team

	Start Time	End Time	Total Time (in minute)
Interview Duration (Start – End time)	1:10	1:35	25

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FGD Checklist

A. **Information Regarding Household:**

SN	Questions	Answers
01	What is the main source of income of the families in your area?	Agriculture
02	What is the average monthly income of your area (per household)?	5000 - 10000 Tk
03	How much is the monthly expenditure of your area (per household)?	5000 - 10000 TK
04	What is the literacy level of the area (%)?	10%
05	Occupation (%): Agriculture; Business; Service; Teacher; Physician; Laboure; Fishing; Others; Landlords	Agriculture - 90% Labour - 5% Fisheries - 5%

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B. General knowledge on Naf Tourism Park

SN	Questions	Answers
01	Do you know about Naf Tourism Park?	No
02	What do you know about the cable car project?	No
03	What are your views regarding the Tourism Park (TP)?	Positive (Mostly)
04	Will the project impact your livelihood status of the area positively or negatively? (Especially project area)	Yes (Positively)
05	Do you think you will be economically benefited from the project?	Yes (Majority)
06	Will this Naf Tourism Park serve as a recreational center for you?	Yes
07	Ethnic people and their living pattern in the project area. How they can contribute to the project	N/A

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C. **Land Use:**

SN	Questions	Answers
01	Is the land arable?	Yes
02	What is the land generally used for?	paan & Supari
03	What crops are mostly produced in surrounding area?	Paan & Supari
04	What is the main source of food in your community?	Fish (Salt water)

D. **Socio-economic impacts:**

SN	Questions	Answers
01	Will the project have any socio-economic impact on your daily life?	Yes (positive)
02	Do you think the local culture will experience a shift to the economic and social changes after the implementation of the project?	Yes in a good way

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03	How can the socio-economic impacts be minimized?	Enhanced Security & Keeping peace

FGD Co-Ordinator

Simoon Mostafa

Name: Simoon Mostafa

Date: 03/09/2020

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Focus Group Discussion on Cable Car Installation and Preparation at Naf Tourism Park

Public representatives of Teknaf

Focus Group Discussion

Greetings!
My name is Simoon Mortafa, and I am working with **'Cable Car Installation and Preparation at Naf Tourism Park'**. We are conducting a survey and would appreciate your participation. I would like to ask your views about the Naf Tourism Park. This information will help to install a cable car at the tourism Park. The discussion session usually takes 60 minutes to complete. Whatever information you provide will be kept strictly confidential and will not be shown to other persons. Personal information that identifies you or your house will be blackened out by the field teams after we have left the village.

Participation in this survey is voluntary and you can choose not to answer any individual question or all the question. You may terminate the interview at any time. However, we hope that you will participate in this survey since your views are important. Will you participate in this survey?

At this time, do you want to ask me anything about the survey?

Area:	Domdomia Ghat
Number of participants:	20
Union:	Nila
Latitude and Longitude:	20.922419, 92.266458
Date:	03/09/2020
FGD Conducted By:	Israque, Simoon
Venue:	Domdomia Ghat Bazar

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Processing Team

	Start Time	End Time	Total Time (in minute)
Interview Duration (Start – End time)	10:00	10:35	35 min

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FGD Checklist

A. **Information Regarding Household:**

SN	Questions	Answers
01	What is the main source of income of the families in your area?	Seasonal * Tourism Related business. * Labour
02	What is the average monthly income of your area (per household)?	10 to 15 k
03	How much is the monthly expenditure of your area (per household)?	10 to 15 k
04	What is the literacy level of the area (%)?	90%
05	Occupation (%): Agriculture; Business; Service; Teacher; Physician; Laboure; Fishing; Others; Landlords	Business 70% Fishing 10% Agri 20%

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B. General knowledge on Naf Tourism Park

SN	Questions	Answers
01	Do you know about Naf Tourism Park?	Yes
02	What do you know about the cable car project?	Yes
03	What are your views regarding the Tourism Park (TP)?	Positive
04	Will the project Impact your livelihood status of the area positively or negatively? (Especially project area)	positively (Yes)
05	Do you think you will be economically benefited from the project?	Yes
06	Will this Naf Tourism Park serve as a recreational center for you?	Yes
07	Ethnic people and their living pattern in the project area. How they can contribute to the project	N/A

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C. Land Use:

SN	Questions	Answers
01	Is the land arable?	Yes
02	What is the land generally used for?	rice, vegitable
03	What crops are mostly produced in surrounding area?	Tarmuz Shash
04	What is the main source of food in your community?	Fish

D. Socio-economic impacts:

SN	Questions	Answers
01	Will the project have any socio-economic impact on your daily life?	Yes
02	Do you think the local culture will experience a shift to the economic and social changes after the implementation of the project?	Yes

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03	How can the socio-economic impacts be minimized?	Enhanced Security

FGD Co-Ordinator

Simoon Mostafa

Name: Simoon Mostafa

Date: 07/09/2020

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ANNEXURE 2: FOCUS GROUP DISCUSSION ATTENDANCE SHEET

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Focus Group Discussion on Cable Car Installation and Preparation at Naf Tourism Park

Teknaf

Participants of Teknaf

Attendance Sheet

Location: Teknaf

Latitude: 20.922419 **Longitude:** 92.266458

Total Number of Participants: 20

Date: 02/09/2020

Male Participants

SN	Name	Contact Number	Signature
1	Abdus Salam	01859998928	
2	Abdul Malek	01928169810	
3	Faridul Alom	01908210858	
4	Taibul Islam	01985946547	
5	Nurul Hasue	01814914869	
6	Arif Ahmed	01865466155	
7	Obaidulla	01885002882	
8	Saidul Islam	01951079824	
9	Bashir Ahmed	01408209538	
10	Monir Ahmed	01838049864	
11	Nur Islam	01875749450	
12	Lal Mia	–	
13	Md. Ismail	01720658143	
14	Rabiul Alom	01995009798	

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15	Todul Ahmed	01880194688	[illegible]
16	Afaz Ahmed	01822344705	2823432
17	Faridul Alom	01824467023	faridul Alam
18	Abul Basar	0 —	[illegible]
19	Sawkat	01875124514	[illegible]
20	Jafor Alom	01402076698	[illegible]
21			
22			
23			
24			
25			

Female Participants

SN	Name	Contact Number	Signature
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

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Officials

Sl	Name	Contact Number	Signature
1	Ashraque Bin Khalil	01675390902	
2	Simoon Mostafa	01756584954	Simoon Mostafa
3	Reetika Ali	01779291243	Reetika Ali
4	Md. Sayed Imran	01877722852	
5	Sadia Mahajabin	01927074829	Sadia
6	Sourav Paul	01948123301	

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10			

FGD Facilitator from O.CREEDS

Name: Simoon Mostafa

Position: Junior Engineer

Signature: Simoon Mostafa

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Focus Group Discussion on Cable Car Installation and Preparation at Naf Tourism Park

Teknaf

Participants of Teknaf

Attendance Sheet

Location: Teknaf

Latitude: 20.888224 **Longitude:** 92.263636

Total Number of Participants:

Date: 02/09/2020

Male Participants

SN	Name	Contact Number	Signature
1	Md Younus	01813909338	
2	Abdur Rashid	01884154185	
3	Md Shahidullah	01[illegible]3383104	
4	Md Akbar	01881307009	
5	Amir Ahmed	01847548056	
6	Din Mohammad	01 "	
7	Md. Mokibullah	01639241728	
8	Hasi Ali Ahmed	01864728391	
9	Rashid Ahmed		
10	Jahir Ahmed	01813786262	
11	Abu Siddique	01864231388	
12	Md. Jafor	01869504933	
13			

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Officials

Sl	Name	Contact Number	Signature
1	Ishraque Bin Khalil	01675390902	
2	Simoon Mostafa	01796584954	Simoon Mostafa
3	Reetika Ali	01779291243	Reetika Ali
4	Md. Sayed Imran	01877722852	
5	Sadia Mahajabin	01927074829	Sadia
6	Sourav Paul	01948123301	

FGD Facilitator from O.CREEDS

Name: Simoon Mostafa

Position: Junior Engineer

Signature: Simoon Mostafa

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ANNEXURE 3: KEY INFORMANT INTERVIEW

(9)

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Key Informant Interview on Cable Car Installation and Preparation at Naf Tourism Park

Public representatives of Teknaf

Key Informant: Tajul Islam 01985-346547 **Designation:** Tourism Business (Shopati)

Greetings!
My name is Simon Hafada, and I am working with **'Cable Car Installation and Preparation at Naf Tourism Park'**. We are conducting a survey and would appreciate your participation. I would like to ask your views about the Naf Tourism Park. This information will help to install a cable car at the tourism Park. The discussion session usually takes 60 minutes to complete. Whatever information you provide will be kept strictly confidential and will not be shown to other persons. Personal information that identifies you or your house will be blackened out by the field teams after we have left the village.

Participation in this survey is voluntary and you can choose not to answer any individual question or all the question. You may terminate the interview at any time. However, we hope that you will participate in this survey since your views are important. Will you participate in this survey?

At this time, do you want to ask me anything about the survey?

Area:	Dende mia
Union:	Nila
Latitude and Longitude:	20.921977, 92.216361 | Ward: 9
Date:	2/09/2020

Processing Team

	Start Time	End Time	Total Time (in minute)
Interview Duration (Start – End time)	17:35	18:00	25

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FGD Checklist

A. Information Regarding Household:

SN	Questions	Answers
01	What is the main source of income of the families in your area?	Tourism Related business Per day 10000 visitors (Peak time)
02	What is the average monthly income of your area (per household)?	20000 - 30000
03	How much is the monthly expenditure of your area (per household)?	15000 - 20000
04	What is the literacy level of the area (%)?	90%
05	Occupation (%): Agriculture; Business; Service; Teacher; Physician; Laboure; Fishing; Others; Landlords	* Business → 90% (Tourism related) * Fishing * Agriculture

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B. General knowledge on Naf Tourism Park

SN	Questions	Answers
01	Do you know about Naf Tourism Park?.	Yes
02	What do you know about the cable car project?	Yes
03	What are your views regarding the Tourism Park (TP)?	Positive
04	Will the project Impact your livelihood status of the area positively or negatively? (Especially project area)	Positively
05	Do you think you will be economically benefited from the project?	Yes
06	Will this Naf Tourism Park serve as a recreational center for you?	Yes
07	Ethnic people and their living pattern in the project area. How they can contribute to the project	N/A

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C. Land Use:

SN	Questions	Answers
01	Is the land arable?	Yes (very few)
02	What is the land generally used for?	rice, vegitable (bangle)
03	What crops are mostly produced in surrounding area?	vegitable
04	What is the main source of food in your community?	fish

D. Socio-economic impacts:

SN	Questions	Answers
01	Will the project have any socio-economic impact on your daily life?	Yes (positive
02	Do you think the local culture will experience a shift to the economic and social changes after the implementation of the project?	Yes

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03	How can the socio-economic impacts be minimized?	* Enhanced Security (Deripline)

Key Informant

Name: Tazul Islam

Date: 02/03/2020

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GEOSCAPE CONSULTANTS LTD.

CLIENT: O.CREEDS LTD.	DATE OF BORING:	05/09/2020
PROJECT NAME: CABLE CAR INSTALLATION AND PREPARATION AT NAF TOURISM PARK, TEKNAF, COX'S BAZAR.	DATE OF TEST:	07/09/2020
LOCATION: TEKNAF, COX'S BAZAR.	TEST METHOD	ASTM D 422

GRAIN SIZE DISTRIBUTION

SAMPLE NO.	LEGEND	PLASTICITY	W%	SAND (%)	SILT (%)	CLAY (%)	D_{60}	D_{30}	D_{10}	C_c	C_u	FG/CG	USCS
S1-05 SEP 2020 BEZA, NAF TOURISM PARK			26.24	68	23	9						CG	SM

GEOSCAPE CONSULTANTS LTD.

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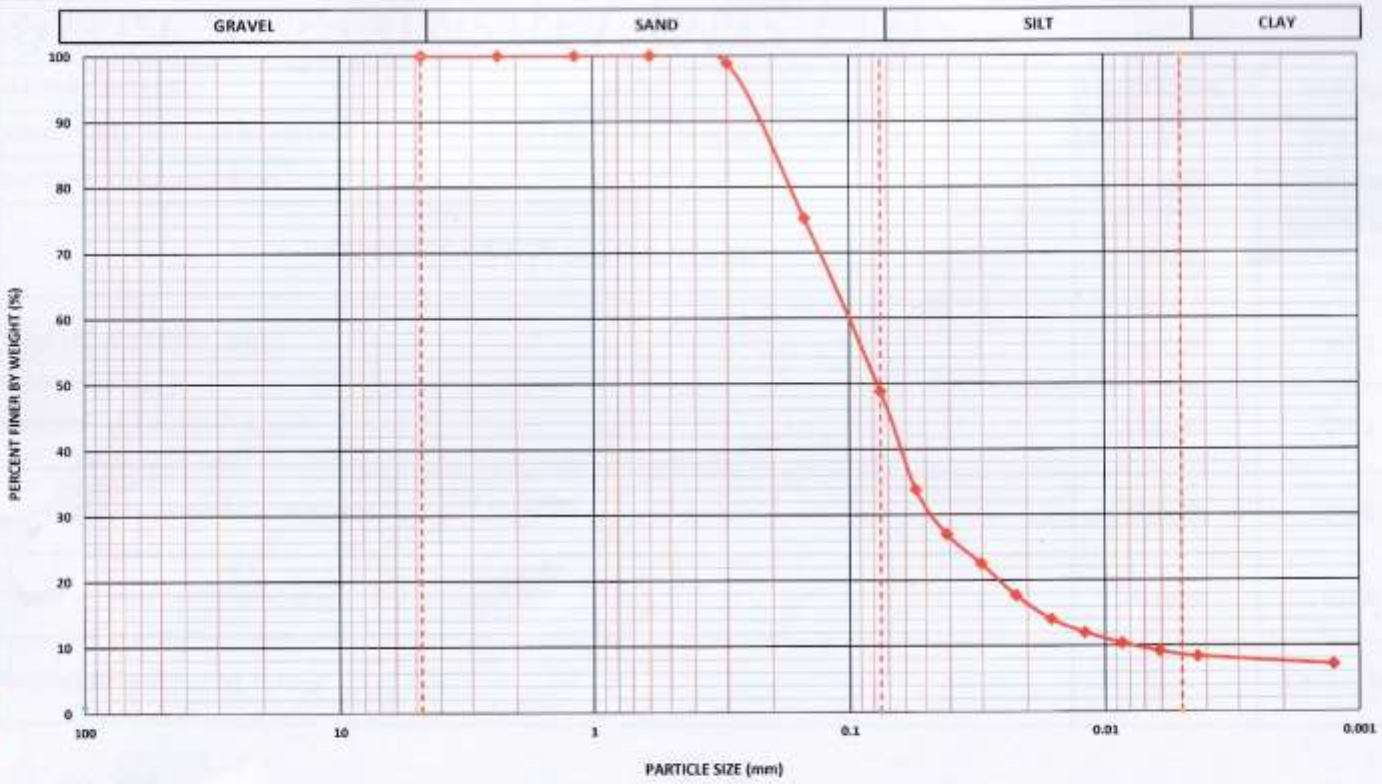
LOCATION: TEKNAF, COX'S BAZAR.	TEST METHOD	ASTM D 422

GRAIN SIZE DISTRIBUTION



SAMPLE NO.	LEGEND	PLASTICITY	W%	SAND (%)	SILT (%)	CLAY (%)	D_{60}	D_{30}	D_{10}	C_c	C_u	FG/CG	USCS
S2-05 SEP 2020 BEZA, NAF TOURISM PARK			26.5	51	41	8						CG	SM

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GEOSCAPE CONSULTANTS LTD.

CLIENT: O.CREEDS LTD.	DATE OF BORING:	05/09/2020
PROJECT NAME: CABLE CAR INSTALLATION AND PREPARATION AT NAF TOURISM PARK, TEKNAF, COX'S BAZAR.	DATE OF TEST:	09/09/2020
LOCATION: TEKNAF, COX'S BAZAR.	TEST METHOD:	ASTM D 854
SPECIFIC GRAVITY CALCULATION	SAMPLE	S1-05 SEP 2020 BEZA, NAF TOURISM PARK
Weight of pycnometer, (gm)	M_1 (gm)=	162.5
Weight of pycnometer+Soil, (gm)	M_2 (gm)=	249.8
Weight of pycnometer+Soil+water, (gm)	M_3(gm)=	710.2
Weight of pycnometer+Water, (gm)	M_4 (gm)=	655.4
Specific Gravity of Soil, (at 20 Deg)	G_{20} =	2.686153846

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ANNEXURE 5: AIR QUALITY & NOISE REPORT

AMBIENT AIR QUALITY TEST & AMBIENT NOISE LEVEL INSPECTION REPORT

Report No.	: ECIL/2020/445/AAQ&NLI
Name of the Client	: **O.CREEDS Ltd.**
Client Address	: Mohakhali NEW DOHS, Dhaka, Bangladesh
Project Name	: **Construction of Cable Car at NAF Tourism Park Project.**
Sample collector	: EnviroCare Monitoring Team
Description of Sample	: Ambient Air Quality Test and Noise level Inspection Report
Sampling Date	: 19th March 2020
Reporting Date	: 25th August 2020

Environmental Condition:

Ambient Temperature	: 30.1°C
Relative Humidity	: 55.5% RH
Weather Condition	: Sunny

Sampling Location : Near A & C Points.

Figure 1: Sample Location for Ambient Air Quality Test and Noise Level Inspection

Address: House # 09, Road # 6, Sector # 12, Uttara, Dhaka-1230, Bangladesh. Cell: 01737077356,
Phone: +88 0255087283, Web: www.envirocarebd.com, Email: info@envirocarebd.com

Description of Test Method for Ambient Air Quality:

The suspended Particulate Matter (SPM, $PM_{2.5}$, PM_{10}, SO_x, NO_x, CO) test was conducted by using Respirable Dust Sampler with Gaseous Attachment

Device Name: Lata Envirotech Dust Sampler, The analyzer is designed to meet **BS 8494** standard.

Model: APM 250

Particulate Counter Specification:

Size Range : 0.2µm~10µm
Flow Rate : 2.83 Liter/min (0.1cfm)
Counting Efficiency : 50±20%@0.3µm; 100±10%@0.5µm

Air Analyzer Specification:

Parameter	Resolution	Accuracy	Specified Range	Over Range
Carbon Monoxide	1ppm	±5 ppm < 100ppm ±5% > 100ppm ±10% > 1000ppm	200-4000 ppm	9999ppm

Description of Inspection Method for Noise Level Inspection:

The noise levels were measured with the help of a portable precision digital sound level meter (Model-SI-4033DS, made in Taiwan). The instrument calibration was achieved using manufacturer supplied pistaphone calibrator capable of producing known sound pressure level.

Instrument Specification:

Instrument Name	Digital Sound Level Meter	**Resolution**	0.1 dB.
Measuring Range	35 to 130 dB.	**Accuracy**	± 5 dB.

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Table 1. Ambient Air Quality Monitoring at Construction of Cable Car at NAF Tourism Park Project

Description of Analysis

Sl. No.	Sample Locations	Concentration present different parameter in ambient air (µg/m³)					
		$PM_{2.5}$	PM_{10}	SPM	SO_x	NO_x	CO
1	Sample - A	19	46	102	2.90	15.12	0.27
2	Sample- B	11	31	86	2.36	11.84	0.10
Units		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
Test Duration (Hours)		24	24	8	8	8	24
Method of Analysis		Gravimetric	Gravimetric	Gravimetric	West-Gaeke	Jacob and Hochheiser	Electro-Chemical Sensor
National Ambient air Quality Standard (NAAQS) for Bangladesh (2005)		65	150	200	365	100	10,000
IFC/ WB Standard		45 (24H)	150 (24H)	230 (24H)	125 (24H)	200 (1H)	7000(24H)
Remark		NDA	NDA	NDA	NDA	NDA	Excellent

Comments: The level of concentrations of air pollutants were within the limit of Environmental Conservation Rules 1997 of Bangladesh (Amendment 2005) and IFC/World Bank.

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Table 2. Ambient Noise Level at Construction of Cable Car at NAF Tourism Park Project

Sl. No	Time	Day Time **Sample A**	Night Time	Zone
1	**Sample A**	58.9	42.9	Mixed Zone
2	**Sample B**	52.2	35.0	Residential Area
Bangladesh ECR -1997Standard for			Day Time	Night Time
Industrial area			75	70
Commercial			70	60
Mixed area			60	50
Residential area			55	45
World Bank / IFC Standard				

Comments: The levels of noises were below the standard limit of Department of Environment, Govt. of Bangladesh and IFC/WB.

Prepared By	***Reviewed By***	***Approved By:***
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ANNEXURE 6: PROJECT LOCATION PHOTOS

Wild life of Teknaf

Jaliar Dwip

Traditional boat of teknaf

Naf River

Figure 12.1: Project Location Surroundings

Local of teknaf

Teknaf local

Discussion with locals

Discussion about route

Figure 12.2: Discussion with locals

FGD at Damdamia

FGD with locals

FGD at Hatiarguna

FGD with locals

Figure 12.3: Focus group discussion with locals

Karachi Para

Teknaf Jetty

Teknaf Beach

Jaliar Dwip

Figure 12.4: Beautiful places of teknaf