

REPORT
ON
MODEL PROJECT ON WATER MANGEMENT FOR
NATIONAL SPATIAL DATA
INFRASTRUCTURE(NSDI) UTILIZATION PROJECT

By

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Acronyms and Abbreviation:

Serial No	Abbreviation	Official Name
1.	SDI	Spatial Data Infrastructure
2.	NSDI	National Spatial Data Infrastructure
3.	BIWTA	Bangladesh Inland Water Transport Authority
4.	BNHOC	Bangladesh Navy Hydrographic and Oceanographic Center
5.	BWDB	Bangladesh Water Development Board
6.	MCB	Mechanized country boats
7.	CEGIS	Center for Environmental and Geographic Information Services
8.	CW	Circular Waterways
9.	JICA	Japan International Cooperation Agency
10.	ICT	Information and Communication Technology
11.	SDG	Sustainable Development Goal
12.	SoB	Survey of Bangladesh
13.	HPM	Honourable Prime Minister

14.	DPS	Data Product Specification
15.	LGED	Local Government Engineering Department
16.	BWDB	Bangladesh Water Development Board
17.	GIS	Geographic Information System
18.	DPHE	Department of Public Health Engineering
19.	GPS	Global Positioning System
20.	DLRS	Department of Land Records and Survey
21.	WARPO	Water Resources Planning Organization
22.	ICT	Information and Communication Technology
23.	IWM	Institute of Water Modeling
24.	SRDI	Soil Resources Development Institute
25.	BARC	Bangladesh Agricultural Research Council
26.	GSB	Geological Survey of Bangladesh
27.	DEM	Digital Elevation Model
28.	MP	Model Project
29.	RAJUK	Rajdhani Unnayan Katripakkha
30.	IW	Inland waterways
31.	WMG	Water Management Group
32.	WG	working group
33.	BBS	Bangladesh Bureau of Statistics
34.	DMDP	Dhaka Metropolitan Development Plan
35.	BPC	Bangladesh Parjatan Corporation
36.	DAP	Detail Area Plan
37.	ENC	Electronic Navigational Chart
38.	ECDIS	Electronic Chart Display and Information System

Abstract

Spatial Data Infrastructure (SDI) is a system of gathering, sharing and disseminating spatially referenced data and information in a coordinated manner with technological support in order to ease policy formulation and decision making to meet the social needs in local, national and global scale. When SDI system is developed and maintained nationally, it becomes National Spatial Data Infrastructure (NSDI). For more than last two decades, worldwide applicability of NSDI has been grown-up widely because it enables sharing of spatial data in a fashionable manner which helps local, national and regional level users to achieve their targets by providing easy access to spatial data, reducing data duplication as well as saving time and financial resources. Since the initial development, many developed and developing countries have adopted NSDI. Bangladesh govt. also felt the importance of NSDI and taken initiative to establish NSDI for Bangladesh. National Spatial Data infrastructure (NSDI) service for Bangladesh is being constructed as a core database and web-based geospatial data sharing system. Using this platform all member organizations can provide the valuable geo-spatial information and map data easily and safely without a fear of violating privacy issues and ownership policies. NSDI for Bangladesh is being established under the ministry of defence where Survey of Bangladesh (SoB) is the main responsible organization to coordinate with other stakeholders. Japan International Cooperation Agency (JICA) is the technical partner assisting and supervising the development of this platform. This platform will be service oriented and it will work as a hub among the stakeholders, researchers, academicians and planners. To activate the portal, geospatial data are to be supplied from the stake holders. In this regard, to encourage the stakeholders for adopting this platform a sequential program has been taken. A 05 days workshop was one of them which was conducted at BRAC CDM,SAVAR. After a thoughtful group discussion between stakeholder's representatives,03 model projects were launched from this workshop to produce some spatial data layers which will be uploaded in NSDI portal. Using those layers from NSDI portal, stakeholders will be able to learn how to use the portal and how the data will be analysed to meet their own requirement. Among the 03 model project, Water management group was designed their model project titled with "Feasibility study on Waterways around Dhaka City to select the best site for Recreation".

To accomplish the model project, a detailed study has been conducted based on reconnaissance survey and field survey data. However, during the analysis of data this study focuses on prospects of enhancing recreational aspects of the Circular Waterways (CW) of Dhaka city. With the help of water ways around Dhaka, potential scope for water based outdoor recreation for the city dwellers can be explored. Based on reconnaissance survey, three portion of CW have been selected to explore their potentialities for recreation and place making.

From the analysis of field surveyed data, it is found that '**Tongi- Ashulia- Mirpur**' route has the true essence of a water based recreation route and in future it could be the best recreation site for the visitors if it is possible to develop considering multiple expectations of them. People gather here as river is their main attraction for enjoying their activities. Among the three routes only this route provides some facilities to its recreational users. The recreational development of these routes' highly depends on the visitors' satisfaction. To measure visitors' satisfaction level gaps between their expectations and reality has been

identified. From the analysis it is found that the items related to natural beauty and atmosphere satisfied visitors the most and create a pleasure incitement into their mind rather than the facility related items. These routes are deprived of proper facilities and services. That's why, these routes have not revealed any positive gap scores except the two items under 'environment' and 'recreation facilities' domain of "**Mirpur - Ashulia -Tongi**" route. That means the other items are not meeting visitors' expectations. As we have seen that the 'Recreation Experience' domain has got the highest satisfaction level of the recreational users and lowest negative gap scores among all the domains, it can easily be said that the recreational users come to these three routes for relaxation and aesthetic beauty of the routes though the provided facilities and services are not up to the mark and sometimes absent. With the help of these explorations some proposals and recommendations have been suggested in respect of the existing situation for enhancing water based recreation for the city dwellers. Some proposals were shown with few exemplary images to show how specific problems may be solved and make easily understandable. This study attempts to identify and enhance the attraction points along the selected route. Finally, it also suggested an exclusive waterbased recreation zone to meet the expectations of foreign and local tourists. In addition, based on field Bathymetric and Topographic survey, few nautical charts both in Paper and Electronic mode has been produced which are consists of different geospatial data layers .Those charts and its consisting data layaers will be uploaded in NSDI portal for using by the concern stakeholders.

Chapter- 1 Introduction

1.1 Background of the Study

NSDI is a web based platform which acts as hub of all geospatial data producing agency locally, nationally and globally. Worldwide applicability of NSDI has been grown-up widely because it enables sharing of spatial data in an organized manner which helps local, national and regional level users to achieve their targets by providing easy access to spatial data, reducing data duplication as well as saving time and financial resources. Since the initial development, many countries have adopted NSDI. Although, Bangladesh cannot be considered as an early adopter of NSDI but still it has made some remarkable progress in the establishment of NSDI in the country. The way, Bangladesh has mentionable success stories in using NSDI, still full-scale implementation foresees many challenges to be overcome to get desirable benefit of NSDI. Government of Bangladesh formally announced the concept of “Digital Bangladesh” in 2009. Digital Bangladesh introduced e-Governance and service delivery to citizens through the use of Information and Communication Technology (ICT). Digital Bangladesh is a vision for e-Government which aims to improve the efficiency and transparency of public administration and socio-economic growth through proper and wide use of ICT. By the policy maker it has been realised that NSDI is indispensable part and can be very instrumental to achieve Digital Bangladesh. It has also been recognized that proper utilization of NSDI for public and other facilities is essential for the formulation or release of various plan proposals and operation/maintenance of infrastructure when establishing digital government and upgrading citizen services and it is expected that this will contribute to economic growth and a transition to an information society supporting the achievement of sustainable development goals (SDGs). Against this background, an **International seminar on National Spatial Data Infrastructure (NSDI)** was organized by Japan International Cooperation Agency (JICA) and Survey of Bangladesh (SoB) in 2016. In this seminar, international keynote speakers from Japan, Indonesia and India shared their experience. The threadbare discussion in that seminar made participants understand about NSDI, its necessities and way forward to establishment of Bangladesh NSDI. In this seminar it has been discussed that, valuable mapping information as well as all geospatial information stored by different agencies needs to be brought under a centralized platform. This will facilitate the relevant organizations and public users to have access this geospatial information for using in many sectors including urban/ rural planning, disaster management, public-service domain, infrastructures planning. This is also expected to facilitate people’s participation in decision making contributing to socio-economic development of Bangladesh. Honourable Prime Minister (HPM) attended the inauguration of this seminar as chief guest and realized that development of NSDI is of paramount importance for the national development of Bangladesh. HPM also urged to form a national committee to develop the Bangladesh NSDI. However, successful implementation of this GIS set-up led to spreading the use of GIS technology among different government departments, national and international NGOs. Since then, use of GIS for national and local level development plans in Bangladesh is being used widely. Many organizations in Bangladesh have been using GIS for planning and decisionmaking process starting from local to regional to national to global levels. At present a significant number of organizations in Bangladesh have developed their own system to produce, update and disseminate geospatial data. The organizations prominent in producing and using geospatial data are Survey of Bangladesh (SoB), Local Government Engineering

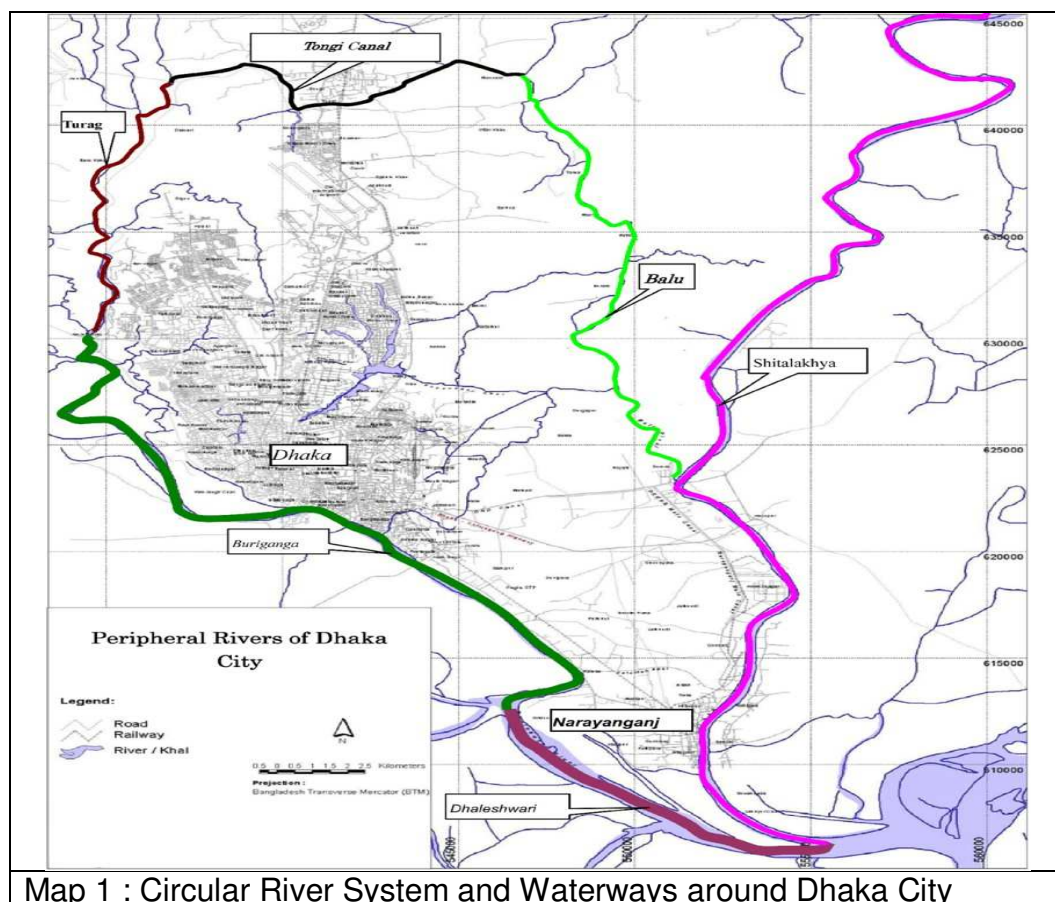
Department (LGED), Bangladesh Water Development Board (BWDB), Department of Public Health Engineering (DPHE), Center for Environmental and Geographic Information Services (CEGIS), Water Resources Planning Organization (WARPO), Department of Land Records and Survey (DLRS), Soil Resources Development Institute (SRDI), Bangladesh Agricultural Research Council (BARC), Geological Survey of Bangladesh (GSB), Bangladesh Inland Water Transport Authority (BIWTA), Bangladesh Navy Hydrographic and Oceanographic Center (BNHOC) and Institute of Water Modelling (IWM). These organizations produce spatial data of different type features in different formats according to their needs and mandates. The spatial data produced by different organizations includes but not limited to Topographic map of different scales, Digital Elevation Model (DEM), Administrative boundaries of different levels, flood inundation and extent map, hazard map, land use map, physical infrastructure map, agricultural land zoning and crop mapping, arsenic contamination map, soil resource map, facility location and distribution map, route map, transport network map, nautical chart etc. Different organization uses GIS as a decision making and planning tool. The application of spatial data in Bangladesh depends primarily on their rule of business and domains. Notable applications of using spatial data may be attributed to land use zoning and planning in urban area, environmental management, agricultural zoning, ecological mapping, nautical charting, infrastructure planning, rural development planning, disaster management, population mapping and poverty mapping etc.

With this background, a thoughtful roadmap has been designed to implement NSDI in Bangladesh. As per the roadmap, JICA arranged a 05 days' workshop (20-24 March 2022) which was held at BCDM, Savar. In that workshop near about 70 representatives from different organizations were taken part with vibrant presence. All the participants have given an elaborate presentation on rules and functions of their own organizations. Through this presentation the attendees have received a clear idea on the rule of business of all stakeholders who all are dealing with geospatial information's. Later on, there was a brainstorming session which was really amazing to the participants and it helped to realize the importance of NSDI platform. That also taken the participants to find the best way to contribute in this platform by providing own spatial data. Finally, 10 groups were formed by JICA and assigned with model projects based on common spatial data usually dealt by group members. After huge brainstorming discussion between group members, each group developed their own model project and delivered a rationale presentation on their thoughts and visions. Finally, an online vote was conducted amongst the participants and based on compiled result 03 projects were selected for future implementation as Model Project (MP). Among 03 selected projects, This Model project was titled as "Feasibility study on Waterways around Dhaka City to select the best site for Recreation".

1.2 Problem statement

Dhaka, the capital city of Bangladesh has been facing the pressure of new development and redevelopment due to rapid socio-economic development. Change in land use pattern, land scarcity, increased land value, lack of mature theoretical guidance and the awareness of preservation the old part of the city is losing its identity. It has become extremely difficult to provide recreational needs with increasing population in Dhaka. The severe lack of recreational facilities for the city dwellers calls for the regeneration of recreational activities – a natural option at hand is that related to the waterways around Dhaka. Dhaka is located

in a delta; water in the form of rivers, canals, waterways, ponds and flood plains form the matrix of Dhaka. It is not just an image of a picturesque landscape; it implies communication, drainage, economic life, festivity, and a certain way of being. The city is blessed with so many rivers and canals, such as the River Buriganga, Turag, Sitalakhya, Balu and the Tongi khal, which encircles the city and forms a 110km Circular Waterway (CW) around Dhaka (See Map No. 1.1).



Map 1 : Circular River System and Waterways around Dhaka City

The tributaries of these rivers and canals once formed an intricate web over the city. But over time much of this network has been dismantled and severe consequences are being experienced. Most of the peripheral areas of Dhaka city are deprived of the recreation facilities; the few amounts of recreational opportunities available are situated and serve the inner city. To facilitate recreational facilities for people living in the periphery as well as in the inner, a vibrant and opportune option in hand is the water bodies around Dhaka. When there are talks about Dhaka's outdoor recreation, the images first strikes one's mind are the open spaces, parks, play grounds, etc. But there is no mere mention about the immense possibilities of the waterways in and around Dhaka. People enjoy water- based recreation knowingly or unknowingly. Someone does not have to travel to far-flung, exotic destination to see amazing sights. The beauty, mystery, and history of Dhaka are all waiting right on the doorstep, ready to be discovered and re-discovered. Inland waterways (IW) are a living infrastructure which has benefited countries all over the world and which has immense potential to intensify recreational activities. IW also enhance communication, environmental improvement, enhancing cultural heritage, promoting healthy lifestyles and improved wellbeing and sports, sustainable transport, encourage active communities, can also act as a visual amenity and contribute to place making. Place making is the process of retaining

the essence of a place while improving its physical and psychological aspects so that people are attracted to that place. These places attract visitors not only on weekends but also on weekdays and can act as a catalyst for attracting people in interesting ways so that people's feeling are provoked to visit them. When the interaction between places and visitors are really satisfying, visitors feel to visit those places again and again.

Waterways also act as a tourism asset and provide a link between existing and new attractions and support the holiday industry through water-based activities. Visitors drawn to the waterways contribute to the economy of the waterway corridor through expenditure on local goods and services. The use of water in urban design to enhance aesthetics is also well known. A city along a water-route, with the presence of water, creates a powerful esthetic image for the city. World over attempts have started to revive eco-friendly and sustainable waterways to cater to transportation, tourism, place making, etc. The appeal of spending leisure time on the water is a common theme in recent urban waterfront development all around the globe. Although dramatically different in their geography and culture, people around the world like to associate relaxation and enjoyment with being on the water. Dhaka has the fortune of riverbanks that are a natural treasure of potential public spaces. Through place making the city can meet the recreational needs of its dwellers, as there seems to be very limited opportunities in Dhaka for residents to spend their leisure time or short holidays within the city. The waterways of Dhaka can provide excellent opportunities to enhance all these. Thus, this study intends to show the prospects of enhancing recreational aspects of the Circular Waterways (CW), how trip makers, on site recreational users and traders currently perceive and use the water- routes for recreation, transportation and communication and what improvements they expect along selected routes. The intention is also to show how this can also contribute towards place making of Dhaka through better plan and design of places along the selected routes of the waterways.



Photo1: Environmental Degradation of River Turag



Photo2: Encroachment of River Turag



Map-2: Existing river and Canal connectivity



Photo 3: Riverside walkway works in Progress by BIWTA

Based on those points the study of this project also found that multiple organizations are involved with this river due to their role of business. All the organizations are dealing with surveyed geospatial data for their regular infrastructural development work and at the same time they are also creating their own database for future use. As, creating individual database is a matter of expertise on GIS and time consuming as well, the study found that all the stakeholders who all are creating common data format on same feature; it is nothing but duplication of effort. Many stakeholders do not know that the same feature layers are available in another organization which is exchangeable. As a result, while they are taking a new project in their hand, initially they are conducting feasibility study in the relevant field which is economically cost effective and time consuming. Keeping those points in mind, water management group has taken initiative to conduct a feasibility study on Circular Waterways around Dhaka city and collect geospatial information and conduct a research using that information and finally make a recommendation to establish a model waterbased recreation zone for the city dwellers. However, using the collected geospatial information water management group intended to design few navigational charts both in Paper and Electronic mode which will be consist of different geospatial data layers. The charts will contain different features including Bathymetric and Topographic informations that can help primarily the navigator for safe navigation. In addition, many stakeholders may share the common feature layers from this charts which will definitely reduce the dual effort of the users. That will also help the users economically as it is readymade product which can also be easily downloaded from NSDI platform as per data sharing policy of NSDI.

1.3 Objective

The overall objective and goal of this project are given below:

1.3.1. Overall objective

The main objective of the project is to conduct a feasibility study on Circular Waterways around Dhaka city and collect informations based on which a well thought recommendation may be given to select and establish a best waterbased recreation zone for the city dwellers and also produce few navigational charts both Paper and Electronic means which will help in inland navigation and its consisting data layers may be shared by the concerned users. Moreover, this study can

behelpful to the stakeholders to share collected geospatial information through NSDI platform that will reduce dual effort of same spatial data production. In addition, by preserving geospatial data in NSDI data bank, stakeholders can retrieve their required data in any major crisis.

1.3.2 Overall Goal

Overall goal of this project is to provide necessary updated geospatial information's to the stakeholders when it is required. That information's will help the policy makers in the following aspects:

- ❖ To re-establish circular waterways to decrease traffic jam in Dhaka, reviving the rivers in and around the capital to integrate the waterways with the land transport systems, improving tourist value and sustainable environmental Development.
- ❖ To establish few recreational sites for the city dwellers based on geospatial information of this project that will give some breathing space for the inhabitants of Dhaka City.
- ❖ To establish a wide structured permanent Embankment system around the city, this will protect the city from flooding and also provide recreational facility to its inhabitants.
- ❖ To ensure well-balanced water management system which will help to maintain balanced Echo system of waterbody and that will also help environmentally.
- ❖ To develop a well-planned green park around the city, this will create a healthy environment for its dwellers.

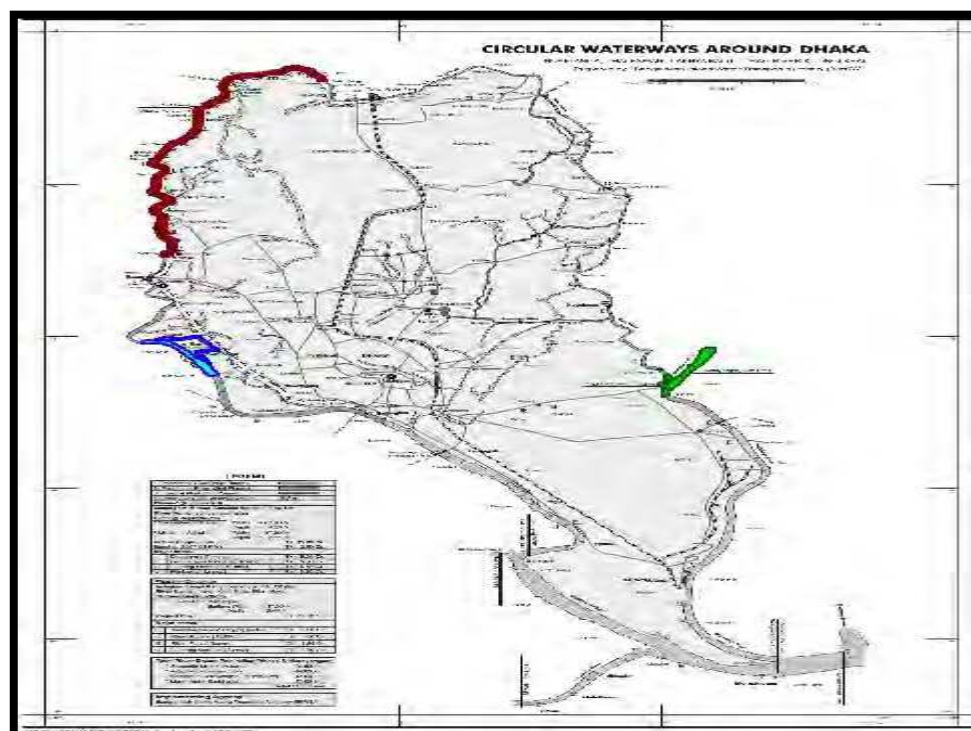
1.4 Rationale of the Study

Dhaka is a tender land-mass virtually an island framed by rivers and a fluid landscape. Even now a ten-minute ride outside Dhaka shows the aquatic reality of the land-flood plains, wetlands, agricultural fields and canals completely tie the city. This character has been lost due to unplanned developments. In many countries and cities all over the world that has only one river or canal, the water body is coveted and protected like a precious gem and the activities taking around them are beyond the imagination of our designers and planners. But in our country where we have insufficient outdoor recreation and open spaces, the waterways can be utilized for outdoor recreation activities. Some routes of the Circular waterway's and their corridors are being used as recreation point presently. Recreation activities can take place surrounding the rivers and place making can occur centralizing on the recreation activities. The adjacent land areas need to be developed for that purpose. But this prospective issue has not been considered or developed in a planned way yet. This issue has immense potentialities; but the main constraint is that the western embankment totally neglected during planning and design. On the other hand, the completion of the Eastern Embankment will turn Dhaka into an island surrounded by walls and embankments. When the banks of the river were stabilized for flood protection, little thought was given to either aesthetics or recreation, i.e. public enjoyment. But the eastern part still has the potential to connect the rivers with people and make proper utilization of the resources

when the need for enhancing recreation is paramount. With these the congested city will have effectively provided with a significant amount of accessible open spaces. How these routes can be enhanced by place making from the users point of view is the main concern of this study. The small rivers, canals, ponds and open spaces within the city have been used up for development; the only option left is to create recreation opportunities based around CWs as well as to create places along its routes which the city and the citizen will cherish. In addition this route could play a vital role in water based transportation as it has sufficient navigable depth. Those are the main concern points of this study. The waterways of Dhaka can provide excellent opportunities to enhance all these. Thus, this model project intends to show the prospects of enhancing recreational and transportation aspects of the Circular Waterways (CW), how trip makers and on site recreational users currently perceive and use the water- routes for recreation and how CW can be the best options for inland navigation along selected routes. The intention is also to show how this can also contribute towards place making of Dhaka through better plan and design of places along the selected routes of the waterways.

1.5 Selection of Project Site

Reconnaissance survey has identified that the route from Sadarghat to upstream up to Basila has a unique pattern of water transport for passengers and upstream up to Aminbazar for goods transportation. For a significant size of recreational users' route trip making, exclusive potentialities for recreational prerequisite and immense scope for future development for recreation, and potential attraction points for recreation along the river routes, three portions of routes of CW have been selected. The **"Tongi – Ashulia- Mirpur"** Route, **"Sadarghat-Washpur- Basila"** Route and **"Demra - Noapara"** Route (Shown in Map No. 3) have been selected for conducting initial study.



Map-3: Selected sites for the study area

1.6 Importance of the study

Dhaka was established on the north bank in a planned way by the Buriganga river side. The other areas were purely rural in characteristics that had a superb beauty of their own which city administrators have failed to protect. This character has been lost due to unplanned developments. In our country where we have insufficient outdoor recreation and open spaces, the waterways can be utilized for outdoor recreation activities. Some routes of the Circular waterway's and their corridors are being used as recreation point presently. Recreation activities can take place surrounding the rivers and place making can occur centralizing on the recreation activities. The adjacent land areas need to be developed for that purpose. But this prospective issue has not been considered or developed in a planned way yet. With these the congested city will have effectively provided with a significant amount of accessible open spaces. How these routes can be enhanced by place making from the users point of view is the main concern of this project. On the other hand, those rivers can play a vital role in inland transportation system. As existing road transportation system is overburdened with massive population of this megacity, this inland route could be an alternative transportation system which will save time of her inhabitants. This river route could play a vital role in developing Inland transportation which can contribute to accelerate national economy. This river could be a great source of fresh water that leads the city to become a healthy one. Keeping those points in mind, a well thought model project was designed from which a lot important geospatial information will collected and using those layers few in number navigational charts both in Paper and Electronic means will be. This map primarily will be used as navigational chart and secondarily its different layers will be shared in NSDI portal that will help the stakeholders by downloading their required information's. Through this process stakeholders will be benefited by reducing dual effort of geospatial database preparation. It is notable that this data sharing process will be highly secured as it will be operated under NSDI act. To fulfill the objective of NSDI, this model project will play the vital role to make aware the mass people and relevant users.

1.7 Possible outcomes of the Project

The development of recreation and tourism along waterways will bring together the community's needs for leisure and economic growth with an opportunity to experience and understand the historic waterway environment as part of a managed and protected landscape. However, properly targeted, improvements to our waterways can make a contribution to improving the quality of life for those living in the deprived communities along the waterways as well as for other communities. In encouraging a modern, integrated and sustainable approach to their use, this study intends to maximize the opportunities of the waterways which can offer for leisure and recreation and as a catalyst for urban regeneration. This intends to lead to a drive to re-open and revitalize abandoned and under-used waterways. The CW has the immense potentialities to act as an alternative to mitigate road traffic congestion and environmental degradation and this can act as a promoter for better plan, design and development of Dhaka to create positive impacts on the city, such as recreation, transpotation and place-making. From the analysis of this study, some recommendation has been made which may implement by concerned authority and the model project study route may get a sustainable development with respect to recreation and place making.

1.8 Scope of the Work

The project is planned to implement based on the guidelines of JICA (Japan International Cooperation Agency) as co-partner of developing NSDI. A well thought plan is scheduled to run the project. The project period is designed from 01 January 2023 to 31 December 2023. To implement the model project, a working group was formed consisting of 10 members (Core Member) from concerned organization (Annex-1) that has the sharable spatial data. This group was headed by a Team leader (Representative from BD Navy) who was the main responsible member to the JICA for overall progress and submission of the model project. All the relevant organizations assist the working group (WG) members of Water Management Group (WMG) to accomplish the project and design a meaningful recommendation. During the progress of model project, a series of meeting and site visit was held between the group members and JICA based on work schedule proposed by team leader of water management group. Meeting was held by physical presence and sometimes online basis. During the project period, a series of progress report was submitted to JICA and NSDI authority as well.



Photo 4: Kick-off Workshop



Photo 5: 03 Days Workshop



Photo 6: WG Discussion

1.9 Study Methodology

1.9.1 Nature of study

The present study endeavors to find out the gaps and prospects of enhancing navigability of the CW, how the industrialists, local traders and on site recreational users currently perceive and use the water- routes for navigation and recreation purpose, and what improvements they expect along selected routes. Consideration has also given to show how this can also contribute towards the enhancement of tourist value of Dhaka through better plan and design of places along the water-routes. Nature of this study is exploratory rather than testing any hypothesis. By definition, an exploratory research involves investigation of problems on which little formal knowledge is available. Being the nature of this study an exploratory one and using descriptive statistical tools rather than inferential statistical ones, the present study is both at hypothetical as well as a practical one. Both the qualitative and quantitative approach has been used to explore the research.

1.9.2 Outline of methodology

The overall approach to the study has been formulated with conformity to the scopes of the study and to provide a complete guideline to fulfill the objectives.

A. Conceptualization

The study begins with the conceptualization of the potentials of water based transportation and recreation along the waterways around Dhaka. With the perception of the role of the waterways in transportation and recreation to re-establish the waterways and to improve the overall outdoor recreation sector in Dhaka, this study has been initiated to justify its prospects, and further steps have been planned accordingly.

B. Reconnaissance survey

After making the first thoughts of the project, a reconnaissance survey has been conducted to have a general understanding about CW to see how people use the water routes for the purpose of transportation, communication and recreation. For this, the reconnaissance survey has been made on the River Buriganga, Turag and Tongi Khal starting from Sadarghat to the upstream up to Tongi Jtama field and Sitalakhya River from Demra to Noapara. Reconnaissance survey has been made to recognize existing river condition and the extent includes the physical infrastructure for the waterway transport, the land uses on the riverbanks, existing landing stations, road linkage to the landing stations, and circulation pattern of the waterway users.



Photo 7: Reconnaissance survey at River Turag

C. Formulation of objectives

Few specific objectives have been developed for the study and the total study intends to fulfill those objectives.

D. Formulation of study plan

After the formulation of the objectives, a comprehensive work plan has been prepared to carry out the study. By maintaining sequential flow and interrelationship of activities of the plan has been developed to achieve the desired result.

Table1: Work schedule of the model project

S.N.	Sub-task	Jan-23	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec-23
1	Submission of inception report (ICR)												
2	Reconnaissance and Planning												
3	Data Collection												
4	Data processing												
5	Creating DPS												
6	Quality control												
7	Producing Map												
8	Validation check												
9	Progress report												
10	Draft final report												
11	Final report and Output Layer												

E. Literature review

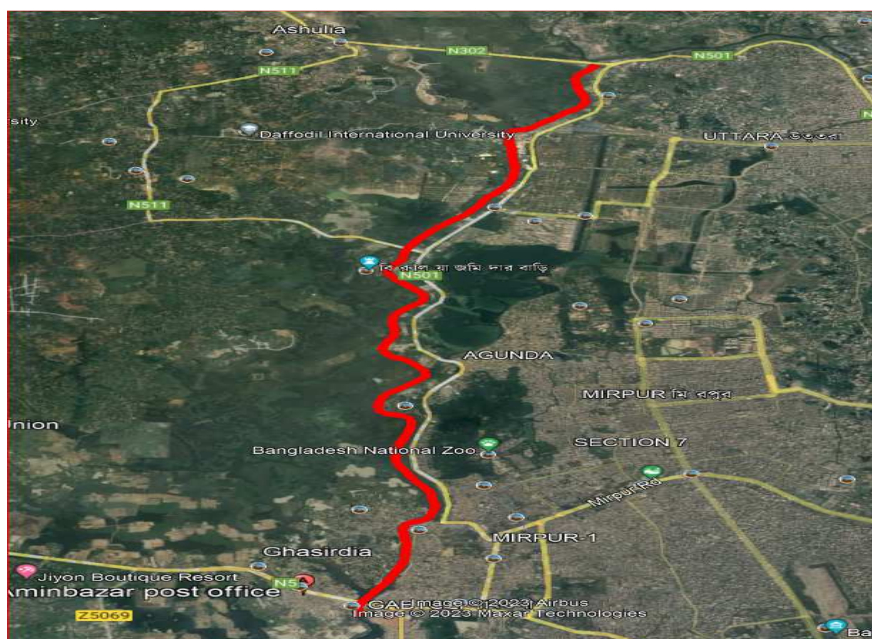
An elaborate literature survey was carried out to have a basic understanding on importance of river for transportation, communication, recreation and other practices around the world. River side recreation provision in Dhaka as well as in the whole country is a totally neglected issue in Bangladesh but it has huge potentialities to expand in a great extent and could be able to take significant contribution in the tourism sector of Bangladesh. From the review of literature, we found that a number of studies have been undertaken by various scholars, inter-governmental organizations and research institutes in related area and the literatures reviewed so far, have no doubt made significant contributions to the field of study. However, specific studies on prospects and challenges of inland waterways with respect to transportation and recreation systems for Bangladesh are very less. For this reason few research projects were consulted related to development of transportation and recreation’.

The purpose of these studies was to understand how user and interest groups currently perceive and use the river corridors, and how they would like to see the corridors improved for transportation, recreation and related values.

F. Selection of model project data collection site

Reconnaissance survey has identified that the route from Sadarghat to upstream up to Basila has a unique pattern of water transport for passengers and upstream up to Aminbazar for goods transportation. This length of the river has sufficient water depth for navigation. However, the river bank is occupied by encroachment which is not suitable as recreational spot. From Aminbazar to Ashulia, water depth reduced abruptly but the river bank (Right bank) acting as major road upto Ashulia which could be a suitable recreation site for visitors. For a significant size of recreational users’ route trip making, exclusive potentialities for recreational prerequisite and immense scope for future development for recreation, and potential attraction points for recreation along the river routes, “Aminbazar to Ashulia” observed as the best

site. Finally, considering all the aspects “Aminbazar to Ashulia” Route has been selected for conducting Bathymetric and Topographic survey for collecting geospatial information.



Map-4: Selected site for Model Project

G. Sampling

The on-site traders related to transportation, recreational users and route trip makers have been taken as samples. A representative sampling has taken randomly for 95% confidence level with a sampling error of 6% and that came to around 200. But due to several limitations, sample size has been fixed at 150. “Aminbazar, Shinnirtek and Ashulia” three points have covered more samples because 80% samples are from those points and it gives the true picture of requirement of waterbased transportation, possibility of river side recreation and potentialities of expansion of tourism. Though this sample size is very little in respect of the total volume of users’, but 150 can be a representative sample of the whole volume of users for an exploratory research.



Photo 8: Field Survey

H. Preparation of questionnaire

After performing a reconnaissance survey on the study area, a clear and well defined questionnaire was developed. As this study was mainly based on primary data sources, questionnaire preparation was an important part of this study and special attention was given to preparation of the questionnaire. For this study, preparation of questionnaire was completed in three phases:

1. **Preparation of draft questionnaire:** Keeping in mind the objectives of the study the questionnaire was prepared so that it included every aspects related to river user's characteristics, respondents identification, their perception, satisfaction level and expectation about the water based transportation and recreation.
2. **Pretesting of questionnaire:** After preparing a draft questionnaire containing questions related with all possible types of aspects needed for the study, apretesting of questionnaire was conducted. It helped to find out the errors of the questionnaire. It also helped to rearrange questions, and to make question more meaningful and answerable.
3. **Finalizing the questionnaire:** After pre- testing of questionnaire, it was finalized after correcting all errors. The final questionnaire was used to conduct survey in the study area. The questionnaire included open-ended questions to capture the wide range of activities, users' likings- disliking, suggestions, user perceptions and attribute preferences, and closed-ended questions to measure attitudes about specific river-transportation, recreation and tourism related issues. The survey was field tested on 30 respondents. When open ended questions were asked in the pretest they did not response well but when the respondents were asked to answer the close ended ones they were more comfortable and the answers were carrying great weight. After pretest some points were removed from questionnaire and decided to give focus on in-depth interview survey because of size of questionnaire is comparatively time consuming and the respondent's perception about the issue is not clear. Questions focused on three major areas: river use characteristics (activities, transportation to the site, distance traveled to the site and the time taken for this journey, visit length); perceptions of the river (the importance of the river, potential problems in the corridor, liked and disliked attributes, perceptions of recent improvements, and suggested changes for rivers in the river area); and demographics (age, occupation, income, sex etc). A five points " Likert Scale" has been used to measure 'levels of importance' and ' levels of performance' to explore visitors' satisfaction level with various attributes of provided facilities among selected route.

I. Method of Data collection

1. **Primary Data** Primary data has been collected through field survey, observation, and questionnaire survey and interview method.

a. Field survey has been conducted for the whole route to collect geospatial data need for charting and evaluation with previous records. Bathymetric and Topographic survey were conducted to get the present water depth of the river Turag and existing river side condition.

b. Observation method has been applied to identify user's trip pattern, pattern of user's activities, characteristics of route, existing physical infrastructure, neighboring land use, accessibility condition of link road, tourist attraction points along the route, type of vessel, its existing condition and speed, number of landing stations, Ghats and their condition, river bank vegetation type, water quality of river and behavior pattern of onsite recreational users'. Along with observation method photographs has been taken to demonstrate the existing condition of study area.

c. **Questionnaire survey:** All interviews were conducted on-spot and face-to-face, with the interviewer writing respondents' answers to open-ended questions precise. Survey respondents were selected carefully, controlling for interviewer bias as much as possible, and ensuring that representative samples of the recreation visitors and users concern to transportation were interviewed. A minimum number of interviews were selected for this site, and a sampling interval was determined based upon the intensity of use along the site. For instance, where there were few recreational users, each solo visitor or a member of each group was interviewed. The in depth, face-to-face interviews took place on the river study routes during (wet season) August and September of 2023. Interviewers were at each site on weekdays and weekends, during mornings (09.00am to 12.00pm) and afternoons (3.00 pm to 6.00 pm).

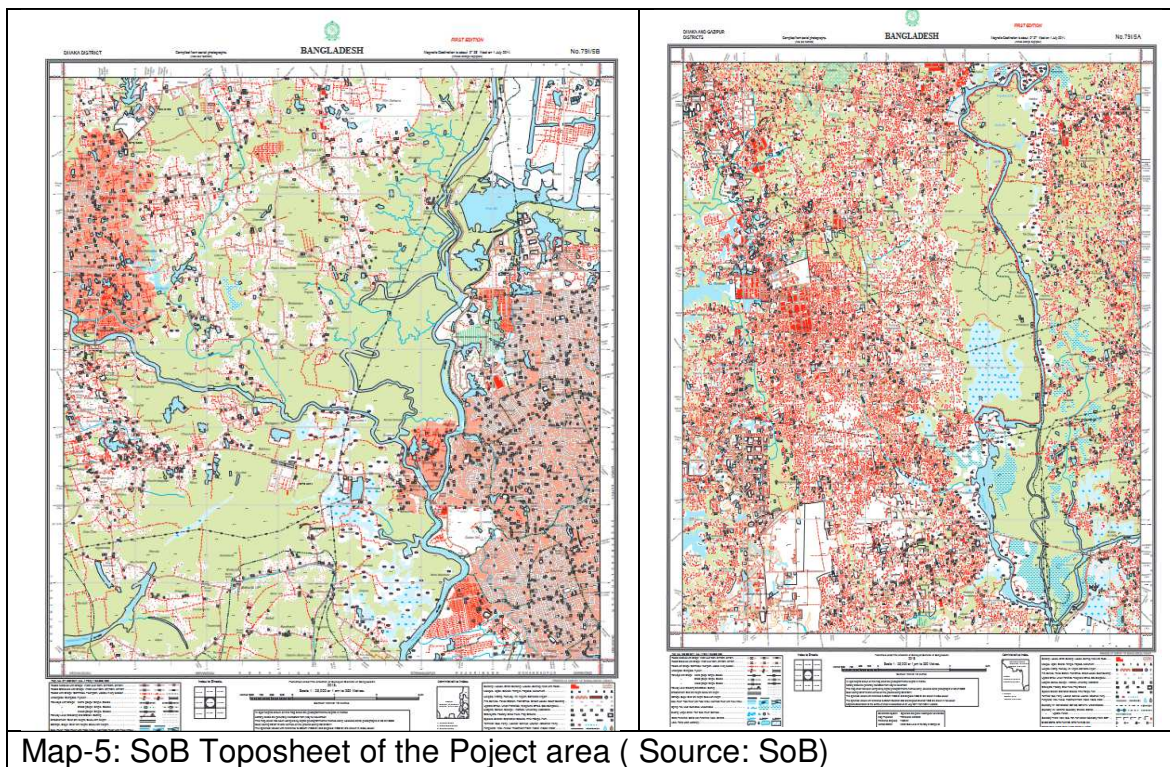
Sites were visited two or more times in each time period. Most users who were approached agreed to participate in the survey. The primary reasons for refusal were lack of time, perception and especially couples showed hesitance to disclose their identities

d. **Interview:** Interview has been conducted with different experts and key personnel of concerned authorities to be acquainted with their views about Waterways transportation, recreation potentialities, their perceptions about river transportation, recreation, problems and opportunities, recommendations for increasing and improving waterbased transportation and recreational use, to provide information regarding the gaps, improvements and ratification of issues raised by the respondents, to obtain information about the current status of transportation, supply of recreation facilities and plans for future

development. In this regard a semi-structured questionnaire was used to collect required information to improve the transportation and recreational aspects of the water way. Interviews with key personnel of BIWTA, BWDB, IWM and planners have been made in different time throughout the study which helped to conceptualize and formulate study plan and suggest recommendations.

2. Secondary Data collection

The sources of secondary data were several books, reports, different journals periodicals, newspaper and through internet, which is one of the best and helpful source of secondary data. Beside these, different official publications of government agencies like SoB, RAJUK, BIWTA were also a prime source of secondary data. Maps have been collected from different organizations like SoB, BIWTA etc. Organizations showed different information for the same issues written the same period which illustrated immense lack of coordination between the agencies in data preparation. As a result, some required map has been made by adjusting and coordinating existing information obtained from different agencies. But Map prepared by SoB(1: 50000) has been considered as base map.



J. Data analysis and Findings: This study is based on exploratory research approach. At first, data were analyzed through descriptive analysis and to measure gap between traders and visitors' expectation and reality 'Gap Analysis' method was used. At the same time collected Bathymetric and Topographic data also analysed by related software and represented in the concern navigational charts.

K. Proposed design concepts for study route

Some design proposals have been suggested through chart and images for the navigational and recreational development of the study route in respect to the existing situation for enhancing the water based transportation and recreation for the

city dwellers. Charts and images have been provided to show how specific problems may be solved and places can be created.

L. Recommendation

To improve the present condition of river side landing stations for goods, recreation points and to explore the hidden recreational potentialities of selected route some recommendation has been proposed. Recommendations have been suggested on the basis of restoration and conservation of the water way, physical development on the route side area, landscaping and plantation type, management and maintenance and over all places making through water sensitive urban design.

1.10 Limitations of the study

The study encompasses a small but potential segment out of 110km of CW of Dhaka city which also has immense potentials for recreational uses. The overall methodology and approach of the study, however, are not beyond its limitations. The major limitations of the study are:

1. The major limitation was that there is absence of comprehensive research work which can give a clear perspective regarding water based transportation, communication and recreation around Dhaka city. Waterways are much neglected issues in Bangladesh. There are a few or very limited studies conducting on the development of waterways. Unavailability of required primary data (Bathymetric and Topographic) for full CW has also been a major constraint in this regard. Some of the data have been used from different organization as secondary source and most of the topographic information taken from google earth for analysis purpose.
2. Different reports showed different information for the same issues written in the same time period. Sufficient updated data are not available for all priority issues.
3. Though the sample size selected for the questionnaire survey to analyze user's satisfaction level regarding the use of waterway for transportation, communication and recreation is expected to represent the authentic output, analysis with a larger size could ensure better result, which was not possible for due time, manpower limitations and seasonal constraints. Survey has been conducted during the rainy season (June - August, 2023).
4. Seasonal restraint is a great limitation for this study. Bathymetric survey was conducted during rainy season. The collected data in this way reveal the activities and pattern of recreation during the rainy season (June - August, 2023) mainly. Due to time limitation, it compelled the present study to exclude information of other seasons (winter season) which are very important for waterway recreation activities. Special characteristics of summer use are not captured in this survey. Site attributes that are liked and disliked and characteristics of recreational users' may change with the season. To gather this information, this survey would need to be implemented in the other seasons.
5. A detail inquiry on the users is necessary to reveal their perception ability, expectations and level of satisfaction, recreation pattern and activities. Respondents

were required to be interviewed for longer period that were sometimes uninterested and irritated with this survey due to lack of interest in the survey, time limitation and lack of clear perception concerning this issue.

6. A lot of young female respondents were unwilling to give interview because of their privacy as they did not want to disclose their identities. But at the same time rest of them heartily participated in the interview.

7. Above all, time, man power and money were insufficient for such an elaborate but interesting study.

1.11 Report Organization

The report is organized into six chapters.

Chapter 1 (Introduction) discusses the background of the study, problem statement, aims and objectives, rationale and importance of the study, describes the methodology applied to fulfill the objectives and possible outcome along with the limitations encountered.

Chapter 2 (conceptualization and review of literature) provides the theoretical background, including discussion on relevant study done in the past. This chapter describes the concept about water transportation, communication, recreation, planning and place making etc. Also includes review on the Development Plans and related projects relevant to the study, water and environment conservation acts, rules and regulations of Bangladesh; water resource management scenario and overall water way condition of Dhaka.

Chapter 3 (Circular Water Transport System of Dhaka City) provides introduction to Circular water transportation system of Dhaka city. It also describes different actions taken by different authorities for Dhaka city to improve water transport system.

Chapter 4 The Historical background of water based recreation of Dhaka and some case studies on the water based recreation in Dhaka and around the world have been discussed and their implications in the context of the study area have been identified.

Chapter 5 (study area profile) incorporates a complete description of the study routes.

Chapter 6 (Users' Satisfaction Level Analysis and Expectations) describes the survey design instruments, findings and however, is a detailed analysis on the present recreation pattern and activities of the selected routes of the CW in the form of literature, numeric data and graphical interpretation, maps and users' satisfaction level through Gap analysis and explore the specific expectations of the users'.

Finally, Chapter 7 represents the proposed design concepts for the recreational development of the selected study route (Mipur-Ashulia- Tongi). It also contains some recommendations and necessary measures that have been proposed based on the findings of the above mentioned chapters.

Chapter 2: Conceptualization and Review of Literature

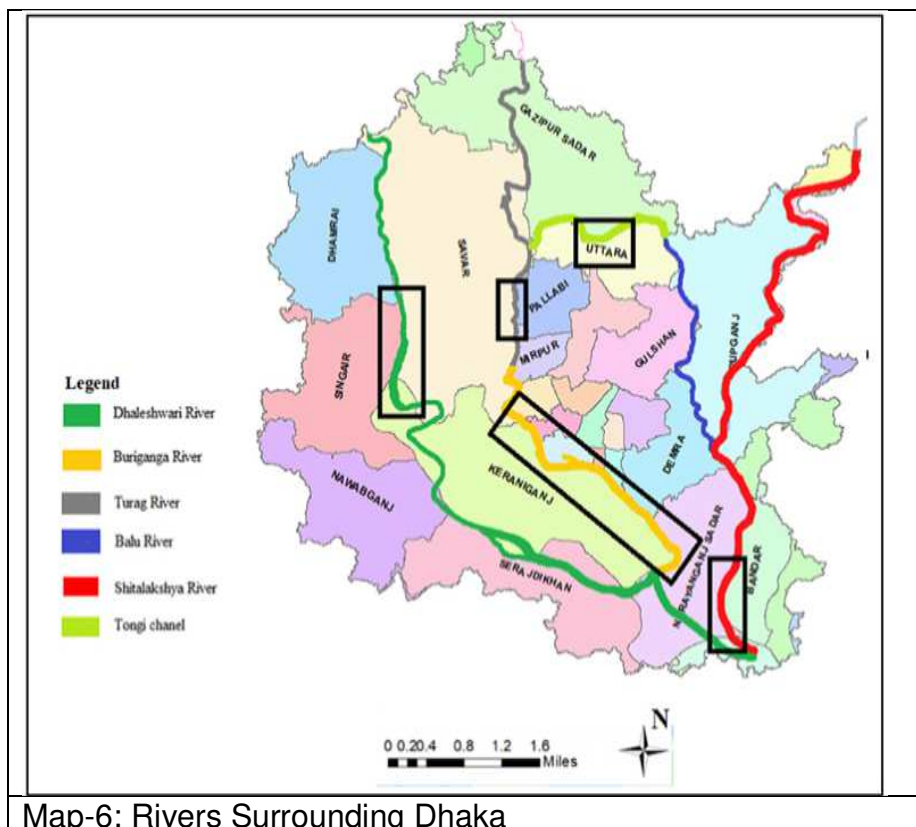
This chapter provides the theoretical background, including discussion on the concept about water based recreation, transportation, communication, planning and place making etc. It also includes review of Development Plans and related projects relevant to the study, water and environment conservation acts, rules and regulations of Bangladesh; water resource management scenario and overall the condition of the waterways in Dhaka. This chapter has helped a lot to conceptualize and has created the base to understand about the relevant issues.

2.1 Introduction

Every individual has individual meaning of recreation and it is applied to great variety of activities. Sometimes the term is applied to activities of young people and adults to differentiate those activities from the play of young children. Because of this diversity in the use of the word, it is desirable to understand clearly in the beginning to avoid confusion. In common usage, however, recreation has a more comprehensive meaning and it is not restricted to any particular age group and activity. Recreation means to regain lost vigour and get a sense of joy, refreshment and satisfaction. Recreation is life itself, without recreation life is meaningless. The modern age is full of complexities, a man in order to survive has to do lot of physical and mental work, resulting in fatigue. Through recreation he can regain the lost vigour or energy. Recreation is concerned with those activities performed by an individual during leisure time or at hours not at work. Hence, it is frequently referred to as leisure-time activity. Recreation education is aimed at teaching people to utilize their free time/leisure time in a constructive manner. To achieve this aim and to have value as recreation, activities must be suited to his physical, mental, emotional and social needs. In other words, it implies a careful selection of activities for the utility of free time in a healthy way. Recreation can be of different types. It can either be individually or collectively, can be physical, mental and social or a combination of all the three. Subject to time we can divide recreation into two parts: Indoor recreation and Outdoor recreation. Outdoor recreation can again be of two kinds: Local- different recreational facilities available locally, such as, library museum, zoo, open space, play ground, etc. Regional- the places which are located in the remote areas of the town, e.g. picnic spot, historical place, scenic places and the riverside, etc. Instinctively, since the beginning of the creation there is a deep relationship in human mind with the environment of nature. At one stage man gets tired with the city environment built artificially and he feels an inherent urge within to go near to the nature. Among the younger generation the necessity of recreation is more profound than in the elders because this age is for work, a period for creating something. Outdoor recreation is almost at herapeutic kind. In the opinion of some researchers recreation plays a remarkable role in holding up the youths from going ashtray and restraining them from other criminal activities.

2.2 Dhaka City and its Waterways

Dhaka, the megacity is bounded by the Buriganga River on the south, Tongi Khal on the north, Balu River on the east and Turag River on the west. The edges of the high lands are flanked by marshes and old river beds. A significant portion of the adjoining low-lying areas have recently been brought under the structured zones of the city due to the accelerated rate of the urban growth in Dhaka.



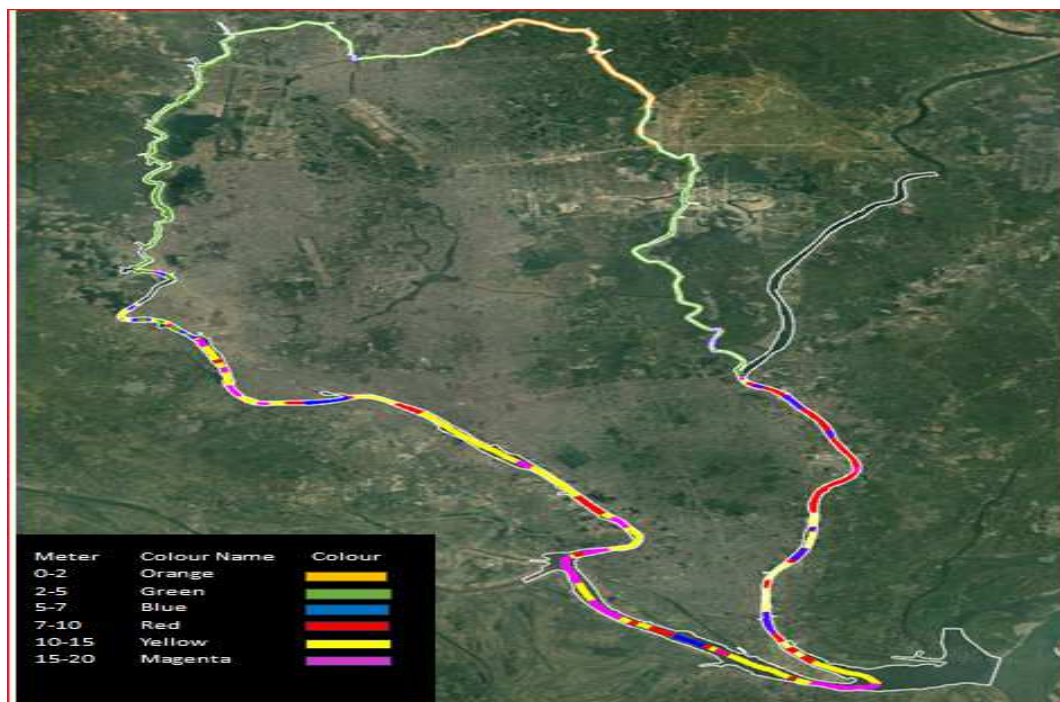
According to BWDB (Bangladesh Water Development Board) the general information about the rivers encircling Dhaka are given in the following table:

Table: General Information of Rivers Surrounding Dhaka

Name	Length(km)	Width(m)	Depth(m)
Tongi khal	17	60	9.15
Turag	71	218	13.5
Buriganga	45	265	14
Sitalakhya	73	277	10
Balu	45	100	9.63

2.3 Present state of CW of Dhaka City

The Buriganga-Turag river system provides an important riverine link with the Dhaka Metropolitan City. Other peripheral rivers such as Balu, Lakhya and Tongikhal are also important in maintaining circular water route and natural environment of the city. Through the ages, these rivers have silted up and offtakes from the main source with the Jamuna have been almost disconnected during the dry season causing obstructions to navigation in the surrounding rivers of Dhaka due to reduced drafts. As the flows of these rivers are practically nil during the dry season, the pollution of the river water has become a chronic problem, degrading the natural environment. Indiscriminate disposal of wastes has added pollution level in the rivers. The present state with respect to depth of above mentioned rivers are given below:



Map-7: Present Depth status of CW (Source: BIWTA Survey data 2018-2022)

Table3: Present Status of River Surrounding Dhaka

Name	Length(km)	Width(m) (Minimum)	Depth(m)(Min)
Tongi khal	17	21 (Dhaka- Gazipur Rail Bridge)	0-2
Turag	71	81(Ashulia) 108(Birulia) 86 (Sluice gate-4) 50 (Tamanna park corner band)	2-5
Buriganga	45	128(Sha Cement Ready miix) 105 (Chandrima) 114 (Khagail Ghat)	5-7
Sitalakhya	73	231(Kanchpur)	No data
Balu	45	75 (Rupgonj Bridge) 35 (Balu Bridge)	2-5

2.4 Present state of outdoor recreation open spaces in Dhaka

Outdoor recreation is a very important activity for crowded city like Dhaka. Unfortunately, the provision of outdoor recreation facilities of Dhaka city has never gained required attention- the open space deficiency in most parts of the city attests to this. There are a number of pressing problems, such as, rising land prices due to land scarcity, rapid population growth, poorly planned residential and shopping areas growth of slums and poor control of landlessness. All these hinder the recreational and overall land use development of the city.

The growth in housing has not been coupled with proportional growth in recreational facilities and consequently, the city lacks miserably in providing recreational space and facilities to its people. There is also no uniformity in open space standard throughout the whole city in general. The existing open space and park provisions vary widely between the old and new parts of Dhaka city and remain far below the standards of provision. In the

older city areas there is too little space allotted for recreation. This is true also for many of the more newly developed areas. The areas are poorly provided with parks, recreation ground and other sports facilities. Even the small amount of recreational spaces is not being properly maintained.

At present, the open spaces are maintained by different government agencies i.e. Suhrawardi Uddyan and Majar area, Ramna Park, Shahid Minar, National Assembly Building, Chandrima Uddyan, Anowara Uddyan, National Eidgah, Mirpur Zoo, Botanical Garden etc. Open spaces are one of the most important ingredients of a city. Buildings alone never make a city, but buildings and spaces in a well-knit fabric. From the planning history of Dhaka it is understood that open spaces had never been developed following the basic principles of planning. As a result, open spaces of Dhaka, particularly since liberation, have been developed without spatial and population consideration. During the decades, population of DCC area is increasing but the quantity of open space has not kept pace with increasing growth of population

2.5 Definitions:

According to the BIWTA rule 1973,

“Inland navigable waterways” means and includes:

1. All rivers and canals where vessels can ply during any part of a year;
2. Any lake, haor, beel or any other expanse of water which are used by vessels in any part of the year;
3. Shores of the above mentioned waterways;
4. Inland river ports, landing ghats and terminals maintained and operated by the authority on any of the above mentioned waterways

“High-Water-Mark” means is a line drawn through the highest points reached by ordinary spring tides at any season of the year; and **“Low-Water-Mark”** means a line drawn through the lowest points reached by ordinary spring tides any season of the year. Foreshore is the soil lying between the low-water mark during dry season and the high-water mark during monsoon.

“Navigable River and Channels” means waterways which allow the passage of vessel of any description. According to the laws on rivers and canals, **“River bank”** means up to 50 meters from where river water reaches during high tide is considered the river bank. BIWTA and BWDB are legally responsible for taking care of this matter.

“Flood and flood flow zone” The rising of a body of water and its overflowing onto normally dry land is called flood. Annual place of inundations are thus flood flow zones. A river in its flow regime maintains a width within which the flows occur during flooding time.

“Main flood flow zone” Main flood flow zone is the cross sectional area of a river that carries the dominant flood flow.

“Sub flood flow zone” Sub flood flow zone is that area which conveys the flood water only during high tide and storms. Flood Flow Zones are designed for control the area where the flood flows are running over the flood time or at a specified time of a year. Land development within the designated flood plain areas requires control to avoid obstruction to flood flow, which might otherwise result in adverse hydraulic effects like rise of flood water levels and change in flow direction as well as adverse environmental effects like hampering ecological biodiversity.

2.6 Studies on Projects Undertaken for Waterway Development and Waterway Recreation Projects

2.6.1 Introduction of Circular Waterways (CW) in and around Dhaka city

Although Dhaka is encircled by rivers, these rivers do not contribute to the urban transport system of Dhaka due to draft limitation, lack of landing stations/ ghats on eastern side, and absence of proper linkages with road transport. BIWTA has completed the western section (Sadarghat to Ashulia) of the Circular Waterways System through dredging and construction of landing stations but the eastern section of the CW System (Ashulia to Demra) is yet to be completed. The DMDP structure plan also recommends development of a circular waterway around Dhaka, utilizing the available natural waterways and rivers. The proposal included dredging of the rivers, channels and canals around Dhaka and establishment of landing ghats with road links to major road network. The navigability of the encircling waterways was expected to enhance and facilitate movement of goods and passengers to different parts of the city by water transport. It was anticipated that these waterways could also encourage development of riverine recreational facilities, and reduce congestion and pressure on existing roads of Dhaka (DAP Final Report, RAJUK).

2.6.1.a Circular Waterway around Dhaka at a glance

- ❖ 110 km ring route around Dhaka.
 - ❖ The first phase stretched 30 km route from Sadarghat to Ashulia.
 - ❖ The second phase is 40 km waterway from Ashulia to Kanchpur via River Balu and River Sitalakhya.
 - ❖ The rest 40 kilometers route connecting Kanchpur to Sadarghat.
 - ❖ The first phase with a provision for 10 landing stations was inaugurated by the then prime minister in March 2005.
 - ❖ The landing stations completed in the first phase are: Sowarighat, Basila, Kholamora, Rayer Bazar, Gabtoli, Aminbazar, Nawaberbagh, Shinnirtek, Birulia and Ashulia.
- **Objectives:**
 - ❖ To enhance navigability,
 - ❖ Reduce Dhaka's traffic congestion,
 - ❖ Facilitate transportation of cargo goods in a relatively shorter time,
 - ❖ Resolve Dhaka's water logging problem
 - ❖ Help improve environment.
 - ❖ Promote recreation and tourism

- ❖ Cargoes of more than 5000 trucks are being transferred through this waterway every day, generating Tk 5 crore revenue annually.
- ❖ Terminals were built at 7 landing stations. Two-storey terminal buildings were built at Sowarighat, Aminbazar, Gabtoli and Ashulia and one-storey buildings were built at Kholamora, Basila and Shinnirtek. RCC stairs were built at Nawaberbagh and Rayer Bazar.
- ❖ The BIWTA started the second phase which has also included three canals between Rampura and Trimohini, between Rampura and Gozaria via Badda and between Trimukh and Namapara.
- ❖ A new river port was built at Tongi and three more landing stations at Kanchpur, Isapur and Kayetpara with pontoons, steel gangways, passenger guestrooms, terminals, and spud.
- ❖ Sponsoring Ministry: Ministry of Shipping
- ❖ Executive Agency: BIWTA

2.6.1.b The main reasons behind the failure of this project are:

- ❖ Lack of comprehensive planning
- ❖ Lack of proper dredging and proper width
- ❖ Ensuring supplementary services like approach roads
- ❖ No policy on types of vehicles eligible to ply the waterway
- ❖ Absence of well defined routes
- ❖ Lack of properly planned landing stations (physical standard, proposed locations)
- ❖ Lack of coordination among agencies concerned like BIWTA, Roads and Highways Department and Railway
- ❖ The waterway route has some physical obstacles like vertical clearance of the bridges
- ❖ Ignorance of Taskforce Recommendations
- ❖ The first-phase failed to serve the passengers due to Selection of wrong type of watercrafts
- ❖ Lack of coordination between existing road network and the circular waterways
- ❖ Infrequent trips of passenger launches
- ❖ Less population in Ashulia
- ❖ BIWTA focused on revenue income from goods transport through the waterways

2.6.1.c River Cruise Programme

Bangladesh Parjatan Corporation (BPC) was inaugurated a regular river cruise programme from Ashulia Landing Station through "Shalook" vessel on May 1, 2005. It was a unique effort to take away the city dwellers from the disordered mechanized ambience of the city to the riverine nature of Bangladesh. But the initiative was not successfully continued because of lack of sincere efforts. Started from Ashulia Landing Station, the inaugural river cruise ended at the same place after two-hour cruising up to Basila. A colorful cultural show was also organized during the cruise. During the river cruise the guests contented their hearts with the beautiful scenery along with the lives of river side people, their activities and opined that the step taken by BPC was really a perfect and timely effort. It was thought that the initiative launched by BPC would definitely encourage the private entrepreneurs to operate

such river cruise from Ashulia. BPC prepared itinerary in order to operate a regular river cruise from Ashulia. It comprised a 7 hr. cruise from Dhaka-Ashulia-Pagla-Ashulia-Dhaka. Its price was fixed at Taka 875 per person which included morning snacks, lunch and transfer by non AC transport. Besides, a two-hour and one-hour cruise at a cost of Taka 200 per person (minimum 25 persons) and Taka 100 per person (minimum 25 persons) respectively and special discount for the students at a cost of Taka 110 per person for a two-hour cruise from Ashulia was offered by the BPC. The students' river cruise comprised a minimum 40 students which includes snacks service also. That initiative would be successful if it was continued with sincerity. Due to lack of initiatives from the private entrepreneurs and planning the cruise programme could not run properly.



Photo 9: Cruise ship “**Sarina**” launched at Ashulia BIWTA landing station

Sarina, another luxurious cruise ship, was launched to entertain local and foreign tourists at Ashulia BIWTA landing station. The ship was fully air-conditioned and equipped with modern facilities. It was capable of carrying 310 passengers. Initially the ship sailed on every Fridays and Saturdays on a seven hour cruise from Ashulia landing station to River Padma and back. The fare for adults and children (under 12) has been fixed at Tk 2000 and Tk 1500 respectively. It is inclusive of morning and evening tea, coffee, cookies, buffet lunch and live cultural programme. The ship usually stayed at BIWTA landing station at every night which was used as floating restaurant for dinner during wet season.

2.6.1.d Water bus Service: Gabtoli bus station was far away from the Water bus station at Gabtoli Landing Station, Dhaka. The service has very low frequency. Though a vessel is supposed to be leaving either station every 90 minutes, but the actual waiting time often crosses the 120- minute mark. There are no information centers at the two landing stations, and passengers are often seen leaving the stations due to the absence of any official. The design of vessel does not allow simultaneous boarding and lighting (as the waterbuses in other countries). Significantly, BIWTC, which introduced the waterbus service, is yet to recruit necessary hands. The water bus services with a capacity of 35 passengers every trip from Gabtoli to Sadarghat after a pause of one and half hours. The fare for 16 km journey from Sadarghat to Gabtoli was fixed at Tk 30. In reality however, the trips take 1hr 15 mins. Moreover, the landing station of Sarina, a luxurious cruise ship,

was launched to entertain local and foreign tourists at Ashulia BIWTA landing station. The ship is fully air-conditioned and equipped with modern facilities.

2.6.2 Recently Undertaken Waterway Recreation Projects

According to the DAP report (2015) the following Waterway Recreation Projects have been taken for Dhaka city

2.6.2.a “River Bank development cum park scheme”: Old Dhaka: East and West

Project Objectives:

- ❖ To remove intensely commercial, blighted and congested land use along the river Buriganga bank (riverfront) on the south
- ❖ To develop parks and open spaces for recreational purpose in the riverfront up to Badamtoli
- ❖ To provide much needed open space along the river side
- ❖ To render planned revitalization of old Dhaka
- ❖ To protect river bank from unauthorized encroachment

Expected Benefits:

- ❖ Create a planned, scenic river front for the old Dhaka
- ❖ To give recreational facilities to the old Dhaka inhabitants
- ❖ To beautify Old Dhaka East & West for regeneration

2.6.2.b “River Bank development (Pedestrian Promenade) scheme”: Old Dhaka

Project Objectives:

- ❖ To develop river front, keeping aesthetics and cultural values of the old Dhaka
- ❖ To provide parks, walking routes, gardens etc along the river front
- ❖ To create beautifully land out promenade, suitable for recreation

Expected Benefits:

- ❖ River front development into planned prime recreation zone
- ❖ Better opportunity for people to relax and have recreation
- ❖ Planned Land use development

2.6.2.c “Continuation of Green Belt cum Water body (wetlands/lowlands)

Project Objectives:

- ❖ To create a ring of land in which development will be restricted
- ❖ To protect the wetland and develop recreation and plantations, social foresting, horticulture, nursery
- ❖ To create an encircled green buffer incorporating both west and east fringes
- ❖ To provide much needed open space, park and recreation facilities

Expected Benefits:

- ❖ A continuous greenbelt encircling the city
- ❖ Better Wetland preservation cum flood water water bodies (wetlands/ lowlands) preservation
- ❖ Enormous recreation opportunity

2.6.2.d “Recreational Park around water bodies (wetlands/ lowlands) in west Embankment”:**Project Objectives:**

- ❖ Continuation of “Green Belt scheme”
- ❖ Preservation of water bodies (wetlands/ lowlands) in the Dhaka City
- ❖ Creation of recreation and park

Expected Benefits:

- ❖ Recreation, open space, parks etc provision for people from Zigatola, Rayerbazar, Hazaribagh, Zafrabad etc.
- ❖ Continued “Greenbelt” development

2.6.2.e “Continuation of Green Belt cum Water body (wetlands/lowlands) scheme in Mirpur West” Mirpur West**Project Objectives:**

- ❖ To assist in the development of a green buffer around the Dhaka City
- ❖ To assist in the safekeeping of drainage functions of water bodies
- ❖ To contain the growth of the city

Expected Benefits:

- ❖ Development of Greenbelt, Peripheral atmosphere and checking of urban growth beyond Embankment
- ❖ Storm water, flood water discharge; wetland preservation through green buffer zone creation to the east, south and west of the city

2.7 Water body Conservation Acts, Rules and Regulations

For the proper development of Dhaka Metropolitan area regarding land development and environmental consequences, several regulations and laws are being exercised. Few examples are as follows:

- ❖ The Private Land Development Projects Rules, 2004
- ❖ Wet Land Conservation Act, 2000
- ❖ Environment Conservation Act and Policy, 1995
- ❖ The Bengal Canal Act, 1864
- ❖ Open Space and Water Body Conservation Act, 2000
- ❖ the Bengal Irrigation Act, 1876
- ❖ The Bengal Port Act, 1908
- ❖ East Bengal Embankment and Drainage Act, 1952

- ❖ Inland Water Transport Authorities Ordinance, 1958
- ❖ East Pakistan Irrigation (Imposition of Water Rate) Ordinance,1963
- ❖ Bangladesh Water and Power Development Boards Order, 1972 (President order No 59 of 1972)
- ❖ Bangladesh Water Rate Ordinance ,1983
- ❖ Land Reforms Ordinance, 1984
- ❖ Ground Water Management Ordinance, 1985
- ❖ Water Resources Planning Act, 1992
- ❖ Water Supply and Sewerage Authority Act, 1996
- ❖ National Water policy,1999, and the Act No 27 of 2000

The Bengal Canal Act 1864: As per the Bengal canal act, " It shall be lawful for the government from time to time to authorize any person to make and open any navigable channel, or to clear and deepen any navigable channel, and to stop any watercourse, make any tracking path, or do any other act necessary for the making or improvement of any such channel." Under that law the government is authorized to 'take possession for a public purpose of any land that may be necessary for the execution of any of the above mentioned works, under the provisions of the act'. It goes on, "Any person who shall willfully cause any obstruction to any line of navigation or any damage to the banks or works of such line of navigation, or who shall willfully omit to remove such obstruction after being lawfully required to do so, shall be punished on conviction before a magistrate with simple imprisonment which may be extended to one month or with fine which may extend to Tk 50, or with both."

The Bengal Port Act 1908: Generally Bangladesh Inland Water Transport Authority (BIWTA) is in charge of the rivers and riverbanks where there are river routes, under the Bengal Port Act 1908. Under this Act, BIWTA was made the regulatory body of the rivers (110 km) flowing around the capital in a gazette notification in 1960 and is responsible for protection and use of river banks. But the authorities were not given magistracy power to stop encroachment and river filling activities. The definition of a river is also sketchy in the laws

Open Space and Water Body Conservation Act 2000: The most important legislation for conservation of wetland is "Water body Conservation Act, 2000. This Act states that natural water bodies mean the places which are demarcated in the Master Plan as river, canal (khal), depression areas (beel), lake, stream or wetland or places which are declared as 'flood flow zones' by the local government notification and such places should also include the land which retains storm water. This law prohibits any kind of development on these areas. It is a legal instrument that will enable RAJUK as well as the concerned organizations to protect the water bodies which includes Flood Flow Zones. According to this law, no water body (Declared in Master Plan) can be transformed or converted to other use except permission of the concerned authority. For conservation of all playgrounds, open spaces, parks and natural reservoir, change of the nature of any land is prohibited in all the municipalities including the municipalities in the capital, divisional towns and district town. These areas must be published by gazette notification This land mark legal tool can protect environmentally sensitive areas of Dhaka but its implication become difficult because the water bodies, the low-lying and retention area, khals within the DMDP area are not demarked on the mouza map. 'Wetland and Open Space Conservation Act, 2000',

which extended the fine up to Tk 50,000 and the imprisonment up to five years, or both. But successive governments have not been very sincere to implement the law. On the other hand, the laws specify what punishments the judiciary may mete out to the violators, but it does not direct the government to recover the original characteristics of water bodies if someone fills them up. So, once someone changes the characteristics of a river, canal, or any other water body -- it does not get back its old shape. Real Estate Developers, DOHS, etc. have encroached many open spaces and wetlands, but no actions were taken to stop them. Some even apply force to appropriate them.

The Private Land Development Projects Rules, 2004: To guide the land development activities in Dhaka Private Residential Land Development Rules (PRLDR), 2004 is framed with guidelines and instructions of private housing project. The implementing agency of this rule is RAJUK. This rule clearly states that how the projects will prepare, will get approval and how the projects will be monitored. In this rule it is strictly prohibited to convert the natural water bodies, flood flow zone and sub flood flow zones for housing projects. The Government will identify such area and notify those in the Government Gazette. There are many housing projects located in the flood flow zones.

The Bangladesh Environment Conservation Act 1995 The Bangladesh Environment Conservation Act, 1995 state that the Government may, by notification in the official Gazette, declare any area as an ecologically critical area if the Government is satisfied that an area is in an environmentally critical situation or is threatened to be in such situation. The Government shall specify the activities or processes that cannot be initiated or continued in an ecologically critical area. This act was revised in 2010 and known as “The Bangladesh Environment Conservation (revised) Act, 2010.

2.7.1 Associated Policies and legal instruments There are many associated Policies and legal instruments through which concerned Authorities will be able to accomplish environmental conservation and wetland protection. National Environment Policy (1992) .The Environmental Policy, 1992 gave a lot of importance to protect water bodies and environment. It states in the part of Policies for Housing and Urbanization that - In every planning, Environmental Consideration will be given due priority, - Controlling such kind of Housing and Urbanization that has negative impact over environment - Water body will be given priority in enhancing the beautification of cities. National Environmental Policy, 1992 states in the part of Policies for Water Development, Flood Control and Irrigation are given below:

- ❖ Ensure environmentally sound utilization of all water resources
- ❖ Ensure that all steps taken for flood control, including construction of embankments, dredging of rivers, digging of canals etc. be environmentally sound at the local, zonal and national levels
- ❖ Keep the rivers, canals, ponds, lakes, haors, baors and all other water bodies and water resources free from pollution

National Environmental Policy 1992 recommended some action plans under this sector:

- ❖ Treatment of domestic and industrial waste before discharging in rivers wetlands or other water bodies will be strictly enforced

- ❖ Rivers, canals and other water bodies will be dredged to increase their water holding capacity and navigability
- ❖ Regular surveys, research and monitoring will be conducted on changing courses and conditions of rivers, wetlands and other water bodies

Tourism policy 1992 Encouraging river tourism and to expand this sector initiatives will be taken to plan for joint venture package tour with neighbor countries to attract foreign visitors.

National Water Policy 1999 National Water policy, 1999 in its every part emphasized usage of water and the water basin management very seriously as most of the part of our country is situated in the area.

Water for Recreation: Use of water for recreational purposes is useful for developing tourism facilities. Introducing these facilities at the sites of reservoirs, lakes, dighis (big ponds), sea resorts, etc. would help the tourism industry of the country. The policy of the Government is therefore that: Recreational activities around water bodies will be allowed provided if it is not damaging to the environment. Policy regarding Water for Preservation of Haors, Baors, and Beels are:

- a. Natural water bodies such as beels, haors, and baors will be preserved for maintaining the aquatic environment and facilitating drainage
- b. Only those water related projects will be taken up for execution that will not interfere with the aquatic characteristics of those water bodies
- c. Haors that naturally dry up during the winter will be developed for dry season agriculture
- d. Take up integrated projects in those water bodies for increasing fish production
- e. Natural water bodies will be developed, where possible, for recreational use in support of tourism

2.8 Development Plans and proposals

2.8.1 Master Plan, 1959: In the Master Plan of 1959 the river bank was reserved as a recreational zone. It emphatically pointed out that Buriganga river front's natural beauty should be safe-guarded. Following this, it can be proposed to create recreational areas like, parks, walkways, trail system, mariners, and neighborhood play areas, open theatre stage, fare ground, Hawkers Mall, Boat club, Parking Zone etc. In addition to this, a continuing walks way and plantation development up to Ashulia can take place.

2.8.2 Dhaka Metropolitan Development Plan (1995-2015)

Dhaka Metropolitan Development Plan (DMDP) has demarcated main and sub flood flow zones of Dhaka City and prohibited any kind of land filling activity on those areas. DMDP has also identified possible location for retention pond areas. Policies on flood flow zone and retention pond are given below.

Policy Regarding Flood Flow Zones in DMDP

There are a variety of rules and regulations in DMDP regarding the flood flow zones. Structure Plan, Urban Area Plan and Detailed Area Plan separately gave policies and regulations regarding the flood flow zones. Structure Plan came up with the following policies:

Policy RS/3- Flood Flow Zones: Land development, within the designated flood plain areas of the DMDP Structure Plan, will be controlled in order to avoid obstructions to flood flow, which might otherwise result in adverse hydraulic effects, such as, for example, the rise of flood water levels and changes in flow direction. The DMDP Structure Plan adopts the same division, whereby development restrictions are more severe in the main flood flow zone. Proposed controls are as follows:

- ❖ Main Flood Flow Zone Land development for residential
- ❖ Commercial and industrial development, including raising the level of land, via land filling, will be strictly prohibited

Permitted uses, provided that they cause no adverse hydraulic effect will be:

- ❖ Agriculture
- ❖ Dry season recreation facilities
- ❖ Ferry terminals
- ❖ Excavation of mineral deposits, including dry season brick works

Causeways for roads or railways will be permitted, subject to detailed geological surveys being undertaken and on condition that they are built with culverts sufficient to allow for unimpeded flood flow.

Sub Flood Flow Zone

Development compatible with the rural nature of these mainly rice growing areas, will be permitted on condition that the:

- ❖ Structures are built on stilts, or on land raised above design flood water level
- ❖ Alignment of structures and raised land to be designed so as not to disturb flood flow

Urban Area Plan came up with the following policies and regulations regarding the Flood Flow Zones:

SPZ: 173 Flood Zone West (Development Management Report: Part I)

Actions Committed/Required

- ❖ The area should enable to function properly as a flood plain and a basic rural/pisciculture zone
- ❖ All the development permits issued for the development of housing should be withdrawn and no new one is needed to maintain the nature of the zone
- ❖ Conversion of land from rural to urban should be regulated strictly in this zone

Development Management Report (Part II)

The Lands Study recommended that development in low-lying flood plain areas be restricted, since it could obstruct natural flood flow. Such restriction would cause a rise in water level and changes in flood direction; affecting the entire metropolitan area. In the Main Flood Flow Zone, now mostly agricultural land, urban development should be prohibited. Only development having no adverse hydraulic effects should be permitted. Such development includes:

- ❖ Agriculture
- ❖ Open space for recreation
- ❖ Ferry terminals
- ❖ Brickyards

The Sub-Flood Flow Zone is less affected by flood flow. It includes village and homestead areas. Development in this zone should only be allowed provided that:

- ❖ The developed land is raised more than the design flood water level
- ❖ The slope of such land is sufficiently gentle to prevent slope failure and is protected from erosion
- ❖ Structure orientation is designed to minimize flood flow obstruction
- ❖ Floor elevation of structure themselves are sufficiently strong to withstand flood damage

For both types of flood zone, it is important that laws preventing land fill soon come into force, otherwise controlling development in these zones will be very difficult, and the effectiveness of flood protection measures will be seriously compromised.

Purpose and intent:

The purpose of the Sub Flood Flow zone is to generally define areas either temporarily or seasonally flooded. The intent is to protect the health, safety and welfare of the general public, to reduce negative environmental impacts within natural waterways, and to protect and preserve natural drainage systems to ensure their proper and continued functioning. Areas designated on the urban area plan map as sub flood flow zone are also designated.

Table 4: Using criteria of Sub Flood Zone

Permitted uses	Conditional Uses
•Agriculture forestry & grazing • Aquaculture & fisheries • Brick fields • Roads\Railways\ Utility ROW • Farm dwellings • Ferry Ghats and jetties • Flood management structures • Institutions • Public uses and structures • Recreation facilities, outdoor • Religious uses & structures • Repair shops, minor • Ship & boat servicing • Utility installations Type A	• Dwellings, farm • Dwellings, minimal housing • Dwellings, single\multi family • Explosives manufacture & storage • Industrial class 2 • Patrol/service stations • Office/services Plan Review Required • Golf courses • Prisons • Terminals-trains, bus, freight • Utility installation type B

The Detailed Area Plan came up with more specific regulations and delineation of the Flood Flow Zones and specified the categories for use permits. The area over which the flow of flood water during monsoon passes through is termed there as flood flow zone.

Purpose: The intent of the Flood Flow Zone is to protect adverse hydrological impact, human life and health, minimize property damage, encourage appropriate construction practices, and minimize public and private losses due to overflow of water. Additionally, this zone is intended to maintain the sound use and development of floodprone areas and to restrict potential home buyers by notifying that property is in a flood area. The provisions of this zone is intended to minimize damage to public facilities and utilities such as water and gas mains, electric, telephone, and sewer lines, street and bridges located in the floodplain, and prolonged business interruptions; and to minimize expenditures of public money for costly flood control projects and rescue and relief efforts associated with flooding.

Land use Permitted for Flood Flow Zone

In the zone, uses permitted by the Authority are:

- ❖ Aquatic Recreation Facility (Without Structure)
- ❖ Dry Season Play Field
- ❖ Marina / Boating Facility
- ❖ Plantation (Except Narcotic Plant)
- ❖ Static Transformer Stations
- ❖ Transmission Lines / Utility Lines

Land use conditionally permitted for Flood Flow Zone

The following uses may be permitted or disallowed in this zone after review and approval by the authority / committee.

- ❖ Communication Tower within Permitted Height
- ❖ Poultry

Restricted Uses

- ❖ All kinds of uses except permitted and conditionally permitted are restricted

2.9 Water Resource Management Scenario in Bangladesh

Regulatory Agencies working in Water resource sector and their responsibilities:

BIWTA: BIWTA is the proprietor of the 110km Circular waterways around Dhaka. BIWTA is responsible for the custody, maintenance of river channels for navigation and management of the government announced waterways.

National Water Council: was established to take possessing decision about the river related issues with the guidance of the Government chief. Water resource planning organization

WARPO: The government has created the WARPO to coordinate the rivers and canals even thus the water related issues. Before starting any development project in these

sectors, the opinion of this organization should be counted but both the Government and private organizations are related in this sector do not follow this matter.

LGED: LGED and R&H are engaged in the building and construction of bridges and culverts over the waterways.

WASA: WASA is engaged for the supervision of canals and solid waste and storm water drainage and Supply of drinking water to cities.

BAWDB's responsibility: Flood control, drainage and irrigation

Dhaka District Administration: Dhaka District Administration is engaged for the responsibility of land management of the canals on behalf of the Land Ministry.

Government has leased 2 hundred acres of lands of the both banks of the rivers for different governmental organizations like hospitals, electrical substations, etc. But there is a severe lack of coordination among these agencies.

Zila Parisad: Optional function of construction and repair of embankments, supply, storage and control of water for agricultural purposes.

Municipalities: Supply of drinking water to small towns

2.10 Reasons behind the adversity or overall situation of the waterways and waterway Projects in and around Dhaka city

- ❖ Avoidance of taskforce rules and regulations
- ❖ Encroachment by the land grabber developers
- ❖ Absence of distinct physical demarcation and physically limited (width do not permit)
- ❖ Filling up the rivers with soil and wastage dumping
- ❖ Concerned authorities and organizations negligence
- ❖ Donner agencies' and related regulating organization's negligence and having no interest attitude about the environmental concern issues like building narrow box culverts, roads and establishments on the canals and rivers
- ❖ Influential political leaders and developer's possession and control over the development.
- ❖ Government agencies aggression
- ❖ Absence of connecting roads to the waterways
- ❖ Physical obstacles' like low height bridges
- ❖ Lack of co-ordination between the agencies
- ❖ The game of change in government
- ❖ Absence of proper information about the vehicles
- ❖ Absence of public participation and awareness in this matter

Funding problem

- ❖ Mismanagement and labor oppression
- ❖ Absence of facilities like waiting space, protection from hostile and adversary climate, toilet facilities, inquiry and complaint centre's mismanagement.
- ❖ Addicted and floating peoples presence in the terminal area at night.

- ❖ Mismanagement of the landing stations, navigability problem, launch proprietor's obstinacy
- ❖ Presence of illegal establishment
- ❖ Insufficiency of government's regulating agencies' manpower in this sector and equipments like insufficient dredgers, modern vehicles.
- ❖ Absence of preparedness of accidents
- ❖ Presence of terrorist groups
- ❖ Gaps in the law's and act's

2.11 Government's Recent Initiatives taken for the development of the waterways Environment

- ❖ Task Force formed by the Government
- ❖ Rivers declared as 'Ecologically Critical Areas'
- ❖ Decision on shifting tannery industry outside the capital
- ❖ Cleaning of Buriganga and Turag has already started and helped launching water bus services
- ❖ Court has directed deployment of law enforcing agencies to prevent dumping of wastes into the rivers and Shut down of some business on the rivers
- ❖ Ministry of Environment has directed all the polluters to in stall Effluent Treatment Plants (ETP)
- ❖ The district river demarcation as per Cadastral survey (CS 1910- 1913)
- ❖ Evict illegal structures from the rivers
- ❖ Construct walkways and plant trees along the river banks

2.12 River Water Quality around Dhaka city

Rivers around Dhaka city are affected by industrial activities, municipal sewage disposal, fecal contamination, agro-chemicals and sediment loading and population pressure. Maintaining a sufficient supply of clean water for the growing population is one of the major challenges, especially in the densely populated Dhaka city. Based on species abundance and richness numerical scores were assigned to potential water quality classes, viz.

- ❖ Class I (none to very slight organic pollution),
- ❖ Class II (moderate pollution),
- ❖ Class III (critical pollution),
- ❖ Class IV (heavy pollution), and
- ❖ Class V (very heavy to extreme pollution)

Table 5: Water Quality of River Turag

River	Site	Water Quality Classes
Turag	Aminbazar Bridge	III
Turag	Nabil parking	III
Turag	Tamanna Park South	III
Turag	Tamanna Park North	III
Turag	Birulia Landing Station	IV
Turag	Birulia Bhanga Bridge	IV
Turag	Uttara 3 rd Phase	III
Turag	Rustumpur Bus Stand Ghat	III
Turag	Ashulia Landing Station	IV
Tongi Khal	Kamar Para	IV

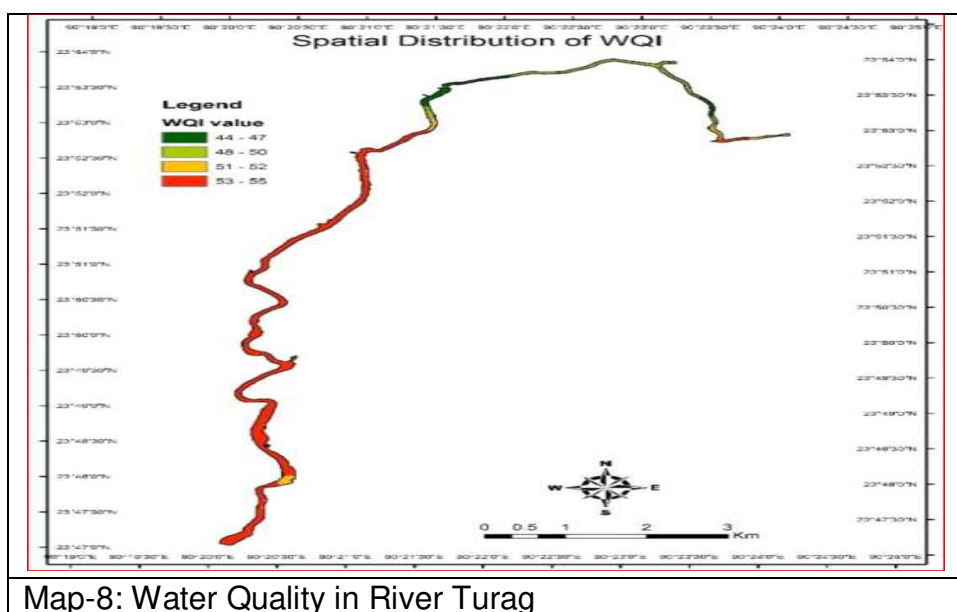


Table 6: Water Analysis Report

Sample name	Location	pH	EC (μs/cm)	Eh (mV)	TDS (ppm)	Temp (°C)
TR-1	Aminbazar Bridge	6.87	1192	-93	597	29.6
TR-2	Nabil parking	7.29	1154	-124	576	30.6
TR-3	Tamanna Park South	7.52	1123	-104	562	29.5
TR-4	Tamanna Park North	7.40	1130	-124	563	30.3
TR-5	Birulia Landing Station	7.54	1147	-117	573	30.5
TR-6	Birulia Bhanga Bridge	7.46	595	-122	1192	30.7
TR-7	Uttara 3 rd Phase	8.44	808	-28	406	32.8
TR-8	Rustumpur Bus Stand Ghat	7.69	787	-112	392	29.4
TR-9	Ashulia Landing Station	7.55	1146	-119	567	29.6
TR-10	Kamar Para	7.93	1034	-31	513	30.9

Pollution source

- Point sources; e.g. industrial effluent (textile, tannery, dyeing etc), municipal waste etc.
- Non-point sources; e.g. agricultural runoff

Chapter – 3 Circular Water Transport System of Dhaka City

3.1 Introduction

Dhaka, the administrative, commercial and cultural capital of Bangladesh, is the largest and most industrialized city in the country. Its success as the primary city of Bangladesh, however, depends very much on the efficient delivery of a range of urban services, of which transport is a key element. The transport sector of Dhaka city is characterized by unbearable congestion and delays, inadequate traffic management, poor coordination among agencies, and also lack of integration between different transpiration modes. Dhaka is perhaps the only city of the world of this size without having a well-organized and scheduled mass transit system. The traffic condition of the city has presently reached a crisis situation. The everincreasing chaos and congestions, high rate of accidents and rapidly deteriorating environmental conditions calls for immediate considerations of an alternative transport option that could efficiently reduce the loads on road transport. Dhaka city is surrounded almost in all sides by five rivers Burignaga, Balu, Tongi, Turag and Lakhya. The total length of the waterways is 110km. The western periphery of Dhaka is skirted by Buriganga and Turag rivers for about 26 miles following a zigzag course (BIWTA, 2001).The river acts as a major linkage between a portion of Keraniganj Upazila and the old city of Dhaka. Under the circumstances, the river Buriganga may be a potential transport option for the city. On the otherhand the western part of the waterways dominated by river Turag which also has enourmus potentiality with respect to tourism and inland river transportation as well.However, there has been an organized and efficient water transport network along the waterways.There are several on-going projects to improve the river transport system in Dhaka city. In this chapter, the major transportation related plans and their prospects regarding water transport and also some on-going projects which have the connection with the study are discussed.

3.2 Actions taken for Dhaka Cityto ImproveWater Transport System There are several projects were taken to improve the river transport system in Dhaka city.Few is described below:

3.2.1 Greater Dhaka Metropolitan Integrated Transport Study (DITS): The DITS has made a number of both short term and a long term recommendations including institutional and policy reforms and physical investment to improve urban transport environment of Dhaka. The DITS final report (volume-1) recommended the strategic direction for the Transport Development Strategy (DTS) to develop waterways for water based transport of inter urban personal travel in Dhaka. Besides a ring road, generally following the alignment of the 2flood protection embankment is also recommended in DITS to ensure an integrated transport network among different modes. Few salient points of these projects are as follows:

- ❖ The waterway ring encircling Greater Dhaka (including Narayanganj in the south and Tongi in the north) does not have its potential for carrying waterborne traffic fully bulky exploited. This is particularly so in the case of fully low value materials. The best example is that more use should be made of the river North of Dhaka as far as Mirpur where cargo handling facilities could usefully be developed.

- ❖ Within the ring, greater Dhaka remains interfaced with waterways, but these are now very largely discontinuous bodies of water of little present or even future value for transport purposes.
- ❖ Those that are continuous are frequently interrupted by physical friction (over-bridges) or physical obstacles (shallow depth narrowness). As such they are largely non-navigable.
- ❖ Construction of the flood protection embankments has already isolated the khals to the West of Dhaka from the ring.
- ❖ The two planned flood protection embankments to the east of Dhaka will isolate all other of Dhaka's khals from the ring unless navigable locks are to be incorporated. Construction of locks is not the present intention.

The DITS final report (Volume 2) identified some potential projects for the integration of waterways with land transport and also to use the existing waterways along greater Dhaka in an optimal fashion. Some of these projects which have their acquaintances with the concerned areas are as follows:

3.2.1.a Outer Dhaka Ring Road following Alignment of Flood Protection Embankment: Under the project, the embankment road provide access to most of the landing stations along Buriganga and acts as the major linkage of waterway transport with the road transportation system of the city. The DITS also recommended public transport routes along the embankment road. When implemented this would encourage the use of waterway and would have a positive effect on improving the traffic situation of the old Dhaka as well.

3.2.1.b Upgrade Waterways Ring and Selected Khals: This project was supposed to continue with an initiative by BIWTA to upgrade the rivers and canals which form a ring route around the Dhaka urban area. The first phase of the project was initiated by BIWTA in 2000 and it was planned to be finished by 2005. The project includes the dredging of river ways to improve navigability and also the development of 12 landing station on both sides of the Buriganga and Turag rivers.

3.2.1.c Waterbus and Water Taxi services: Although the opportunity to introduce waterborne transport services is being eroded by the drainage management and flood control works, the project for water taxi services was supposed to be an attempt to realize the objective of some policy makers to bring back waterborne services particularly for passenger travel. No projects, however, has been initiated in this regard, and no feasibility studies have been made as yet.

3.2.1.d Dhaka Metropolitan Development Plan (DMDP): The DMDP is composed of three components. These are Structure Plan, Urban Area Plan and Detailed Area Plan. The main objective of DMDP is to provide the long term strategies for the guided development of all parts of Dhaka. Both structure plan and urban area plan provide some policies and strategies for the areas adjacent to Buriganga River and also for Keraniganj Upazila which are of immense importance for the future expansion and development of the

study area. These policies and strategies have been discussed in the following section.

Volume 1- Structure Plan: Transportation would play a major role for Dhaka's growth both for the structural plan strategy and also for the alternate options. Water transport component has been prepared in Dhaka Metropolitan Development Plan (1995-2015) to efficiently utilize the natural opportunities with a view to:

- ❖ Develop navigability of the encircling water way.
- ❖ Install new berthing points.
- ❖ Disperse traffic loads of water transport.
- ❖ Reduce congestion in Dhaka metropolitan area.
- ❖ Develop inter-city water transport system.

The whole component includes dredging of channels and canals and installation of berthing points. Navigability of the encircling waterways will enliven the old heritage of Dhaka and enhance the riverine recreational facilities in a great way. Besides these, bulk goods can be transported at a lower cost of different consuming goods will thus be reduced and people will get the benefit.

Volume 2 - Urban Area Plan: In this volume, two projects have been mentioned that have the direct impact upon the waterways. These are:

1. Western link road connecting Amin Bazar with Kamrangir Char.
2. Keraniganj Port and access road.

The implementing agencies are RHD and BIWTA respectively.

3.2.2 Introduction of Waterway around Dhaka City: The objectives of the project are:

- ❖ To develop navigability of the Buriganga and Turag river from Sadarghat to Ashulia Bridge by dredging.
- ❖ To provide modern cargo and passenger facilities at four major landing stations and only modern passenger facilities at four landing stations along the water way. The project involves the following major components:
- ❖ Land acquisition.
- ❖ Dredging.
- ❖ Construction of dyke, approach road, bank protection etc
- ❖ Construction of landing facilities.

3.3 Overview of the Existing Condition of Water Transportation The Rivers of Buriganga and Turag within the study area have a considerable number of landing stations on both banks. Some of them generate huge volume of passenger and freight transport everyday, while some others have no significance.

Table 7: Location and name of landing stations in the study area

Serial No.	Name of the Landing Stations	Location
1	Amin Bazar	West Bank
2	Gabtolli	West Bank
3	Rayer Bazar	East Bank
4	Katasur	East Bank
5	Waspur	West Bank
6	Basila	East Bank
7	Nawabganj	East Bank
8	Ati Bazar	West Bank
9	Kholamura	West Bank
10	Patkajor	West Bank
11	Barisur	West Bank
12	Kusharbagh	West Bank
13	Matabbar Bazar	East Bank
14	Mandail	West Bank
15	Zinjira (Godarghat)	West Bank
16	Bot-toli	East Bank
17	Swarighat	East Bank
18	Balughat	East Bank
19	Waisghat	East Bank
20	Sadarghat	East Bank

Source: BIWTA

3.4 Project on Circular Water Transportation System in Dhaka City The project work on circular water transport system of Dhaka city was completed in two phases by the Government of Bangladesh. First phase was completed in 2005 and the work of the second phase in 2010.

Development in the Phase-I The first phase development of circular water transport system in Dhaka city was launched between July 2000 and December 2004 (completed in 2005). An amount of Tk. 36 crore was spent to develop 29.5 km of waterways. Ten landing stations were built in this phase. These are Swarighat, Kholamora, Basila, Rayerbazar, Nawabbagh, Shinnirtek, Birulia, Aminbazar, Mirpur and Asulia.

The objectives of the project were as follows:

- ❖ To provide circular water ways around Dhaka city.
- ❖ To develop the transportation system of Dhaka city and reduce traffic jam.
- ❖ To develop irrigation system and fisheries cultivation.
- ❖ To develop tourism industry.
- ❖ To develop environmental condition of Dhaka city.

Four two-storied terminal buildings, 3 one-storied terminal buildings, 2 stairways, 2 passenger sitting places, 12 pontoons, 12 steel gangways and 24 steel spades were built in this phase. About 80% works of the project is the dredging of waterways. The project work included dredging of 17.50 lacs of cubic meters.

Development in the Phase-II In the second phase of the circular water transport system, 40 km of waterways was included for development. The project period was July 2007 to June 2010 and an allocation of Tk. 47.50 crore was made to complete the project. The objectives of the project were as follows:

- ❖ To develop the transport system of Dhaka city.
- ❖ To reduce the traffic jam.

Three landing stations are built in this phase. These are Katchpur, Isapura and Kayetpara. This phase also included Dredging of the waterways.

3.5 Problems Associated with the Circular Waterway System

The following sections point out some of the major prospects and problems that might affect the quality and reliability of the existing water transportation system. Some problems were identified by direct field survey and some were identified by the previous reports, magazines etc. recently undertaken. Few problems are mentioned below:

- a. Distribution of Passenger's Trips
- b. Physical Condition of the Landing Stations
- c. Poor Access to the Landing Stations
- d. Lack of Organized Routes
- e. Type and Quality of Vessels
- f. Toll Collection System and Maintenance of Landing Stations
- g. Unauthorized and Illegal Installations Surrounding the Landing Stations.
- h. Close Proximity of Too Many Ghats
- i. No Provision of Fixed Facilities for Cargo Traffic
- j. Problem of Aesthetic and Surrounding Environment
- k. Inadequate Water Transport
- l. Incompleteness of the System

3.6 Prospects of the Circular Water Transport System

Decreasing Pressure on Roads: The large volume of freights that are carried through different points by roads could be diverted to waterways. The cargo could be ferried to the landing stations nearest to the destinations. This would have two possible benefits:

- ❖ The transportation cost would come down
- ❖ The pressure on the city streets would decrease to some extent

Saving Cost: Communication by waterway usually costs half or even one third in comparison to road or railway transport costs. The water way has not only tremendous effect on the existing transportation system, but also helps to increase the scenic beauty of the area.

Navigation Condition: All the landing station has the potentiality in respect of Navigability. However, Study reveals that from Aminbazar to Ashulia water depth is not suitable for inland transportation during dry season as general depth reduced upto 2-5

meters. By dredging this segment upto 5 meter average depth, Goods transportation can easily be handled round the year upto 4 meter draft vessel.

Wage and Employment: Project would be labor intensive. Project would help to create huge amount of employment opportunity at the farm level and also in the service sector. A large number of people get an opportunity to involve in fishing, boating, farming etc.

Agricultural Output: This intervention will increase the agricultural output. Benefit will come from reduction in water logging damage and also changes in cropping pattern by land by land type. Irrigation project will be expanded in the area.

Culture of Fisheries: The present level of culture and capture of fisheries is significantly below in this area. Proposed intervention will helps to increase both type of fisheries.

Economic Livelihood: The proposed intervention is likely to have indirect and direct income effects at household's level. The household will earn income from water born navigation including boat owner, operator and user. The farmers will be benefited from reduction of early flooding and will able to produce and sell agriculture product. Due to the river dredging and water retention, the household who are engaged in fishing will be benefited.

Drainage: The proposed work will improve the drainage condition especially during premonsoon season. The dredging will accelerate the drainage flow resulting in elimination of crop damage caused by drainage congestion. The impact of drainage will facilitate early plantation in past monsoon. It will help to accumulate rain fall inundation.

Tourism and Recreation: Recreational uses may be encouraged in the Buriganga river. If favorable surrounding land use can be ensured, along with the reduction of traffic congestions in the access roads and improvement of the aesthetic and environmental aspects of the river 16 ways, these will surely act as added attractiveness toward recreation trips through the river Buriganga. There are a series of places of historical importance along the Buriganga river within the study area, or very close to the riverside, of which the Intellectuals Martyr Monument, the Lalbag Fort, the Ahsan Manjil are some of the mentionable. These may be utilized to increase tourism attraction of the river ways. Moreover, there is enough vacant land at the northern section of the study area which can be developed as recreational spots.



Photo 10 :Martyred Intellectuals Memorial



Photo 11 :Ahsan Monjil

Chapter 4: History of water recreation in Dhaka and some case studies on the waterbased recreation in Dhaka and around the globe.

Dhaka was known for its greeneries and serenity but over the time period these precious green and tranquil characteristics has been destroyed. Dhaka still can set the example of being a green and fluid landscape paradise. There is an immense scope for planning as well as urban design. If the city is developed with the assets it still contains, trees and water is used as the elements of urban design, and many scenic places can be produced. With the help of water ways around Dhaka scope for water based recreation for the city dwellers can be explored. To find out the potential scopes of water based recreation to make the city again a paradise for the city dwellers it is utmost important to find out what was the role of waterways in recreation in the golden days of Dhaka city. For this reason this chapter has tried to discover the history and the present condition of water recreation in Dhaka. Also some case studies on the water recreation around the world have been discussed and their implications in the context of the study area have been identified

4.1 Introduction

Dhaka city had developed on the bank of River Buriganga. Since historical period, the river had played an important role as main life blood of the urbanization of Dhaka. The city had been a trading town and the River Buriganga used to serve the city for all sorts of transportation needs. From Mughal period the main commercial center had developed near the river and important buildings and residences were built on the river bank. With the growth of the city towards north the river remained neglected as back of city. In spite of tremendous development in inter city transportation by road, the river remained unparalleled as prime water way.

4.2 Water Recreation History of Dhaka

The popularity of water based recreation is very clear and significant in our history. Charles Thomas Buckland was appointed as the commissioner of Dhaka in 1864 , He noticed Buriganga river was causing devastating damage to the magnificent houses that were built by the influential people , when a traveller would come on a boat near the Buriganga shore they would notice the high rise minarets and amazing mansions. Dhaka city looked an amazing sight. So to protect the shore from flooding and erosion and to prevent the formation of great mudflats at low tide, also to facilitate the movement of passenger and cargo at the river ghats Buckland launched a scheme to construct an embankment along the southern front of the city. He also planned a promenade behind the bund to beautify the waterfront and provide a pleasure walk. He asked the rich and elite people of Dhaka to fund it, which they did . Even though there was already a bund by the Buriganga river bank from the Mughal period, it was Buckland who took the initiative to build a metalled road over it. And so that is how the road by the riverbank came to be known as the Buckland Bund which is almost one mile long, from Farashganj to Babu bazar.

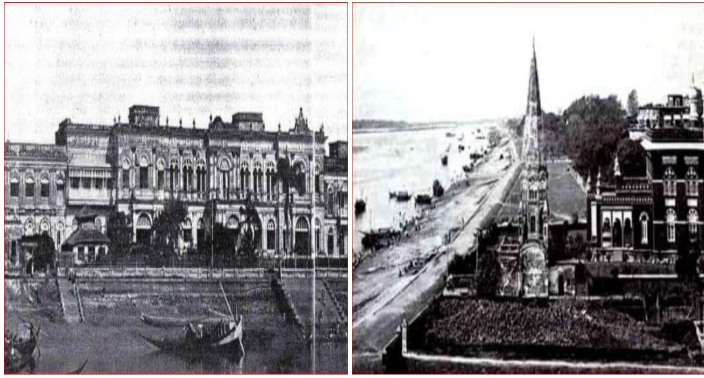


Photo 12: Buckland Bund- 1864(Banglapedia)



Photo 13: Present Condition of Buckland Bund

During 1860s and until 1940s the “Buckland Bundh” was the famous walkway place for the city dwellers and also acted as leisure center. Travel loving people came to the “Bundh” area after work to get fresh and relieved from the monotony. The aristocratic people lived adjacent to the Bundh area and they were fascinated about the morning and evening promenade on the Bundh. On Saturdays and Thursdays the English soldiers’ band troop played their instruments in front of the city dwellers on the Bundh and entertained them. All civic came from outside the city area got a hearty reception from the dwellers on the Bundh and then entered into the city. Wrought iron benches were placed at intervals on the Bundh, parks and gardens were created to enhance its beauty. River ghat points ‘ Shiber Ghat’, ‘Shyam Bazar Ghat’, ‘Lal Kuthir Ghat’, ‘Nawab Barir Ghat’ and ‘Gohona Ghat’ were different in their characteristics like their names . Rabindranath Tagore spent his time adjacent to the Bundh area in barge (bazra) to relish the beauty of the River Buriganga. Municipality took care of the Bundh. Bazaars sit on the Bundh early in the morning and ends before 8 am. After that Municipality cleaned the Bundh area and they did the job twice a day. In the evening aristocratic people visited this place. Clean roads, Wrought iron benches, parks and gardens and the opportunity created to relish gently blowing pleasant breeze faced a tragic death with the help of government initiatives. In 1963 the Government claimed the possession of the Bundh and gave the ownership to the Inland Water Transport Authority (IWTA) who now has possession of the whole strip. The IWTA got involved in commercial trade trap and had destroyed the Bundh by degrees. RAJUK from time to time wanted to develop the area through landscape development schemes. The UAP (1995-2000) pointed that immediate action for the implementation of Buckland embankment development as a recreation center is required. A visit to Dhanmondi Lake makes clear how popular a recreational area it is, and what an important function it serves in city life. In the morning, it is a vital gathering place for exercise, shopping, and socializing; during the day, people continue to walk around the lake, to sit and enjoy the surroundings, and to talk to friends. Many vendors earn their living there, and various shops and restaurants do good business. Lakes can thus be a vital part of the city’s economy as well as social life.

4.3 Water recreation in Dhaka and around the world

Some case studies on the water recreation in Dhaka and around the world have been discussed and their implications in the context of the study area have been identified.

4.3.1 The Marina Bay, Singapore

Marina Bay is a bay located in the Central Area of Singapore, surrounded by the perimeter of four other planning areas, the Downtown Core, Marina East, Marina South and Straits View. The area surrounding the bay itself, also called Marina Bay, is a 360 hectare extension to the adjacent Central Business District. It is also the new downtown of Singapore, built on reclaimed land.

Historical Perspective and Present Status

In 1969, land reclamation work to create 360 hectares of prime waterfront site began at Marina Bay. The reclaimed land forms today's Marina Centre and Marina South areas, and the reclamation work was completed in 1992. In the reclamation process, Inner/Outer Basins (anchorage area for commercial and naval vessels), Telok Ayer Basin (now site of Asia Square Tower 1 and 2) and Inner Roads was removed from the map by reclaiming land, while the Singapore River's mouth now flows into the bay instead of directly into the sea.

The long term visions for the Marina Bay area were first articulated in the 1983 Master Plan by the Urban Redevelopment Authority (URA), with the waterfront areas being deliberately kept open to the public. In 1988, the draft plan for Marina Bay was presented to the public in a two-week exhibition where it set out the objectives for the development, among which are optimising the waterfront location and creating a distinctive image with international landmarks that could become a focal point for the city.

The URA Master Plan for Marina Bay aims to encourage a mix of uses for this area, including commercial, residential, hotel and entertainment and to turn it into a work-live-play vibrant 24-hour CBD. In 2005, the Urban Redevelopment Authority spent \$400,000 on a branding exercise to name the Marina Bay area in order to sell the new major developments in the area, only to settle with the original name "Marina Bay".

The Singapore government also spent \$35 million to complete the 3.5 km Waterfront Promenade around Marina Bay. It includes a new eco-friendly visitor centre and the Helix Bridge linking Bayfront to Marina Centre where the Youth Olympic Park is located. The Promontory Marina Bay (formerly Central Promontory Site) will be used as an interim event and public space used for activities such as theatres and carnivals. In 2008, Marina Barrage was built, converting the basin into a freshwater Marina Reservoir.

Events at Marina Bay

The following events taking place at Marina Bay :

- ❖ National Day Parade
- ❖ Fireworks Celebrations
- ❖ Summer Youth Olympics
- ❖ Annual i Light Festival



Photo 14: Marina Bay Sands, Singapore

Water management

In 2004, the Public Utilities Board announced plans to construct a new downtown reservoir by damming the Marina Channel. This barrage was completed in 2008. Known as the Marina Barrage, it turned Marina Bay and the Kallang Basin into a confined freshwater reservoir with limited access to marine transportation to regulate the water quality. The new reservoir provides another source of drinking water for Singapore, as well as a stable water level for a variety of water activities and events. The barrage also prevents flooding in the Chinatown area.

Transport

There are currently eight rail stations: City Hall, Raffles Place, Marina Bay, Bayfront, Downtown, Telok Ayer, Esplanade and Promenade serving Marina Bay. As the plan set out, by 2020, the 360 hectares of Marina Bay boasts a comprehensive transport network as Singapore's most rail-connected district. The first three new MRT lines (Circle line, Downtown line) opened between 2012 and 2013. By 2018, the Marina Bay district had more than six MRT stations, all no more than five minutes of each other. The Thomson–East Coast MRT line created better connections within Marina South, opened in 2022. A pedestrian network links developments and MRT stations. Within greater Marina Bay, water taxis will even double up as an alternative mode of transport.



Photo 15: Night view of Marina Bay Sands, Singapore

4.3.2 The Sydney Harbor, Australia

Historical Perspective The Sydney Harbor is said to be a “Jewel in Sydney’s crown”. Over the years the harbor has been a major attraction for the tourists, and also a link to workplaces for thousands of local residents.

The Present State One of the most visually stunning bays in the world, Sydney Harbor is also an amazing place to stroll, take a boat ride or just sit a spell. Locations like Circular Quay, the Rocks, and the Botanical Garden fit well with the harbor itself to create a unique waterfront atmosphere. As in Stockholm, Sydney’s waterfront destinations are best accessed by ferry. When people can get around via the water, they are apt to hang around much longer and recreate on the waterfront. The upshot is a constant hum of people having fun at a huge variety of activities, which could easily occupy someone for days on end. Important points along the water way Sydney is famous for its water taxi cruises along the harbor which offers one to come close to the scenic beauty of Sydney.



Photo 16: Views from Circular Quay towards Sydney Harbor Bridge



Photo 17: Sydney Harbour Walkway

The Harbor has numerous points of importance such as Harbor restaurants, islands of National Parks, Opera House, Taronga Zoo, Fort Denison, Cockatoo Island, important sea beaches and even conference halls along its way. Uses of water vessels like wedding water taxi services help to create a unique and magical occasion. No regular transport service is available through harbor. One has to hire boats to reach Sydney Harbor's many small islands, private harbor tours, waterfront restaurants etc. Boats operate from any wharf or jetty situated in the north, all of Middle Harbor and the Lane Cove and Parramatta Rivers. The landing points are all well connected to road transport system

Harbor Events Sydney Harbor is home to many special events, such as Harbor week, New Years Eve and the Australia Day celebrations. Following consultation with relevant port users, the community and business groups, the Harbor Master establishes port procedures that will apply during major aquatic events. Planning for individual events on and around the Harbor rests with arrange of committees and organizations

4.3.3 Circular Quay, Sydney Harbor, Australia. In many ways, Circular Quay is the “heart of Sydney,” and its success is due to the essential role it plays in the city's daily life. Historical perspective Sydney, a city graced with copious sunshine and sheltered from the wind by protecting ridges, has grown up around its waterfront; indeed the waterfront is a national focal point. Circular Quay gradually built up at the side of

Sydney Cove, the 1788 landingplace of the British convict ships which brought Sydney's original citizens. Circular Quay is the "hard edge" along the water - essentially, it is a public space connecting transit, pedestrian and civic elements. Framing the Quay are Sydney Harbor Bridge and the Opera House, among the most popular and internationally known images of the city and the country. The Quay is a perennial site for civic celebrations; in 1994, for example, crowds gathered there to celebrate the awarding of the 2000 Olympics to Sydney. The Present State "Circular Quay" is a stepping-off point for most attractions based around the Harbor and an exciting place to be on a warm summer's day. It is a vibrant, bustling place with ferries leaving every few minutes to different parts of the Harbor, including Manly, Watsons Bay, Mosman and Taronga Park Zoo. There are great views of the Harbor Bridge, a short distance away. On the southern side of Circular Quay is a walkway that leads to the Sydney Opera House and Royal Botanical Gardens; while on the northern side, a short walk along lovely landscaped walkways takes one to the Harbor Bridge and the rocks, one of the oldest, most attractive and most interesting parts of Sydney. Buses depart here for Bondi and the eastern suburbs. There is a major railway station at the quay, which is part of the underground City Circle, which skirts around the CBD. Alongside the ferry terminals are a number of small outdoor cafes and the area is a magnet for buskers of every description. One who is looking for accommodation can find in and within walking distance of Circular Quay.

4.3.4 Sumidagawa River Walkway: Tokyo, Japan.

Historical Perspective With water quality improved through stringent regulations on industrial effluent and construction of the sewerage system and with the waterside development, Sumidagawa River successfully recovered from the deterioration of the river environment. It serves as an advanced model for natural regeneration in Asia. Planned to run seventeen miles along both sides of the Sumidagawa River when completed in the year 2000, the Sumidagawa walkway represents a change in Tokyo's civic planning philosophy. When the banks of the river were stabilized for flood protection years ago, little thought was given to either aesthetics or public enjoyment. As recently as 1990, the downtown section of the Sumidagawa was lined with unappealing concrete that was only occasionally punctuated by an office building's landscaped garden.

The Present State There is now large segments of a beautifully detailed walkway in place which is 28.4 kilometers in size. Where once there were blank walls there are now elaborate plantings, gazebos, tiles with historic wood- block prints of the river and a graceful railing featuring fish, birds and other aesthetic details. With these improvements the planners have effectively provided the congested city with a significant amount of accessible open spaces. The walkway course from the Asakusa subway station towards the harbor features eleven bridges, each of which are of a different design. The new walkway runs beside both apartments and offices in central Tokyo and even passes through the famous Ginza district. Landscaping alongside the concrete walls also enhances the walk, while pergolas and other features provide shaded rest areas. There is seating throughout, as well as steps beside the flood walls where the walkway spaces is wide and green banks slope gently down toward the river's edge. At the northern end of the walkway, near the Asakusa subway is an

enormous underground bicycle storage facility. Bicycles are racked and locked in a brightly lit space that is used by commuters and strollers alike. The walkway is below grade level in some places and is screened from the adjoining road by flood walls in others. It is easily accessed by stairs descending from the bridges, which means pedestrians are below the noise and traffic. Although both sides of the river are heavily built up and an expressway crosses it from west to east and runs up river, the atmosphere on the walkway is relatively quiet and serene. Now a major tourist attraction, this section of the Sumidagawa is cruised by tour boats .



Photo 18: Sumidagawa River Walkway: Tokyo, Japan

The Tokyo Metropolitan Government (TMG) created guide map provides interesting sightseeing spots, suggested walking routes around Senju, waterfront area including local events, traditional crafts and local delicacies and other valuable information. The map covers the areas Akabane, Oji, Ogu, Minowa, Kitasenju and Minamisenju. There are various scenic spots along the course including the monument of the loyal retainers, Basho Museum, and Mannen Bridge. There is a promenade in “Sumidagawa Terrace”, a walking route for many people during the weekdays and holidays by the river bank. The glimpse of the boats going up and down the river while walking during daytime is also enjoyable but the atmosphere in night time is great with the illuminated bridges. The walk way is very popular with people trying to get away from everyone else during their lunch break. This area is also suitable for jogging. Both old and new-style boats are available, along with a nice river cruise and a meal. A slow walk is full of unexpected surprises; one can find attractive soba shops and restaurants in the downtown

Sumida River Cruise and Events: Tokyo Cruise Ship Co. operates a variety of cruiseboats along the Sumida River and on the Tokyo Bay. The boats are called *suijō-bus* and are popular among tourists. One can arrange his/ her own cruise if one would like. Boats pass under 12 unique bridges on the Sumida River. Azuma Bridge, Komagata Bridge, Umayu Bridge, Kuramae Bridge, Ryogoku Bridge, Shinohashi Bridge, Kiyosu Bridge, Sumidagawa ohashi Bridge, Eitai Bridge, Chuo-ohashi Bridge, Tsukuda-ohashi Bridge, Kachidoki Bridge. Azuma, Kiyosu, Eitai, and Kachidoki Bridge are illuminated at night, and the reflection of lights on the river brings a romantic mood to the cruise. It's interesting to see old and new buildings along the river.



Photo 19: Cruise Ship on Sumida River, Tokyo, Japan

Ohanami Party: Ohanami party is a kind of festival for viewing cherry blossom (hanami) belong the friends, so that one can experience the Japanese native cultures. Sumida Park in Asakusa is one of the most popular places for enjoying the festival. The term the cherry blossoms are very short. From the end of March to mid-April, cherry blossom viewing boats are operated along the Sumida River. Lots of people come to see the festival around the Sakura (cherry blossoms) Bridge. Sumida River Fireworks Festival (Sumidagawa Hanabi Taikai): Viewing fireworks from a cruise boat is very popular during the Sumida River Firework Festival held at the end of July and Tokyo Bay Firework Festival held in August. Fireworks viewing boats require reservations months in advance. The Ryogoku Fireworks Festival is the oldest fireworks festivals for which historical records exist. In 1733, the restaurants near the Ryogoku Bridge received official permission to set off fireworks, which was the start of a long tradition



Photo 20: Ohanami party, Japan



Photo 21: Fireworks Festival, Japan

4.3.5 Kuching Waterfront: A waterfront park as a catalyst for urban redevelopment the redevelopment of the old Kuching waterfront near the heart of the city is as bold as dramatic. There are a number of unique characteristics that have made the Kuching Waterfront as popular as it is today. Opened in 1993, it is regarded as one of the best examples of urban regeneration and rehabilitation projects in Asia. The waterfront has successfully created a lucrative atmosphere for business and leisure and is also known as The People Place. On Saturdays or Sundays morning a lot of local volunteers

cleaning up the area as part of the community programme to in still the sense of belonging of this river beautification project.

Historical Perspective Kuching lies on the Sungai Sarawak 20 kilometers in from the sea. The city's riverfront used to be the regional shipping and distribution point of the Malaysian state of Sarawak. It acted as a seam between the commercial area on main bazaar and the river. The development of a road network and air transportation during the 1960s and 1970s, and the change in shipping technology led to the abandonment of the go downs (warehouses) and the general deterioration of the waterfront. The river wall had deteriorated, mud flats filled former shipping channels, and squatters had built shacks along the waterfront. At the same time it was a lively colorful area of fishing boats and commerce. In order to upgrade the image of Kuching, the re-invention of the waterfront became a necessity. In 1989, SEDC (Sarawak State Economic Development Corporation) was as signed to develop the waterfront by the state's government. By redeveloping, an area formerly characterized by deterioration, abandonment and squalid living c onditions had been transformed into a beautiful new promenade, audio visual center and public space. The Present State Kuching Waterfront epitomizes how it has modernized itself without losing any of its charm. Drab warehouse have been replaced with an approximately 1 kilometer long esplanade stretching from the main hotel and commercial heartland of the city to downtown Kuching. This waterfront has brought about a revitalization of the nearby commercial area. By re-establishing vistas and visible connections to the city center, it has also physically and symbolically reunited Kuching with its historic riverfront and has become the most popular meeting place in the city. The place has something for everyone and is ' self-contained' with facilities for entertainment, refreshment, relaxation, cultural enjoyment and arts appreciation. It is also a great place for family gatherings, corporate outings and school and community projects.

Main Feature and Details The main feature includes a new river wall, a wide shaded promenade, a handsomely landscaped waterfront park, cantilevered belvederes over the river and restored historic buildings. This esplanade is beautifully landscaped and dotted with wooden benches, food stalls, restaurants and entertainment facilities. The centerpiece of the kuching waterfront is the new town square waterfront park containing a nineteenth century square Tower flanked by pools and fountains. This square has become a favorite gathering spot for visitors and the local population alike

The paving, artworks, decoration and promenade wall all draw on the rich cultural heritage of the island of Borneo –its mix of ethnic populations and its colonial history. Thirteen different mosaic patterns are used in the paving, and designs on the river wall balustrade are based on a traditional Chinese motif. Pavilion roofs likewise are influenced by colorful, traditional designs. Planting is lush, and attractive street furniture and light fixtures and an imaginative nighttime illumination scheme have been used

Important points along the waterway The water taxis (locally called sampans or tambangs) take people across the river at their leisurely pace or board the river cruise for a short trip up the river. A number of older buildings have been preserved and incorporated into the design, including the Chinese History Museum, the Sarawak Steamship Building, an open air theatre and the Square Tower. Modern additions to the

Waterfront include a restored Chinese pavilion an observation tower, a tea terrace, an open-air theater, colorful musical fountains, and a number of modern sculptures, Main bazaar, the Sunday Market at Satok, the Kuching Civic Center, the Astana, Fort Margherita and the Malay kampong which line the north bank of the river or even the newly constructed DUN complex and the New Sarawak State Legislative Assembly Building.



Photo 22: The Darul Hana Bridge spanning the north and south bank (Kuching Waterfront) of the Sarawak river



Photo 23: Kuching Waterfront Musical Fountain

4.3.6 Events Aptly called The People Place, Kuching Waterfront was built for the people of Sarawak to enjoy, entertaining and be entertained, a heritage to be proud of and a legacy to pass on to generations to come. Decorated Boat Parade: One of the most interesting events is the 'decorated boat parade' around Sarawak River at Waterfront Kuching. Some of the boats are static, but some of them are moving all the time. Some of them were fast, some of them were slow. Sometimes, the boats may turn its direction so that the visitor at both sides of the river can see both sides of the boat.



Photo 24: Decorated Boat Parade, Kuching Waterfront



Photo 25: Monthly Dance and Music Performance, Kuching Waterfront

Monthly Dance and Music Performance: The Monthly Dance and Music performance focuses on ethnic and traditional dances using their individual costumes accompanied by music and audience are encouraged to participate by joining in the dance. Rounding up the 4th Sunday of each month, the dancer group's startt their multi-ethnic diversity of Sarawak at the Godown Amphitheater Kuching Waterfront between 8:00pm - 9:00pm. The busy weekly schedules to expose the artistic talents of Sarawak are part of

the efforts to bring up a generation of artists and enhance the appreciation of local cultures and ethnic traditions.

River cruises: One can ride the Sarawak River Cruise boats or take the famous Sarawak Sampan Taxis across the river. The Sarawak River Cruises depart daily at about 5.30pm. Some tour agents from the Main Bazaar sell these tickets as well or one can inquire directly from the jetty where the cruise departs.

Kuching Waterfront is the best place to see nightlife of lovers, youngsters and love-makers. It really comes alive and seems like half of Kuching is out meeting friends, watching a show or just taking the air. Various vendors are seen along the main walkway selling all sorts of 'interesting' items. Food kiosks are abundant at various points while couples and tourist flock to enjoy the walk along here. A number of make-shift stalls sell souvenirs and crafts too but at a slightly higher price than the usual shops. The place usually simmers down around 9pm.

The Assiniboine River Marina and the Market and Tower at the Forks, the City of Winnipeg, Manitoba, Canada. As a strategic location situated at the confluence of the Red and Assiniboine Rivers, as well as an important meeting place for people over the centuries, the Forks was designated a National Historic Site to commemorate its importance in the development of Manitoba and Canada's west over the centuries. Evidence found during archaeological digs has proven that aboriginal people were using the site of the Forks as a stopping and meeting place as early as 4000 BC.

It was also a rest stop for aboriginal bison hunters during the seasonal migrations to the plains of Manitoba and Saskatchewan. Today however, the Forks National Historic Site is at the centre of Manitoba's bustling capital city of Winnipeg. It is still used as a meeting place however; today people meet

4.3.7 Jinji Lake, Suzhou: Farmland turns into Lakefront city.

Historical Perspective The Jinji Lake Landscape Master Plan transforms a rural farming community into a modern urban development with multi-cultural appeal and a variety of uses. The waterfront district covers 520 hectares of land surrounding Jinji Lake, the most arresting natural feature of the Suzhou District. Because of the lake's natural beauty, undeveloped resources and opportunities for an open space system, the Chinese government saw the area as prime property to create a world-class, environmentally responsible community. The craftsmanship at Jinji Lake has set new standards in China by which other public spaces are now being judged. Jinji Lake area is in the middle of the Suzhou industrial area. The area of the water is 7.38 square kilometers. The overall plan tries to use less artificial elements in order to make people pay more attention on natural elements. Master Landscape Design encompassing public open space, parks and detailed landscape design around the lake and at the water's edge. The master landscape design divides the lake into eight distinct neighborhoods, connected by a continuous park system. Open space and waterfront parks around Jinji Lake have improved local citizens' quality of life. Jinji Lake has become a landscape success story and destination site in China demonstrating how landscape can create places for people to live, businesses to invest and cultures to celebrate. The division of space AECOM provided a plan that closely integrated the

urban environment with the public realm through recreational areas and land use pattern responsive to the lake. Plan components include a large ceremonial plaza and mixed-use development adjacent to the central business district and a linear waterfront promenade on the west shore. The south shore features a historic fishing pier, a neighborhood shopping district around a manmade cove, and a Sustainability Education Center with wetland gardens. A series of active neighborhood parks and an arts and entertainment district, with an aquarium, outdoor concert pavilion, and display gardens make up the east shore. The north shore is composed of a waterfront park, wetlands, a signature bridge, and a man-made island for resort and water recreation uses. The Jinji Lake area space division:

- a. Harbor Plaza
- b. The Grand Promenade
- c. Marina Cove
- d. Reflection Point
- e. Reflection Gardens
- f. Arts and Entertainment village
- g. Mirror's Crossing
- h. Discovered Island



Photo 26: Jinji Lake, Suzhou, China

Among these, most natural areas are the Discovered Island, the Reflection Point and the Grand Promenade. In Discovered Island, there are many bulrushes in the land along water; it is in order to clean the water in Jinji Lake. In Reflection Point, there is a natural island in south of the street to airport. It is used to protect plants and birds. The Grand Promenade is a place special for the feeling that a good footpath can make people feel closer with water. The platform extends to water, and the depth of water often change, so there are two steps of platform, when the water rise, people can play water on the second step.

Traffic system The traffic system in Jinji Lake is divided into two kinds, one is on water, and another is on land. The surface of the water is a big corridor used to connect with the eight parts; roads on land are well organized with a complex traffic system. Most of the streets here are only for pedestrians. Big roads are necessary as the Jinji Lake area

is big enough to meet the need of traffic and only sidewalks hardly to meet the need. The street for cars connect all squares, parks, green lands and residential areas and designed with other establishments, such as lights, stools and steps which can make the environment closer to people. Between the big and small roads, there are usually grasses to reduce the dust. All the cars and pedestrians are well separated. The walking roads connect the entrances, squares and inner public lands. There are different kinds of paths: footpath, sidewalks with steps, rock paths and plank boardwalks built along water.

The details of Jinji Lake Jinji Lake's landscape design explore and celebrate inherent dualities: The city of Suzhou's status as a revered historical city and its goal to be a modern global player. The landscape design respects the historic traditions of Suzhou and weaves together the worlds of old and new, business and recreation, living and education, linking the past to the future, art to architecture, land to water, city to village and Suzhou to the world. The arts and entertainment village, a marina, and promenades and walkways lead the public to the lake's edge to encourage boating, swimming and other water-related activities.

The Jinji Lake is full of entertainment, because a part of Jinji Lake is special for business and investment. There are restaurants, hotels, bars, shopping mall and an assembly hall. Ligongdi is to the south of Jinji Lake, and along this street, both sides have modern restaurants and clubs but the appearance of the buildings is traditional. Ligongdi can be divided into two parts: one is dynamic and the other part is static. It attracts people in different age groups and business. The government emphasizes that this area must be clean and ecological, because Jinji Lake is one of China's cleanest and largest lakes. EDAW took special measures in the design to clean surface water by using natural and created wetlands along receiving streams to filter pollutants in agricultural and urban storm water runoff. The most interesting street in Jinji Lake is Ligongdi and is called the colored belt of Jinji Lake at night as lighting is used to make a fancy impression

Events and River cruises During the holidays Suzhou Industrial Park (SIP) offers a series of benefits and special promotion activities covering extensive fields of shopping, dining and wining, shows and tourist funs. The Jinji Lake scenic spot offer the night tour at the Ferris Wheel Park and the night cruise is available at the Wanghuge Dock on the west bank of Jinji Lake. The large-scale water show by the Jinji Lake starts at eight in the evening and lasts half an hour. The show at the Bellagio used only water and music, the show at Jinji Lake adds lights, lasers, fire and a water screen that shows videos. The 27 minutes show also last a lot longer than the four minutes Bellagio water display.

4.3.8 Flood precautions turn into truly successful public spaces in Vienna. Vienna has taken cues from both historic and modern precedents to remake the river as a culturally vibrant public place, employing anything from the popular phenomena of beach bars to a renovated pool barge. While facing a number of political, environmental and industrial challenges in the process of reestablishing its riverfront, the city has The most interesting street in Jinji Lake is Ligongdi and is called the colored belt of Jinji Lake at night as lighting is used to make a fancy impression.



Photo 27: Flood Protection Embankment on the Danube River, Vienna

Vienna is susceptible to frequent flooding due to its geographical location, located on the Danube River, downstream the snowy Alps. To avoid historically disastrous floods, the city built an auxiliary channel of the river to flow the length of the city. This channel, and the long island that separates it from the Danube, have become known as the New Danube and Danube Island. Built with dams and other infrastructure to control and take excess flood water, the new utilitarian river has been claimed exclusively for recreational use. In this scenario, the island becomes a park while the new water channel permits only small boat traffic, keeping swimmers safe from barges. Instead of allowing the recreational river and its banks to be developed privately, the city carefully regulates how the buildings, roads, sidewalks and plazas are designed and placed in the new district, guaranteeing the waterfront as a public amenity. The risk of flash floods required Vienna to make a precautionary change to the natural structure of its waterfront.

4.3.9 House boats on the backwaters of Kerala The most exciting thing on the backwaters of Kerala, however, is the Kettuvallam (traditional Kerala houseboat) which has become the most popular tourism product in India today. A holiday in the houseboats of Kerala is even more enchanting. The Kettuvallams were traditionally used as grain barges, to transport the rice harvested in the fertile fields alongside the backwaters.



Photo 28: House boats on the backwaters of Kerala, India

Thatched roof covers over wooden hulls, 100 feet (30 m) in length, provided protection from the elements. At some point in time the boats were used as living quarters by the royalty. The houseboats have converted into floating cottages to accommodate tourists. Most tourists spend the night on a house boat. Food is cooked on board by the accompanying staff – mostly having a flavor of Kerala. The houseboats are of various patterns and can be hired as per the size of the family or visiting group. The living-cum-dining room is usually open on at least three sides providing a grand view of the surroundings, including other boats, throughout the day when it is on the move. It is brought to a standstill at times of taking food and at night. Ketuvallams are motorized but generally proceed at a slow speed for smooth travel. At times, as per demand of customers, electricity is switched off and lanterns are provided to create a rural setting. Photograph Ketuvallams take tourists from a particular point and bring them back to around the same point next morning. There are some specific cruises mostly in the Alappuzha area such as the one night cruise from Alappuzha to Thotapally via Punnamada Lake, two nights cruise from Alappuzha to Alumkavadi, one night cruise from Alappuzha to Kidangara, and one night cruise from Alappuzha to Mankotta. More than 400 kettuvallams ply the backwaters, 120 of them in Alappuzha.

4.4 Implications in respect of the Dhaka Circular Waterways

Every monsoon Dhaka City dwellers experience flood due to rain. Drainage system of Dhaka serves less than 25% of the urban area. The remaining areas drain through overland flow into adjacent water courses or depression areas and back swamps. The building of embankment all around the city was not the right solution. The Eastern Embankment turned Dhaka into an island surrounded by wall all around. Instead of a dam it should have been excavated as a canal like in Vienna where flood precautions turn into truly successful public spaces. In Dhaka this kind of a canal is the most suitable form of flood protection and could become a source of attraction for park improvement and recreational use. Also this waterway can work as a peripheral circulation route for the city, especially for goods handling, and can also be used as pisciculture development. Due to flood embankment, the surrounding area of the “Mirpur- Ashulia- Tongi” route is fixed and there is insufficient area remain for recreational purpose. In that case, floating river walk like on Brisbane River can be a solution and recommended to utilize the minimum resources. In those places where space is limited on the embankment side and route width is maximum there the floating walkway on the Brisbane river concept can be applied. Locations like Ashulia landing station area, the Zoo, Bot Tola and the Botanical Garden fit well with the route itself to create a unique waterfront atmosphere. Like Sydney Harbor the route has the potentiality to act as an amazing place to stroll, take a boat ride or just sit a spell. A beautifully landscaped walkway dotted with wooden benches, food stalls, restaurants and entertainment facilities can lead to the attraction points. Bicycles storage facility can be provided and are racked and locked in a brightly lit space that can be used by commuters and strollers alike. Like Kuching and Fork this route might offer astounding arrays of edibles to its visitors. Some kinds of festivals and events like ‘flower festival’, ‘boat competition’, ‘decorated boat parade’, and Fireworks festival could be arranged to make the routes livelier. Dhaka’s waterfront destinations are best accessed by ferry. Like the Circular Quay the Ashulia landing station area has the potential for connecting transit, pedestrian and civic elements and act as a public space. It can be a stepping-off point for most attractions based around the route and an exciting vibrant, bustling place to be on. Scheduled ferries can leave from here to

different parts of the route. Great views of the 'Ashulia – Tongi Bridge' can be seen from a short distance away. As there are bridges over all the three routes which are low bridges and stand as major obstacle to the Circular Waterway, the taskforce has recommended the bridges to be knocked down and reconstruct them according to the vertical and horizontal clearance. As a result the bridges could have unique identity and it could be the exhibit like the 12 unique bridges on the Sumida River each of which is of a different design and are illuminated at night, and the reflection of lights on the river brings a romantic mood to the cruise. Traffic problem could be solved in multi levels like Sumida River walkway. The walkway should be below grade level in some places and accessed by stairs descending from the bridges. Pedestrians should be established below the noise and traffic and have the atmosphere of relatively quiet and serene. House boat concept like Kerala can be used in Amin Bazar to Sadarghat via Nawapara. As the "Jamdani Hat" starts early in the morning at 4.00 am and finishes at 8.00 am only on Friday in a week and it is quite impossible for many of the wishers to reach there in the early morning. Considering that, House boat concept can be applied to visit Jamdani Polli and there can be arrangement of some house boats converted into floating cottages to accommodate visitors which may solve the problem to attend the hat.

Chapter 5: Study Area Profile

To select the best recreation site within the perimeter of CW, three segment of CW have been selected to explore their potentialities for river transportation, communication, recreation and place making. These routes were selected because of their exclusive potentialities in the field of transportation and recreational prerequisite and immense scope for future development for recreation through place making. So the target of this chapter is to give a complete picture of these three routes and has tried to explore their potentialities and to indicate the problems and limitations. Then find out the best place for recreation and place making.

5.1 “Mirpur – Ashulia-Tongi’ Route

5.1.1 General information

Ashulia is being already used as a recreation site by the recreational users of Dhaka city. People are strolling, roaming, boating, gossiping and enjoying the scenic beauty of the river there. The attractive view of Turag River and vast paddy fields of Ashulia make it a popular tourist spot and is one of the nicest and most romantic places nearby Dhaka. People usually love to go there with their friends and families. Now-a-days Ashulia meet the demand of recreational site with boating and other facilities for the city dwellers. It is a nice place where one can get fresh air and also get some breathing space. For its absolute natural beauty during monsoon it is called the Cox’s Bazar of Dhaka. Again in winter it has another attraction for its cosmic greenery natural exquisiteness provided by paddy and vegetable fields. During dry season, usually the Ashulia landing station area of this route generates about 300 persons per day in weekend. In weekdays on average 100 persons per day come to Ashulia landing station area. Other than during wet period, the number increases to 300/400 at weekdays and 500/ 800 at weekend. But special events and occasions like ‘Eid-UI-Fitr’, Pujas and ‘Eid UI Azha’ the number reaches more than thousands and festivals like Valentine’s Day, Pohela Falgun, and ‘ Pohela Baishakh’ it reaches 2000 to 3000. The beauty of the river and the charming nature changing with the climate and seasons creates its own appeal to the visitors to relish only the different scenic beauty of the river and its surrounding areas. Hence this statistics shows the fact that this route has great opportunities and potentialities for developing it as a standard recreational spot for the city dwellers.

In dry season Ashulia has high agricultural value. On the other hand during the months May to September there is immense opportunity for fishing and boating. Wetlands of Ashulia play a vital role as catchments area in facilitating the drainage of Dhaka city in the wet season. There is no formal recreational arrangement in Ashulia landing station area from any organization, authority or any private sector except a small food corner in landing station. The food corner sells overpriced goods which has created a monopoly.

Important Recreation Attraction Points along the route There are some attractive recreation points along “Mirpur – Ashulia-Tongi’ Route such as Ashulia landing station area, Mudapara green area, Bat-tola, Birulia landing station area, Tamanna Complex, sluice gate area etc. Different types of recreational opportunities are there along the waterway side. A Botanical park and a Zoological park have developed spontaneously alongside the route which makes the possibility of the bank of the

waterways to be used as recreational zones. The beautiful natural environments of the zoo offer almost all recreational facilities to the visitors. About 5 million visitors visit the Dhaka Zoo every year and attract around 30,000 visitors every day (Wikipedia, Dhaka Zoo). The number increases during the weekends. Locations like Ashulia landing station area, the Zoo, and the Botanical Garden fit well with the route itself to create a unique waterfront atmosphere. Like Sydney Harbor the route has the potentiality to act as a fantastic place to stroll, take a boat ride or just sit and while away the time. But this crucial potential point has no connection with the two recreation point- Botanical Garden and National Zoo. Connections should be created between these points with the help of waterways. Recreation routes identified in the “Tongi Ashulia Mirpur” Route are:

- ❖ Ashulia landing station to Mudapara Tongi New Baily Bridge
- ❖ Ashulia landing station to Rustampur
- ❖ Ashulia landing station to Shinnir Tek
- ❖ Sluice gate to Shinnir Tek
- ❖ Sluice gate to Tamanna Complex

5.1.2 Existing Physical Infrastructure

Landing stations and ghats in the “Mirpur – Ashulia-Tongi” route: There are three BIWTA recognized Landing Stations and five landing ghats identified in the “**Mirpur-Ashulia-Tongi**” route area. The Landing Stations are: Ashulia Landing Station, Shinnir Tek Landing Station and Aminbazar Landing Station and the Landing Ghats are in due order: Mudapara ghat, Ashulia Ghat, Rustampur ghat, Sluice gate ghat, Tamanna ghat and Shinnir Tek ghat. Brief descriptions of the Landing Stations are given below.

Ashulia Landing Station: Ashulia Landing station is situated at the meeting point of the flood control embankment on the bank with the Tongi- Ashulia Highway. The station has two R.C.C ramp, one steel gangway for passenger, two spuds and one 100 ft pontoon for the passengers. There is also one steel gangway and one 100 ft pontoon for cargo. The station has a two storied passenger cum terminal building with one office, one passenger waiting shed, public toilet facilities and parking space for car and trucks.



Photo 29: Ashulia Landing station During Monsoon, Dhaka

Gabtolli Landing Station: Gabtolli Landing station is situated on the right bank of the Turag River. It is an important landing station and as it is connected with Savar by road. This station has one passenger waiting shed and one R.C.C step both for cargo and passengers.

Shinnir Tek Landing Station: Shinnir Tek Landing Station is situated on the left bank of the Turag River mid- way between Gabtoli and Ashulia Bridge. It is a very busy landing area both for the passenger and cargo. This station has one steel gangway of 100 ft long, one 100 ft pontoon both for the passenger and cargo. The station has a one storied passenger cum terminal building and one passenger waiting shed cum toll office of 100 sft. Passengers rarely use the landing station. They prefer to use the ghat rather than using the landing station. Accessibility condition of link road to the route Ashulia is a beautiful wetland area- only 31 k m southwest of Dhaka. There's a good road link from the city. The flood embankment cum road is the main approach road for most of the landing stations and ghats. But the link road accessibility condition to the route is not good enough. Proper Link between road network and water routes is one of the main failure causes of circular waterway's 1st phase success. The access links are mostly dirt roads and few of them are brick paved. From A shulia Landing Station, it takes about 30 minutes to arrive at Rustampur ghat, approximate one hour to arrive at the Bot-tola, Birulia Landing Station and around one and half hour to reach at Tamanna complex area through motorized country boat (MCB). Condition of linkage to the Ghats Shinnir Tek landing station is always remain closed because of crime and illegal events occurring in the surrounding areas and the landing station opens only when cruises or Minister's ship boats landed there. Boats landing in Shinnir Tek landing station area do not have any facilities. The users have to jump off the boat as the physical condition of the ghat is very poor. It is very risky and dangerous for the women to walk on the polluted water area, weedy environment and a very muddy and slippery river bank to reach the embankment road to get transportation for destination. Foul odor, safety, high charge of boats as maximum time it hire from Ashulia, lack of facilities are the main problems encountered here.

5.1.3 Recreation activities in the route and route adjacent corridors

For those who come to Dhaka and also the residents, boating has now become a recreational activity because when one is on water one can at least fantasizes that he or she is not confined within this urban chaos. There are very few boating destinations in the city and Ashulia would be the best among these destinations. This route is a popular boating spot and the distance also means that one can indulge in a leisurely drive and it is quite a pleasant experience that soothes the soul after a hectic life in the city. One can hire a boat on hour basis which can be country boats or mechanized one. Boat fares are reasonable. People usually have a walk along the road lined with large space of wetland. The Tongi-Ashulia road intersects the Turag River at this point and gives feelings of two big beautiful lakes, providing an ideal rendezvous for many people. The best time to go for a visit to this route area would be during the evening to watch the sunset. There are small islands spread all throughout the river and they have become a great place for picnics; families come to the area on a weekend and hire a boat to take them to these islands. Tamanna Complex can be termed as true amusement park which provides all kind of recreational facilities like different riding system for children, food corner, swimming pool, boating facilities and from the survey it has been identified that visitor are very much satisfied with facilities and arrangements provided by the Tamanna Complex.



Photo 30: Tamanna Park

Ashulia landing station area represents young group of visitors where Tamanna Complex mostly attract kids who come here with their parents for picnicking or to spend their weekend. Visitor also comes to take food from restaurants located along the route. From survey it has been identified that 'Mela' and 'Puja' take place at Bot-tola every year which generate huge amount of visitors; and people like to attend these kinds of events.

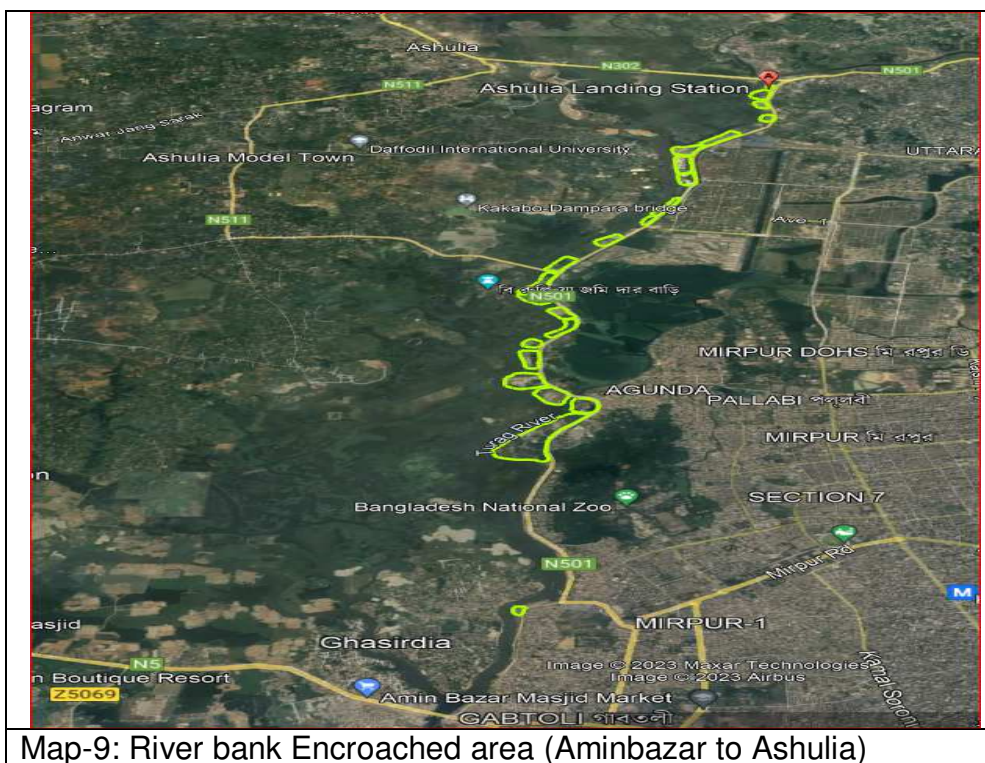
- ❖ Outing with family members
- ❖ Visit Bot-tola area
- ❖ Picnic on the green area
- ❖ walking on river bankside
- ❖ Sight seeing and roaming with friends.

Site seeing is one of the most common activities of recreational users and it covers highest percentage among other activities on the site and though water quality do not support fishing, recreational fishing on the river side is becoming more popular. Vessels In this route, motorized country boats (MCB) and country boats (CB) are available and used by the users. There are 20 MCB and around 90 CB in the Ashulia landing station area. MCB charges taka 500/- per hour and CB charges taka 200/- per hour for making trip and for personal MCB reservation from 9. 00 am t o 5. 00 pm in the surrounding areas it costs taka 3000/-. MCB usually do not operate on the lakes during winter but CB does in all seasons. During wet period a luxurious cruise ship named 'Keari Cruise Dine' always stand by at Ashulia landing station to serve lavish relaxation facilities at high cost. There is a wide variety of boats available in Ashulia and the large wooden boats made for expansive fishing expeditions are the most popular ones; they are sturdy and can accommodate a lot of people therefore a large group of individuals can go together. On the other hand, the engine powered boats are smaller in size and are a lot faster than the wooden ones.

5.1.4 Existing Land Use in the Corridors adjacent to the River

Existing water route proximate areas are: Tongi, Ashulia, Rustampur, Binodpur, Birulia, Kaundia on right bank of the route and Mirpur, Turag, Dhaur, Diabari on the left bank of the route area. Ashulia is a suburban area near Dhaka. Nearby areas are Savar and

Tongi. Two major theme parks namely Fantasy Kingdom and Nandan are also located at Ashulia. There are small islands or chars spread all throughout the route. Most of the route proximate areas are agricultural and vacant lands.



Map-9: River bank Encroached area (Aminbazar to Ashulia)



Map-10: Gabtoli Landing Station

Existing land use on river banks According to the Port Act 1908 and Port Rules 1966, up to 50 meters from where river water reaches during high tide is considered the river bank. According to the law, setting up any unapproved structures, digging soil and sand, filling through soil and sand or waste is punishable offence. BIWTA is responsible for protection and use of riverbanks. But the authorities were not given magistracy power to stop encroachment and river filling activities. The route is not physically demarked as per Cadastral survey and there is no fixed boundary for the river banks. There is unauthorized and illegal setup and land uses surrounding the route corridor. Illegal encroachments, commercial outlets, sand trading on river banks and slums are set aside the route side river banks all of which are punishable offence and are prohibited in the regulations.

Vegetation type and walkways on the river banks RAJUK, DCC, DE and Parjatan Corporation have been assigned by the Tourism sector to implement a project to assist in the development of a green buffer around the Dhaka City and also to support in the safe keeping of drainage functions of water bodies by June 2014.

A continuous greenbelt buffer zone in which development is restricted encircling the city incorporating both west and east fringes and Water Development Board to take measures to dredge the Dhaka Rivers. But no remarkable developments of these projects have been identified in the study area. A small number of malnourished trees as a gesture towards the environment and aesthetics were found alongside the route. There is no marked off trails and walkways there.

Permitted land use for specific area in the development plans and regulations In the Dhaka Metropolitan Development Plan (1995-2015) Ashulia is demarcated as the main flood flow zone. According to the policy of structure plan land development for residential, commercial and industrial development is strictly prohibited in the main flood flow zone. According to the Water Body Conservation Act, 2000, for conservation of all playgrounds, open space, park and natural reservoir; change of the any land of nature is prohibited in all municipalities including municipalities in the capital, divisional towns and district towns. According to proposed Detail Area Plan (DAP), the route area land use belongs to flood flow zone and permitted land use for flood flow zone area are given below. In the zone, uses permitted by the Authority are: Aquatic Recreation Facility (Without Structure), Dry Season Play Field, Marina / Boating Facility, Plantation (Except Narcotic Plant), Static Transformer Stations and Transmission Lines / Utility Lines. The following uses may be permitted or disallowed in this zone after review and approval by the authority. Land uses conditionally permitted for Flood Flow Zone are Communication Tower within Permitted Height and Poultry. All kinds of uses except permitted and conditionally permitted are restricted uses.

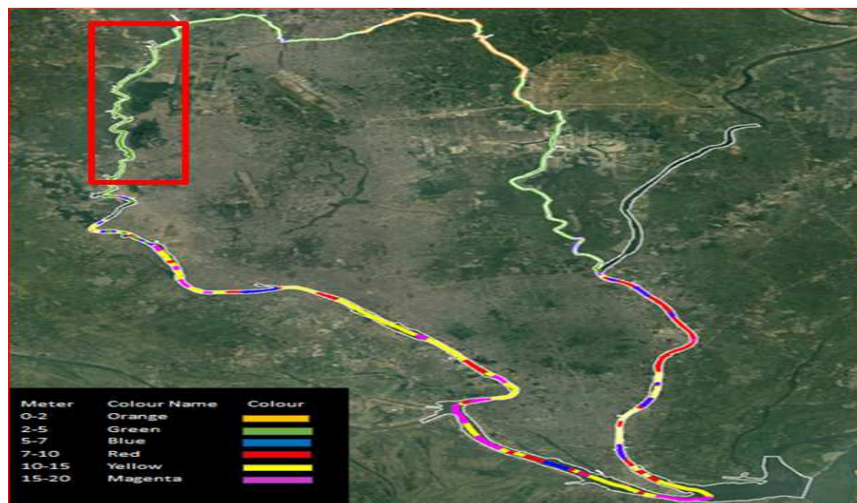
Limitations and Problems Identified in the Route

- ❖ Avoidance of taskforce rules and regulations
- ❖ Negligence of the concerned authority and organizations.
- ❖ Physically limited as width do not permit
- ❖ Physically not demarked as per Cadastral survey and no fixed boundary for the river banks
- ❖ Encroachment by land grabbers
- ❖ Unauthorized and illegal setup and land uses surrounding the route corridor. The sand traders ply their trading during winter on the river banks and the sand fills up the river beds during wet season when the water level rises.
- ❖ A plenty of brick kilns in paddy fields
- ❖ Absence of facilities

5.1.5 Navigability

The depth of the channel depends on the width of the vessel and the number of vessels to be passed at the same time at a certain section. Width of the channel at the landing station shall depend on the length of the vessels. From this point of view the width decided by BIWTA according to the classification of BIWTA class-1 routes should have

LAD (Least Available Depth) 3.6m – 3.9 m and Class – II routes 2.1 m – 2.4 m . The route from Sadarghat to Ashulia in fact up to Tongi is navigable during Monsoon as the available draft is over 12 ft. Traffic movement between Sadarghat to Gabtoli Bridge is quite heavy but between Gabtoli Bridge and Ashulia /Tongi is not so much. Considering this situation and the type of vessels that are plying BIWTA gave the following decision: The route between Sadarghat to Gabtoli Bridge should have a minimum width of 200 ft (63 m) and minimum depth of 12 ft. (3.7 m) The route between Gabtoli Bridge and Ashulia should have a minimum width of 120 ft (37 m) and minimum depth of 8ft. (2.5 m).



Map-11: Minimum Depth Observed Mirpur- Ashulia route (BIWTA)

5.1.6 Water Level

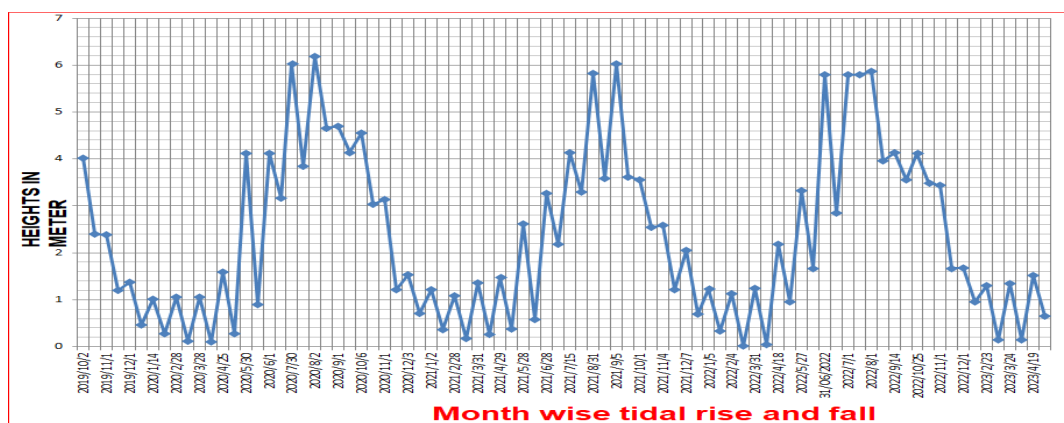


Fig1: Water Level Rise and Fall at Ashulia Landing Station

Water level at Ashulia Landing Station observed that the level is raising max during monsoon (July- September) upto 6.5 meter above from mean sea level (MSL) and falling maximum during dry season (February-April) upto MSL.



Photo 31: Water Level (Monsoon)

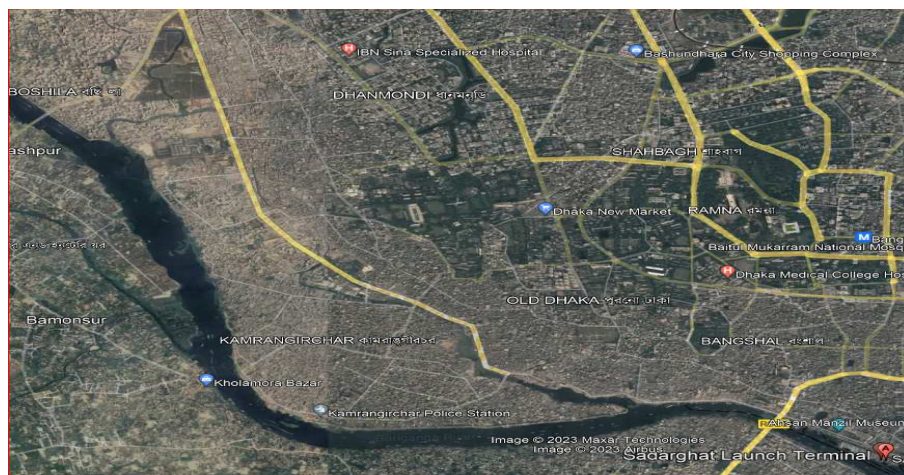


Photo 32: Water Level (Winter)

5.2 “Sadarghat-Washpur- Basila” Route

5.2.1 General information

The route is so dynamic by its physical characteristics that a little touch will make its panoramic view more attractive.



Map-12: Sadarghat-Washpur – BasilaRoute

This route is formed with an excellent shape already. With some modernization and by providing some required basic recreation facilities this place can be developed as an outstanding river side recreation place and meet up the necessity of recreation zone for the city dwellers. Approximately 3%-4% water route trip makers use this route for recreational purpose and the daily average recreation trip makers generated in this route is about 500.

Important Recreation Attraction Points along the route This site has huge potentialities to be developed as an ideal recreation site because this site already contains the well-known Martyred Intellectuals Museum which generates a great number of visitors. Without any facilities this site has ability to generate huge number of visitors, if necessary facilities and service is provided in this site, it would be flourished as a potential water way attraction point. However, due to encroachment and lack of maintainance the canal upto Rayerbazar is almost dead and not usable. On the otherhand, Basila Bridge has made a well connectivity with Rayerbazar Martyred Intellectuals Museum. As such visitors have less interest to use waterways to reach there. Recently Govt has taken initiative to protect the river bank by retaining wall and build walkway along the riverbank for the passerby. However, the walkway is building in

such an alignment, it is nothing but the violation of regulations. Somewhere it is inside the river and there is no plan for parking or sitting arrangement.

5.2.2 Existing Physical Infrastructure Landing stations and ghats in the “Sadarghat – Washpur- Basila” Route

There is one BIWTA recognized Launch Terminal in the “Sadarghat - Washpur - Basila” Route and three local landing ghats have been identified in the route area. The Landing ghats are: Washpur ghat and Basila ghat. Brief descriptions of the Landing Station and Ghats are given below:

Washpur Ghat The landing station is located on the west bank of the Sarai- Jafirabad Khal. It is an important landing station in respect of passenger volume. The daily average volume of passenger is about 1000 but the cargo traffic is negligible. The ghat stands between the Dhaka city and the northern part of keraniganj Thana. Service up to Rayerbazar and Katashur is available through mechanized boat. There are no landing facilities in this ghat and the access roads are not developed. The ghat is accessed from Atibazar by road but there is no regular public transit service.

Basila Ghat The landing station is situated on the left bank of the Turag River near Bosila primary school. One steel gangway with a pontoon serves both the passenger and cargo. Two spuds are provided and one R.C.C ramp is constructed. The station has one story passenger shed cum- toll office at about 140 sq.m with provision for water supply, canteen and toilet facilities. There is a provision of a pontoon with gangway. Unplanned brick field is responsible for river erosion. The depth and width of river beside the Basila is high, the main stream of the river water struck at Basila. No regular passenger service is available at present, except that the boats to or from Washpur catch the ghat for passenger. Reserved boats are usually used to reach destination.

5.2.3 Recreation activities in the route and route adjacent corridors

From survey it has been identified that people are involve with few activities in this site like-site seeing, roaming with friends, outing with family members, walking on riverbank side, photography and boating. There is inadequate arrangement of boating and fishing facilities in spite of having high demand during dry season. They would love to go on boat rides here but there are no boating facilities, they are highly disappointed with that. Boating held here mostly in visitors’ private initiatives. No regular boating facilities is available at present, reserved boats are usually used to reach destination. Visitors come here with their kids to show ‘Martyred Intellectuals Memorial’, Ahsan Monjil etc. and try to introduce our rich history of liberation war to them. At the same time they visit surrounding area, introduce their kids with river, take photographs.

5.2.4 Existing Land Use in the Corridors adjacent to the River

Route adjacent area consists of Ward no. 46, 48, 47 and Washpur. The route is running through ward no. 46 and 48. The Thanas involved are Mohammadpur, and Hazaribagh. The important neighboring areas of this route are Zafrabad, Rayerbazar, Madhubazar, tallabag, Jigatola, Hazaribagh on east side and Basila, Washpur, Madhyar Char, Balur Char and Ati bazaar on west. Unplanned brick fields are seen throughout the route area.

Most of the surrounding areas are privately owned and private housing development scheme is seen here in Katasur and Ramchandrapur area. Lands within the embankment are very low and are flooded in the rainy season.

Existing land use on river banks The route is physically demarked by BIWTA. There are Unauthorized and illegal setup and land uses surrounding the route corridor. Illegal encroachments, filling through soil and sand, waste dumping on river banks and construction material piled on the river banks all of which are punishable offence and are prohibited in the regulations.

Vegetation type and walkways on the river banks RAJUK, DCC, DE and Parjatan Corporation have been assigned by the Tourism sector to implement a project to preserve the water bodies and develop recreation and plantation. To provide much needed open spaces a continuous greenbelt buffer zone in which development is restricted encircling the city, parks and recreation facilities are suggested in the project. But no remarkable developments of these projects have been identified in the study area except few kilometers newly built walkway.



Photo 33: Newly Built Walkway by BIWTA

Permitted land use for specific area in the development plans and regulations

According to the proposed Detail Area Plan, the route area land use belongs to flood flow zone and Overlay zone. The wetland/ Flood Flow Zone as suggested in Structure Plan and Urban Area Plan will remain as it is, both in West and Eastern Fringe. No recommendation has been set for Overlay Zone land use yet. River bank development with promenade, Civic facility, Greenbelt cum embankment and Hazaribagh Tannery area will be developed mostly as open spaces and recreational uses will complement the neighboring area of Zigatola, Rayer Bazar, Zafrabad, Madhubag etc. This route shall not be encouraged for private housing development because of their relative importance as flood water retention area cum a buffer zone featuring possible strip plantation, Park development and government reserve land propositions. However, housing development is increasing rapidly violating rules and regulations.

5.2.5 Navigability

Main River Buriganga is navigable round the year but the channel towards Rayer Bazar is almost dried. A planned dredging could ensure the navigability throughout the year and also ensure the landing of vessels.

5.2.6 Limitations and Problems identified in the route area

- ❖ Unauthorized and illegal setup and land uses surrounding the route corridor and landing Ghats
- ❖ Concerned authority and organizations negligence
- ❖ Poor access and bad condition of the link roads to the landing station and Ghats
- ❖ Poor physical condition and maintenance of landing station and Ghats.
- ❖ Pile of construction materials hampers the aesthetic and environmental quality of the waterway surrounding.
- ❖ No fixed Ghats and facilities for passenger and cargo vessels.
- ❖ Absence of public facilities like drink and food corners or restaurants, toilet facilities, sitting benches, drinking water etc
- ❖ Inadequate arrangement of boating and fishing facilities in spite of having high demand.
- ❖ During dry season. No regular boating facilities is available at present, reserved boats are usually used to reach destination.

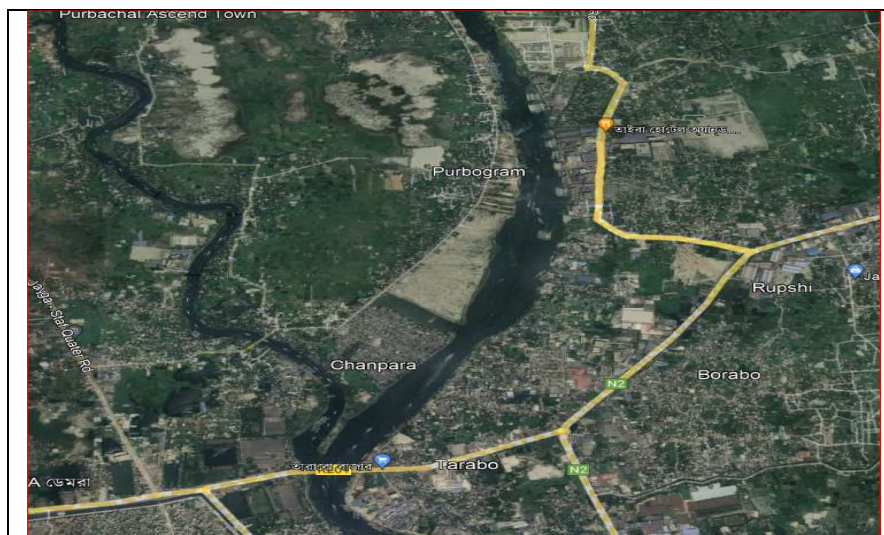
5.3 “Demra- Noapara” Route

5.3.1 General information

Once Muslins and Jamdanis were amongst Bangladesh’s most prized contribution to the rich Textile heritage of the world. Most of the handloom goods are brought by the weavers to the local hat or weekly bazaar, where they are sold to traders, wholesalers and their agents. The two major cloth markets in Bangladesh are in Narsingdi near Dhaka and Shahjadpur in Pabna. But other markets exist for specialized goods like Jamdani Saries are sold at the Demra hat where as the Tangail cloths are sold at Patiya. It is estimated that the production is carried out in over 200 villages in Demra, Rupgonj, Sonargaon and Siddhirganj in Dhaka. Demra Ghat is about 15 km east of Dhaka. From Demra Ghat it takes 15-20 minutes to arrive at Noapara village by boat. Noapara is famous for the traditional Jamdani weaving; anyone is welcomed to visit the skilled weavers producing the intricate textile, a special kind of textile unique in Bangladesh. It will be possible for one to buy pieces of Jamdani cloths here as a souvenir.

Important Recreation Attraction Points along the water way

1. Jamdani Polli
2. Jamdani Hat



Map-13: Demra- Nawapara route

Routes identified in the “Demra- Noapara” Route Passenger Routes, Demra Tarabo ghat to Chan Para 1 no ghat, Demra Tarabo ghat to Chan Para office ghat, Demra Tarabo ghat to Chan Para 6 no. ghat, Demra Tarabo ghat to Noapara/ Naya Para ghat. Recreation Routes are:

- ❖ Demra Tarabo ghat
- ❖ Noapara/ Naya Para ghat
- ❖ Finish ghat/ Ruposhi ghat.

5.3.2 Existing Physical Infrastructure Landing stations and ghats in the “Demra- Noapara” route

There is no BIWTA recognized Landing Stations in the “Demra- Noapara” Route but six local landing ghats have been identified in the route area. The Landing ghats are: Demra Tarrabo ghat, Chan Para 1 no ghat, Chan Para office ghat, Chan Para 6 no. ghat, Noapara/ Naya Para ghat and Finish ghat/ Ruposhi ghat. Demra Landing Ghat: This is a very busy cargo and passenger landing ghat on the right bank of the river on the east of Dhaka city. The predominant passenger movement at this ghat is between Demra and Tarabo Bazar via using non mechanized country boats. Chan Para 1 no ghat, Chan Para office ghat, Chowdhuri Para Ghat, Noapara/ Naya Para ghat and Finish ghat/ Ruposhi ghat are situated on left bank of the route. In addition to Demra Tarabo ghat and Chan Para 6 no. ghat are situated on right bank of the route. Noapara ghat is situated opposite to the 6 no. Chan Bazaar Ghat. The Finish Ghat is just next to the Noapara Ghat.

Accessibility condition of link road to the route: Demra Ghat is about 15 km east of Dhaka. There’s a good road link from the city. The Dhaka- Demra road is the main approach road of the Demra Ghat. But the link road accessibility condition to the route is not good enough. Proper Link between road network and water routes is absent. The access link roads to the route are mostly dirt roads

Condition of linkage to the Ghat

This route area does not have any facilities for boats landing. For the use of country boats steps are constructed in the Chan Para 6 no. ghat, Noapara ghat and Ruposhi

ghat. Rest of the ghats does not have that facility. The users have to jump off the boat as the physical condition of the ghat is very poor. It is very risky and dangerous for the women to walk on the polluted water area, weedy environment and a very muddy and slippery river bank. Foul odors, safety, lack of facilities are the main problems encountered here.

5.3.3 Recreation activities in the route and route adjacent corridors

This route is basically used by recreational users during morning. The hat starts there in the early morning and that is the main reason for morning use. Survey has identified three major groups of recreational users' – users' who come for shopping at Jamdani hat, visit Jamdani Palli and boating. People mainly come to attend the Jamdani hat. But if they miss it then they just visit Jamdani Palli for site seeing. People also are involved here in other type of recreation activities like-site seeing, walking on river bank side, roaming with friends, photography. For outing with family member or picnicking this place is not suitable because this site is totally undeveloped for recreation purpose but has great potentialities to flourish as a recreation point. Tourist attraction spots were identified a long the vicinity of the waterway. However, by providing water scooters, speed boats, floating restaurants, etc. facilities can create attractions for recreational use of this route

Vessels

In this route, non motorized country boats (CB) are available and used by the users. There are around 100 CB in the Demra Ghat area. CB charges taka 200/- -300/- both for up and down for making trip to Noapara Jamdani Polli. MCB usually do not moving on the route but on demand it can be hired from adjacent route's ghats and landing stations with the help of the local boatman. There is a traditional cruise boat named 'M. B . Ruposhi'16 which is a traditional local sailing boat ideal for day- cruises on the rivers, parties and weekend outings around Dhaka. The boat has open air dinning space on the deck with seating arrangements for 12 guests. It provides accommodation in one large cabin with 8 beds and attached toilet.

5.3.4 Existing Land Use in the corridors adjacent to the river

Route adjacent prominent neighboring areas are Tarabo bazaar, Noapara, Dakshin Ruposhi under Tarabo Union and Rupganj Upazila on left side and Chan para at right side. Most of the route proximate areas are manufacturing and processing activities and residential lands. Existing land use on river banks Up to 50 meters from where river water reaches during high tide is considered as river bank. There are Unauthorized and illegal setup and land uses surrounding the route corridor. Illegal encroachments, sand trading on river banks and slums are set aside the route side river banks, filling through soil and sand, waste dumping on river banks and construction material piled on the river banks all of which are punishable offence and are prohibited in the regulations.



Map-14: River Encroachment on Shitalakshya

5.3.5 Present land use on the river banks River bank condition, vegetation type and walkways

No remarkable development projects have been identified in the study area. The route area is rich with a plenty of trees as a gesture towards the environment and aesthetics but not in a planned way. There is no marked off trails and walkways there.

Permitted land use for specific area in the development plans and regulations According to the proposed Detail Area Plan, the route area land use belongs to flood flow zone, non conforming use zone and rural settlement zone. All kinds of uses except permitted and conditionally permitted are restricted here. No recommendation has been set for non conforming use zone land use yet. A continuous green belt open space is suggested in DAP on the right bank near Demra Ghat.

5.3.6 Navigability:

The required draft and width of the Sitalakhys is available. No dredging is required at the moment. The water depth along the center of the river was seen to vary between 20 and 30 ft.

5.3.7 Route limitations and Problems identified in the route area

- ❖ Bad condition of the approach roads and poor access to the landing Ghats
- ❖ Absence of properly well located landing station and fixed Ghats for passenger and cargo vessels and no fixed facilities for cargo traffic
- ❖ Poor physical condition and maintenance of the landing Ghats
- ❖ Lack of organized routes and distribution of passenger trips
- ❖ Poor quality of vessels
- ❖ Unauthorized and illegal setup and land uses surrounding the landing Ghats. Piled construction materials hamper the aesthetic and environmental quality of the waterway surrounding.

- ❖ Water quality and pollution due to vessel waste product, bathing, weeds etc.No public facilities such as toilet facilities, sitting benches, drinking water, small commercial outlets etc
- ❖ Too distant from the city centre

Chapter 6: Users' Satisfaction Level Analysis and Expectations

This chapter is one of the potential parts of this study. The infrastructural development of water based transportation and the recreational development of these routes highly depends on the visitors' satisfaction. Aim of this chapter is to find out the selected three route's visitors' expectations concerning the route's transportation and recreation. To fulfill this aim it is necessary to find out the visitors' satisfaction level according to the provided facilities and services by the authorities. So this chapter has tried to find out the gaps between their expectations and reality as well as explored their likings dislikings, problems they are facing there and the suggestions they have made for the development of these routes. This exploration has helped a lot to suggest their problem's solution and recommendation for these three routes recreational development and contribute the city's recreation and place making enhancement.

6.1 Introduction

The purpose of this study is to explore the satisfaction level with various attributes of provided facilities among selected routes of water based transportation and recreational users and also to examine the nature of relationships between satisfaction at tributes and overall satisfaction. This study has been carried out with three groups of users –users of “Mirpur– Ashulia - Tongi” route, “Sadarghat-Washpur-Basila” route and “ Demra-Noapara” route.

6.2 Survey design

To explore users' satisfaction, this survey was designed with a number of items under a few domains to measure 'levels of importance' and 'levels of performance'. The number of domains can be ranged from three to ten and 33 items under six different domains to attempt to explain overall satisfaction level of users'. Environment, Transport, Recreation Facilities, Service, Information and Recreation Experience are the six different domains. A 5 -point Likert scale ranging from ' 1' t o ' 5' (where 5 is highly satisfied and 1 is highly unsatisfied) was used to measure 'levels of importance' and 'levels of performance'. Descriptive statistics is used to summarize the Likert scale data and to measure gap between visitors' expectation and reality 'Gap Analysis' method was used.

Questionnaire design

It is an exploratory type of research, which has used both open ended and close ended questions. Some factors have been taken into mind during questionnaire design like demographic characteristics of users' and factors influencing outdoor recreation behavior of users'. Users' demographic characteristics impact on overall satisfaction levels of users', their preferences and also type of recreation activities. Outdoor recreational behavior of a person or a group of people is influenced by economic changes (Technology, production market), socio-cultural (religious believes, social values, demographic condition, education), psychological (motivations, perceptions), physical and structural changes (transport and communications, land use pattern). It is noteworthy that these factors, although are presented separately, may act jointly to change behavior of visitors with respect to the Recreation and Transportation. The questionnaire included open-ended questions to capture the wide range of activities, user perceptions and attribute preferences,

liking-disliking issues, problems and possible suggestion to overcome these problems of visitors and closed-ended questions to identify demographic characteristics and their preferred recreational activities, to provide suggestion for enhancing the attractiveness of the route, and to find out river condition for recreational purpose. On the basis of those factors questions focused on three major areas: **Demographics Characteristics** (sex, age, occupation, education, income, residence), **river use characteristics** (activities, transportation to the site, distance traveled to the site and the time taken for the journey, visit length,); and **perceptions of the river** (importance of the river, potential problems, liked and disliked attributes, perceptions of recent improvements, recent condition of river for transportation and recreation purpose, and suggestions for river improvement). Last portion of the questionnaire contains a 5-point Likert scale to explore the users' satisfaction level in selected routes. Some issues and points were eliminated from the questionnaire after pretest. Respondents were asked to rate both the importance and their satisfaction with the attributes. Response categories that were rated are Highly satisfied (HS), Satisfied (S), Neutral (N), Unsatisfied (U), Highly Unsatisfied (HU) and very Important (VI), Important (I), Neutral (N), Unimportant (UI), Highly Unimportant (HUI) and were coded as follows: HS = 5, S = 4, N = 3, U = 2, HU = 1 and VI = 5, I = 4, N = 3, UI = 2, HUI = 1. Then to depict the range of responses visually, charts were used to display the number and percentage of respondents who expressed satisfactory, unsatisfactory etc. with each item under all domains. This study has tried to bring some differences because of different context of Bangladesh from the developed world where river side transportation, communication and recreation facilities already exist in a well developed form and in Bangladesh river side this concept is totally undeveloped but not new.

6.3 Findings

Data were further analyzed and interpreted to formulate the survey findings. However, the findings of the field survey at different routes have been described in the following sections. Demographic characteristics and river use characteristics of each route users' are illustrated below. Some subgroups are made under each group according to their demographic characteristics and river use characteristics by correlating them.

6.3.1 Findings of "Tongi- Ashulia- Mirpur" route

6.3.1.1 Demographic characteristics of visitors' Gender: The survey represents that number of male users' (78%) are greater than female users' (22%) in the "Tongi- Ashulia- Mirpur" route. But actually the difference between the ratio of male and female visitors is not so high. Maximum no. of visitors come to visit this route are couples. Most of the female visitors did not show any interest or hesitate in answering questions because they did not want to disclose their identities and then her male partner responded. Sometimes the male partners were interrupting in between the interview and then the female partners stopped.

Education

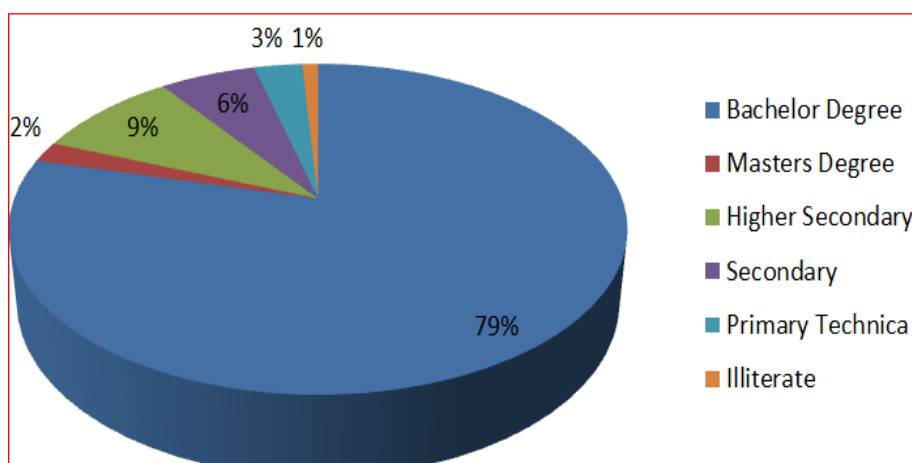


Fig 2: Education

Fig No.2 shows that a prominent group of visitors are students studying in higher secondary school, secondary school and University. Maximum numbers of visitors, about 79%, are doing their Bachelor degree or already have completed it. About 2% and 3% of visitors are students of Masters Degree and primary respectively. The higher secondary scores at 9% whereas secondary 6%. Negligible percentage (1%) of people is illiterate.

Occupation

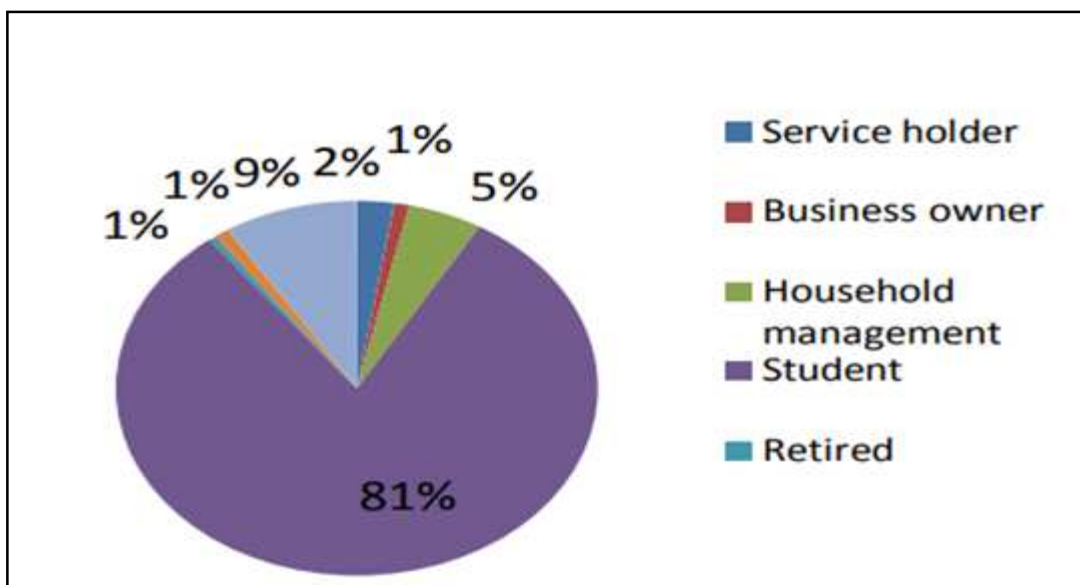


Fig 3: Occupation

Dominant occupation of visitors, about 81%, is student; that means young people are very much interested to visit here with their friends. Retired persons (1%) also come here to spend some time in calm and quite environment. 1% of visitors is businessman, 2% of them are service holder, 5% is engaged in household management, 1% is unemployed and 9% is self employed.

Age: Survey has identified that visitor of all age specially ranging from 10 to 40 years old gather here to spend some time with their family, friends and beloved person.

Aged people also like to visit here but their intention is focused on health rather than recreation activities but they are very few in number. Young people, especially age between 20 to 25 years old, are the key focus group of visitors' in this route.

Family income:

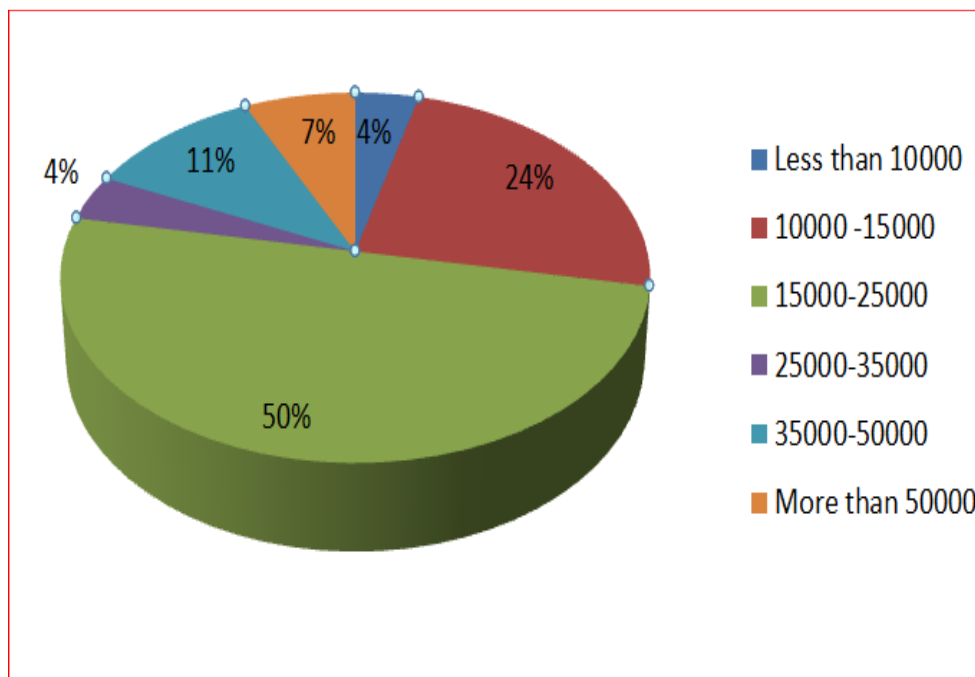


Fig 4: Family Income

Above chart indicates that percentage of visitors with family income range between 15,000 to 25,000 taka per month is highest (49%) and second highest (25%) belong to 10,000 to 15,000 taka per month. So, this statistics has established that middle income people represents as the prime group of visitors here because people with family income between Tk. 10,000 to Tk. 25,000 (74%) belong to middle class. Along with middle income people the other prominent group is higher middle income (16%) and higher income visitors (7 %) with family income above 50,000/- also like to spend their leisure here. But lower income visitors (3 %) with family income less than 10000/- are not so much interested.

Living area of visitors Visitors come from all the segments of Dhaka city and its surrounding areas like Dhanmondi, Kochukhet, Uttara, Savar, Narayanganj, Mohammadpur, Kazipara, Gazipur, Agargon, Motijhil, Rampura, Mohakhali, Greed road, Dhaka University etc. But highest portion of visitors originate from Mirpur area. City center has scattered and clustered form of open spaces and recreation spots. Dhanmondi Lake, Crescent Lake and Gulshan Lake are notable open recreation spaces which are inadequate in number against demand of the city. People from different parts of the city come here to relish the juvenile beauty of this water route and are greatly fascinated to visit here with their friends and families to enjoy natural beauty and to pass their leisure time.

6.3.1.2 River use characteristics

Transport Pattern

Public transport is used by 40% users, it means this route is well connected and easily accessible by road way. 20% of visitors travel by private cars, 16% use bike and 10% use auto to reach here whereas 14% use rickshaw. This site is basically dispersed from locality so without transport, this site is not reachable on foot. Most of the visitors travel over two to four miles to reach this site and it takes maximum 1.30 to 2 hours.

Frequency of visit

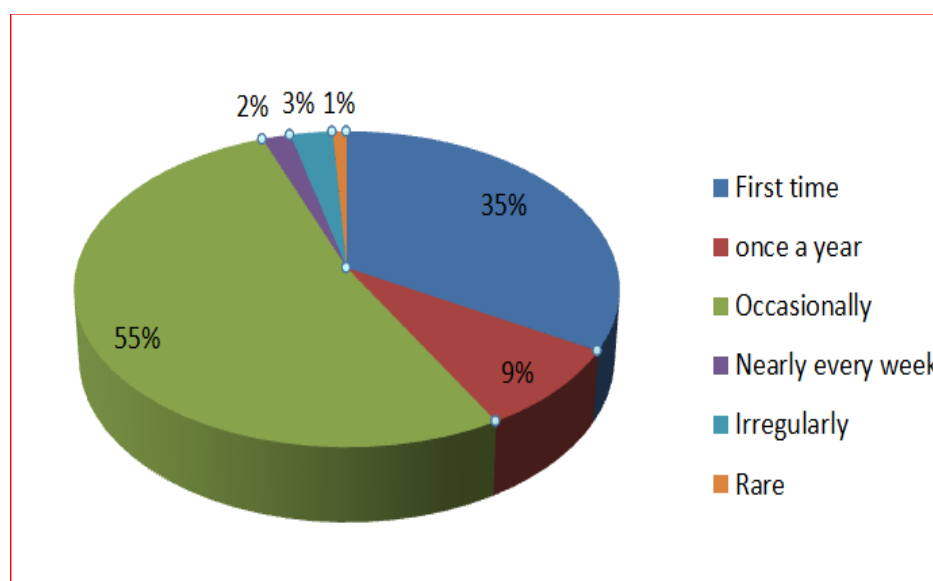


Fig 5: Frequency Of Visit

Survey shows that maximum visits are held on the basis of personal or other special occasions of visitors; 65% of visitors has agreed that they like to make a visit here to celebrate their birth day or marriage anniversary or Valentine's Day, Friendship Day; religious festivals like Eid- Ul- Fitr, Eid- Ul Azha, Puja, Christmas; cultural festivals like Pohela Fulgun, Pohela Baishakh, and other special Occasions. 20% visitors have visited this route for the first time, 9% have visited it once a year, whereas 3% come here irregularly, 2% nearly every week. 1% users' visits the route rarely and there was no visitor found who visits the route every day.

Visit time Generally visit length is large enough (3 to 4 hours), as a result visitors (60%) prefer to come here at afternoon to enjoy recreational activities but about 40% of the respondents majority of whom are young couples have a preference to get there at morning because of maintaining their privacy. Due to lack of security and safety, absence of required facilities at recreation spots etc. visitors try to return before sunset; hence at evening no one is interested to come here. Thereafter, the visitors, especially the young people who Survey shows that maximum visits are held on the basis of personal or other special occasions of visitors; 65% of visitors has agreed that they like to make a visit here to celebrate their birth day or marriage anniversary or Valentine's Day, Friendship Day; religious festivals like Eid- Ul- Fitr,

Eid- Ul Azha, Puja, Christmas; cultural festivals like Pohela Fulgun, have their own vehicles like private cars, motor cycles, etc. sometimes tries to enjoy the juvenile night's beauty under the full moon.

Recreational Activities

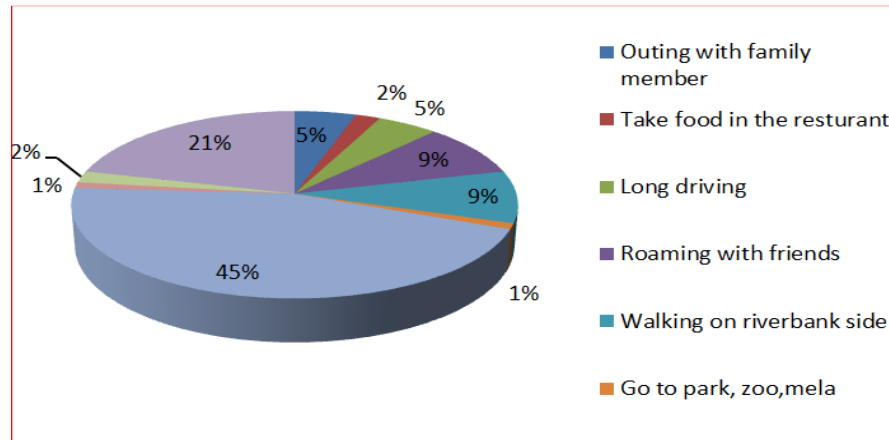


Fig 6:Recreational Activities

Survey has identified that visitors are engaged in eleven different types of activities here like site seeing (47%), boating (19%), roaming with friends (10%), walking on riverbank side (8%), outing with family member (5%), long driving (5%), take food in the restaurant (2%), go to park, zoo, mela (1%), photography (1%), fishing (1%), and picnicking (1%). Most of the visitors have a greed with the fact that river is the key element for generating their recreational trip. Though water quality of river is terrible and causing detrimental effects to its surrounding area, it is not interfering with visitor's use and enjoyment of the river.

Enhancement of attractiveness of the route Most of the respondents have agreed with the necessity of enhancing the attractiveness of the route. During the survey, some possible proposals were provided to them to know their opinion about which option they like most as the prerequisite of enhancing attractiveness of the route. 5% of them went with the provision of planting seasonal flowers and plants, 40% of them supported regular cleaning and maintaining initiatives, the highest percentage (50%) of them suggested to take initiatives about increasing facilities to the site and 4 % and 1 % of them recommends respectively about incorporating commercial outlets and reserving area for vegetation and wildlife along the route.

Quality of river for recreation

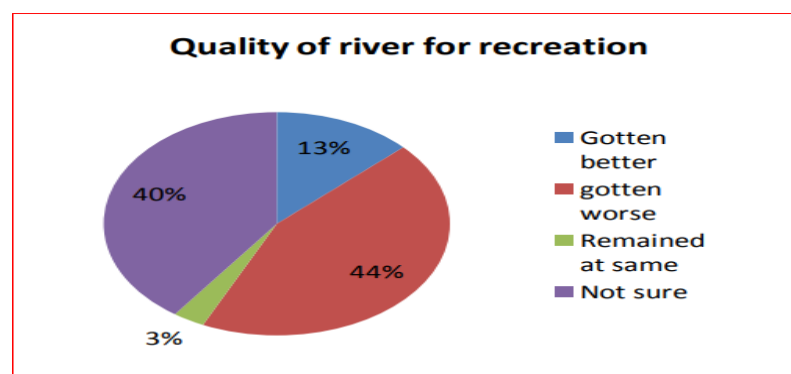


Fig 7:Quality of river for recreation

44% of respondents think that over the last several years' rivers in and around Dhaka has gotten worse for recreation and 40% of respondents have no idea about it. That means a huge portion of visitors have no interest in anything related particularly on rivers or they are very much familiar or used to with this existing situation. 13% of respondents think river condition has gotten better than before for recreation purpose as Ashulia tourist spot, Tamanna Complex, Monpura restaurant are established and flourished as recreation attraction points few years ago. Dhanmondi Lake and Crescent Lake are most favorite water side recreation areas beside this peripheral river side recreation point.

6.3.1.3 Likings, Dislikings, Problems, and Suggestions

Likings and dislikings

During survey, respondents were asked to response open ended questions about what they liked and disliked about the site. Majority of users' did not provide any concrete answer or said not sure when asking for their opinion about open ended questions because of their lack of perception about that concerning issue but when they were asked to answer the close ended Likert scale for their satisfaction level measurement their responses were quite satisfactory. Very few respondents (37%), comparatively aged person rather than young people responded to the open ended questions and express their experience about their disliking and problems.

The visitors like most the scenic beauty and solitude of the river. Serenity and relaxing environment, picturesque landscape, and views of and from the river, river side green paddy fields and open spaces the river provides attracted the visitors. Boating facilities of Ashulia landing station, physical arrangement and facilities of Tamanna complex also satisfied them. Water quality problems with pollution, color, odor of river mainly disappointed them the most. Although male visitors love boating as popular recreation activities here but they dislike poor and unimproved ghat condition the most or boat landing area condition. Those who come here with kids and women do not show much interest for boating for all these reasons most of the time.

Problem identified by the visitors here When the visitors were asked about the problems they faced here, many respondents said "nothing" because of their lack of perception, avoiding tendency due to lack of time. Some of them willingly expressed their experience about the problems like –

- ❖ Poor physical condition of the boat landing ghats and inadequate facilities.
- ❖ Poor quality and absence of public equipments like-sitting arrangement, waiting space, shades, insufficient food and drinking corners, drinking water scarcity etc.
- ❖ Absence of toilet facilities; especially for female visitors it is their most common problem
- ❖ High cost of food and drinks
- ❖ Another important problem is because of unethical behavior and attitude of young couple, other visitors who attain here with their family and kids have to fall

into embarrassing and awkward situation .They said that because of this type of circumstance they are not interested to come here next time with their family specially kids and they demand separate zone for young couple to get relief from this type of uncomfortable situation.

- ❖ Disturbing and annoying attitude of Transsexual (Hizra) toward the couples.
- ❖ Sand traders encroach river bank areas by sand lifting up from river bed and deposits here and there on river banks which hampers the aesthetic beauty of the river route.
- ❖ Enormous numbers of brick fields are established by river side low land area destroying aesthetic beauty and environment of this route.
- ❖ The users' want to come closer to the water but no provision for that is present there.
- ❖ Absence of definite trail or walking way, seasonal plantation and vegetation along route side area.
- ❖ Due to absence of provision for safety, security and regular services like lighting, guard arrangement etc incidents like hijackings are happened there in this route sometimes.
- ❖ Due to absence of parking facilities visitors, especially male visitors has to concentrate more on their private vehicles rather than enjoying their leisure.
- ❖ Absence of any authority that is responsible for taking care of these river side recreation spots.
- ❖ Overall absence of modern information system.

Suggestions The users' have suggested solving these problems immediately and this site should include different types of recreational activities specially which attract the kids more. Also increase recreational facilities, develop more restaurants and other riverside destinations reachable by foot or boat, plant seasonal plantation and vegetation along river side, develop park space and a river walk. They also have suggested that this area should be protected enough to ensure visitor's safety and security. The users' most desirable expectation is to come closer to the water. Another expectation is to have modern type of vessels and boating facilities and specific parking space for car parking. During survey most of the visitors have showed high desire to do fishing here but this route do not provide such type of arrangements. So they demand fishing club and fishing arrangements like-specific spot and sitting arrangements for fishing, fishing instruments etc. According to this group of recreational users', any organization like Porjoton Corporation may take over the responsibility of these river side recreational spots or this can be held by any other government or private organization. With existing commercial development and public equipments, they are very much upset. Demands of visitors are limited; according to them basic necessity should be fulfilled by the concerned authority.

6.3.1.4 Performance level analysis of different domains at “Tongi-Ashulia-Mirpur” route

To identify the performance level of items under different domains at **Tongi-Ashulia-Mirpur** route, a five point likert scale has been used and highest scored domain and lowest scored domain are identified. Significant differences are noted for satisfaction within six domains. Recreation experience domain shows the highest scores for this

measure (mean = 3.05) and 'Information' shows lowest satisfaction levels and its mean value is 1.63. This statistics reveals that those visitors are comparatively satisfied with 'recreation experience' domain and this selected route area failed to provide minimum range of information facilities to its visitors. No significant difference is noted among other domains.

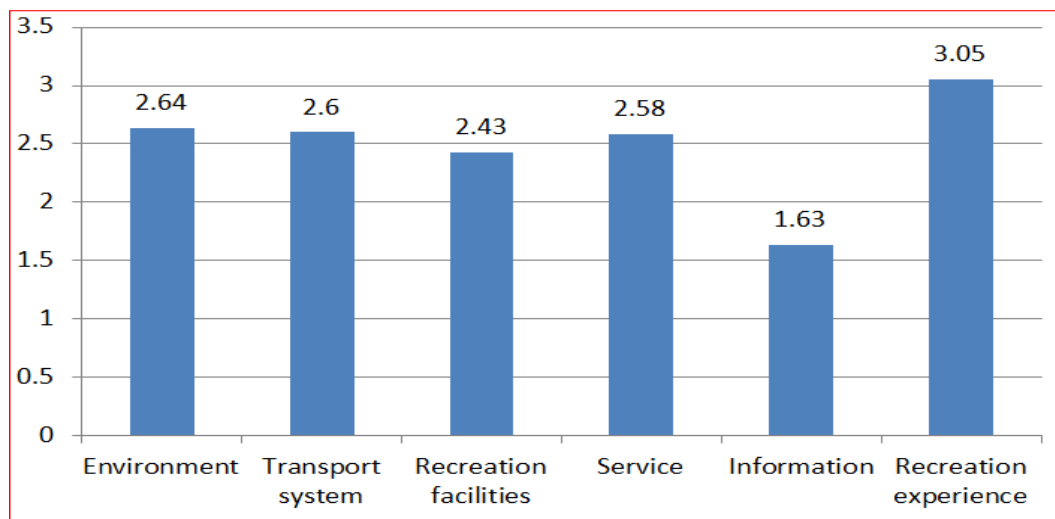


Fig 8: Performance level of six domains at “**Tongi- Ashulia- Mirpur**” route

6.3.1.5 Problems identified by young couple group

- ❖ Disturbing and annoying attitude of Hizra; they harasses visitors for money.
- ❖ Absence of waiting space and sitting arrangements, toilet, inadequate drinking and food corner
- ❖ Poor water quality and odor
- ❖ According to them safety provision of this site should be strong enough and commercial development like gift shop, well furnished restaurant or food corners should be established here. Problems identified by those visitors who come here with family or friends
- ❖ Lack of safety and security provision
- ❖ Absence of parking facilities
- ❖ Inadequate commercial development
- ❖ lack of maintenance and cleanliness
- ❖ Visitors want to go fishing here but there is no arrangement

Visitors who come here with kids said that Ashulia landing station mainly represent as a recreation spot for young group of people. If this spot is provided with some kid's suitable facilities and activities they also can come here to enjoy with their kids. Safety and security issues are also very much important for them. Scenic beauties of this route, its peaceful at mosphere, are equally liked by these three groups of visitors. According to them poor water quality and odor, low water holding capacity of rivers all are disliking issues of these route. According to them over the last several years rivers in and around Dhaka have gotten worse for recreation and facilities should be included to make rivers of Dhaka used as recreational areas for the dwellers of the city.

6.3.2 “Sadarghat-Washpur-Basila” Route

6.3.2.1 Demographic characteristics of visitors

Gender and Age: Female visitors cover only 22% and remaining 78% are male visitors. Survey has identified that visitor of all age ranging from 14 to 50 years visit here. Major portion of visitors belong to the age group of 20 to 25 years old. **Education:** Among the respondents, majority fulfill both the bachelor degree (26%) and secondary school criteria (26%), 17% are in higher secondary school, 22% belong to the master's degree group and remaining 9% are illiterate

Occupation

Dominant occupation of recreational users who visit the “Washpur-RayerbazarKatashur” route is student (48%). The percentages of other recreational users' occupation are self-employed (23%), business owner (17%), household management (9%) and others (3%).

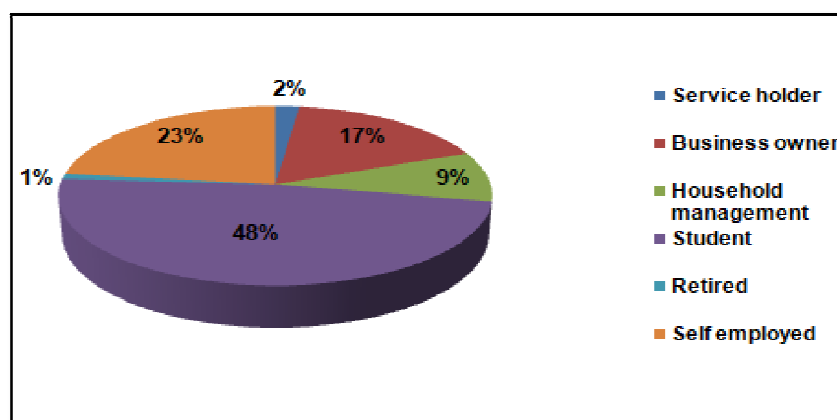


Fig 9: Occupation

Family Income per month

30% of visitors with family income ranging from 15, 000 to 25, 000 taka per month are highest and 23% of visitors have family income between 10, 000 to 15, 000 taka per month; Family income of 22% visitors is 35, 000 to 50, 000. 4% of total visitors have family income above 50,000/- and 4% have family income less than 10000/-. So, 53% visitors belong to middle income group and 4% belong to lower income group.

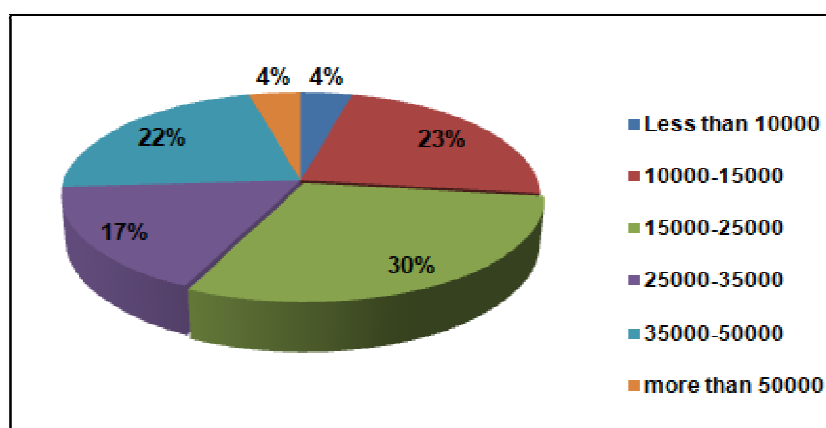


Fig 10: Family Income per month

Living area of visitors

From survey it has been identified that visitors come here mainly from Savar, Mohammadpur, Mirpur, Hazaribagh, Farmgate, Kazipara and Sadarghat area.

6.3.2.2 River use characteristics

Transport Pattern

39% of visitors make a trip here by auto and 35% of visitors use public transportations. 15% of visitors come here using private transports. People living near the river or the monument (7%) come here by rickshaw. 2% come here by bike and 2% of total visitors get here on foot. Most of the visitors have to travel over two to four miles and it takes maximum 1.30 to 2 hours.

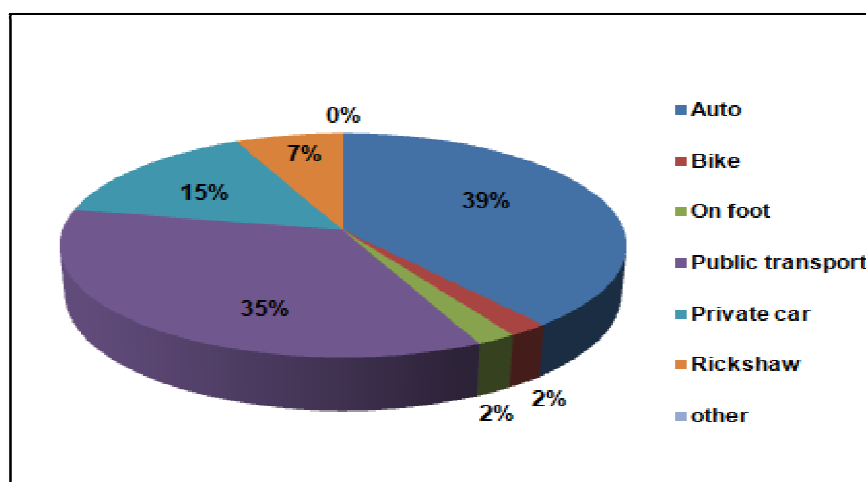


Fig 11: Transport Pattern

Frequency of visit

During the survey it has been identified that 48% of visitors come here for the first time, 39% of visitors like to come here occasionally, 9% come here by chance and 4 % of them come here irregularly.

Visit time

70% of the total visitors usually come here at morning and the rest 30% frequently visit in the afternoon. Visitors generally come here for site seeing and roaming with friends and normally visiting time of these visitors last for 2.5 hours to 3 hours.

Importance of river for recreation purpose

According to 60% of visitors, river is somewhat important for their recreation purpose. For 22% of visitors river is not important and 18% of them find it very important recreational element.

Quality of river for recreation

According to 77% of respondents, over the last several years rivers in and around Dhaka has gotten worse for recreation and 21% of respondents are not sure about it and 2% of them said that it has gotten better

Recreational Activities

From survey it has been identified that this site is involved in few activities like- site seeing (41%), roaming with friends (39%), outing with family member (12%), walking on riverbank side (7%) and 1% visitors are involved in boating. In wet season boating is also held here but in visitors' private initiatives. They love to do boating here but due to the absence of boating facilities; they are highly disappointed with that.

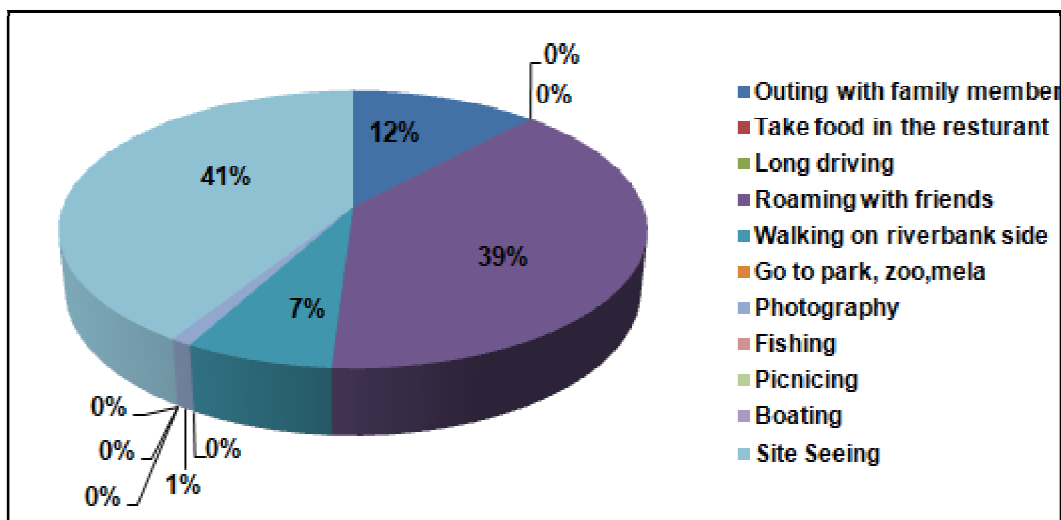


Fig 12: Recreational Activities

Enhancement of attractiveness of the route

Most of the respondents agreed with the necessity of enhancing the attractiveness of this route. As the provision of enhancing attractiveness of the route, 55% respondents went with provision of cleaning and maintaining facilities, 27% by increasing facilities, 15% supported planting seasonal flowers and plants, 2% liked commercial outlets and 1% preferred reserved area for vegetation and wildlife along the route. Beside this peripheral river side recreation site, they mostly prefer Dhanmondi Lake as water side recreation point.

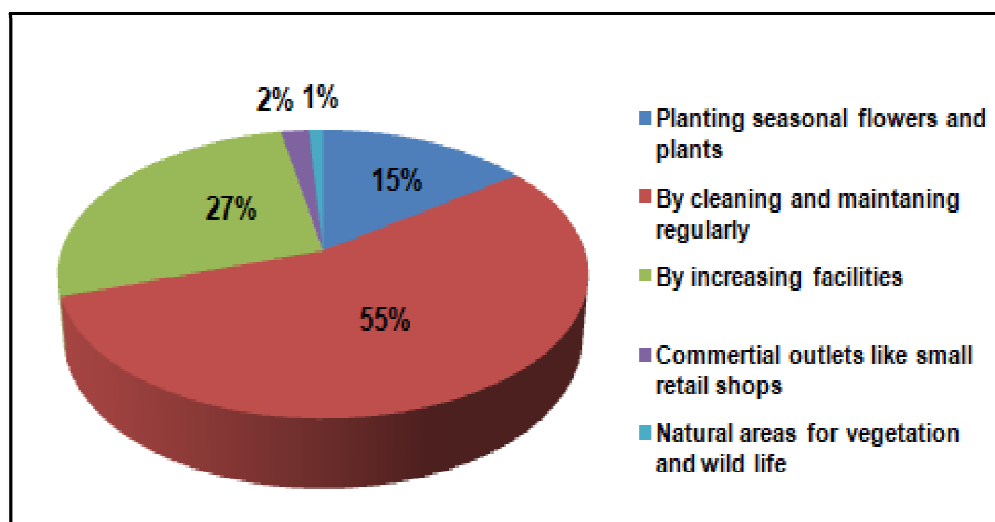


Fig 13: Enhancement of attractiveness of the route

6.3.2.3 Likings Dislikings, Problems and Suggestions

Likings and Dislikings

The Martyred Intellectuals Memorial and tone of its surrounding areas are main attraction for the recreational users'. Visitors define this place as relaxing and aesthetically pleasing area and its openness and refreshing air attract them more to visit here. To introduce our rich history of liberation war visitors come here with their kids to show Martyred Intellectuals Memorial. At the same time they visit surrounding area, introduce their kids with river, and take photographs. They disliked river bank condition; polluted water and river bank encroachment, poor condition of ghats and absence of boating facilities the most about this route.

Problems

- ❖ Poor river bank condition and water quality, odor all are problematic issues here.
- ❖ They also complain about safety issue. Local goons and drug addicted vagabonds reside along the monument or river side areas.
- ❖ Especially for women and kids, absence of toilet facilities identified as a significant problem
- ❖ Visitors are extremely disturbed by vagabond's annoying attitude and they identified it as a great problematic issue for all visitors.
- ❖ Absence of food corners or restaurants.
- ❖ This site is perfect for boating or fishing and visitors have high demand for that type of activities but this site lacks such type of arrangement.

Suggestions

They have suggested that government should take initiatives to develop this route and its surrounding area as recreation attraction point for city people. They demand different kinds of recreational activities especially which attract kids, they also like to have water based recreational activities like boating, fishing etc. After construction of Bosila bridge water way transportation become less important for people and their access become much easier. They want different types of recreational activities to do here; only site seeing could not satisfy them at all. They have said that this site is completely suitable for boating but authority has no concern about it; which can be possible if authority cooperates. Authority can also provide fishing facilities or arrange and develop some specific point along the river side for fishing by private initiatives. Visitors said that huge amounts of low land had already been encroached by different housing company and encroachment is still going on, which is very risky for city ecology and environment. They are very much anxious about this issue. Water pollution of the river is mainly caused by domestic waste and domestic sewage which adds odor to waters. Visitors have suggested that development of river side area as a recreation spot is one of the best opinions to stop river encroachment. They suggested that if authority take any initiatives to include basic recreation facilities like boating facilities, fishing facilitates, regular services, maintenance and cleanliness in this site, it will be able to generate and attract huge

quantity of river recreation visitors. Government should take initiatives for this type of plan or program.

6.3.2.4 Performance level analysis of different domains at “Sadarghat-Washpur- Basila” Route

To identify the performance level of items under different domains at “WashpurRayerbazar- Katashur” route, a five point likert scale has been used and highest scored domain and lowest scored domain are identified. Each and every domain gets poor or unsatisfactory score because more or less all items under each domain cannot satisfy its visitors. Little differences were noted for satisfaction within six domains. Recreation experience domain showed the highest scores for this measure (mean = 2.89). ‘Information’ domain showed lowest satisfaction levels and its mean value is 1.62. During survey , some items had to be eliminated from ‘recreation facilities’ domain, ‘service’ domain and ‘recreation experience’ domain because those items are totally absent from the site.

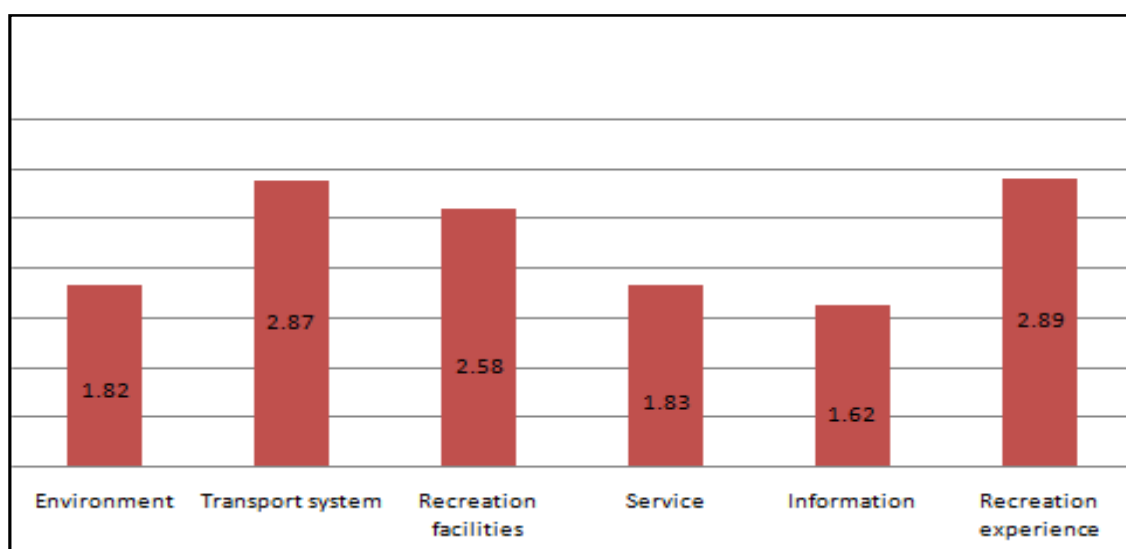


Fig 14: Performance level analysis of different domains at “Sadarghat- Washpur-Basila” Route

Visitors who come here for site seeing and roaming with friends

Visitors who come here with friends or with their beloved ones love to site seeing at river side area or chatting at the spot of Martyred Intellectuals Mausoleum (Buddijibi Monument). Although they love to site seeing here and especially come here for enjoying it's refreshing atmosphere, poor water quality, odor of river create an negative collision which directly impact on their satisfaction level of site seeing. Other than site seeing and roaming with friends they want to do different types of recreation activities and their high demand is to reach near to the river so that they could touch river water. This group of visitors is mainly concerned about safety issues because incidence of hijacking by local goons or drug addicted people who reside at nearest slum area of embankment often takes place here. Trees, greenery and vegetation areas are important items for any recreation area and absence of these element loses the importance of recreation value. Majority of visitors become unsatisfied with the item of river bank condition and natural area for vegetation and wild life , because natural area for vegetation and wild life is absent from the site and

encroachment of river has turned river bank conditions vulnerable. Major portion of visitors wish to do boating here but there exists no private or public authority that have any interest to provide such type of recreation facilities which is disappointing for them. Visitors expect the government will take initiatives to develop this area as an attracted recreation points, at least basic requirement and facilities for visitors should be included in this site. For enhancement of attractiveness of the route, 45% of visitors want cleaning and maintaining initiatives, 40% of visitors like increased facilities, 8% of visitors want planting seasonal flowers, and 6% of visitors demand for commercial development.

Visitors who like to outing with family

This group of visitors likes to come here at morning in weekend and at evening in week days and like to spend a long time here. Their main intention is to visit Martyred Intellectuals Mausoleum and then it's surrounding area, walking along the river side, and taking photograph etc. But they are very concern about safety and security of this site because this route area has a large size of slum where all types of unethical activities are done. Public equipments like toilet facilities, shade, food corner are absent from this site which are very necessary requirements for this group of visitors. They have said that if this site could be provided with necessary facilities and arrangement of recreation activities kids would love this place more. They also demand for an arrangement that they could reach near the river as they want to spend some time there or do river related activities like boating. Absence of greenery along the river side is an issue for this group of visitors. For enhancement of attractiveness of the route, this group has given priority on increased facilities (43%); 32% of visitors put importance on cleaning and maintaining initiatives , 15% of visitors want planting seasonal flowers, 8% of visitors demand for commercial outlets and 2% of visitors liked natural area for vegetation and wild life. 86% of visitors are unsatisfied with pedestrian link and 67% of visitors are unsatisfied with access roads. 85% of visitors are satisfied with the item integration with other mode of transport. For its natural scenic beauty and attractive at mosphere, 59% of visitors are satisfied and 28% of visitors are highly satisfied with the item 'relaxing and aesthetic pleasing atmosphere'.

6.3.3 “Demra- Noapara” Route

6.3.3.1 Demographic characteristics of visitors

Gender and Age

During survey it has been observed that major portion of visitors is male (66%); although difference between male and female visitors are not significant. In some cases because of high distance from city center female visitors are not always very much interested to come here. Survey has identified that young aged group of visitors; especially age ranging from 20 to 25 years old like to visit here; young people especially young couple come here to enjoy boating and site seeing and older people like to shop at Jamdani Palli.

Education

Survey shows that majority of visitors are higher educated; Masters Degree (30%) and Bachelor degree (30%). Illiterate visitors cover 1% of them. 20% and 15% of visitors were studying in higher secondary and secondary level respectively. 4 % of them are primary students.

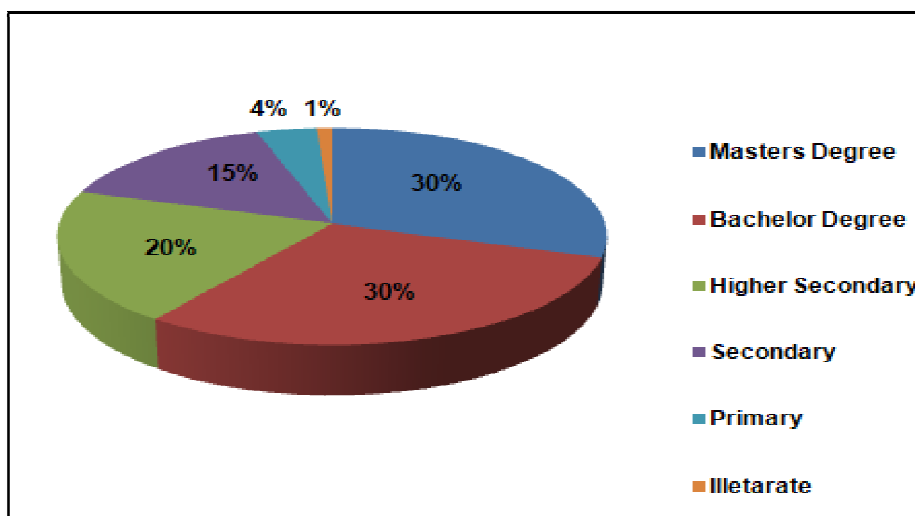


Fig 15: Education

Occupation pattern

Survey has concluded that 40% of visitors were students; basically they come here to enjoy natural beauty of river and boating or photography. Service holder (20%), self employed person (20%) and people involved in house hold management (13%) also very much interested to spend their leisure here or like to attend to Jamdani Hat held in Jamdani Palli every Friday. 6% of visitors involved in business; most of them come here for business purpose like buying Jamdani sari for their cloth shop and enjoyment.

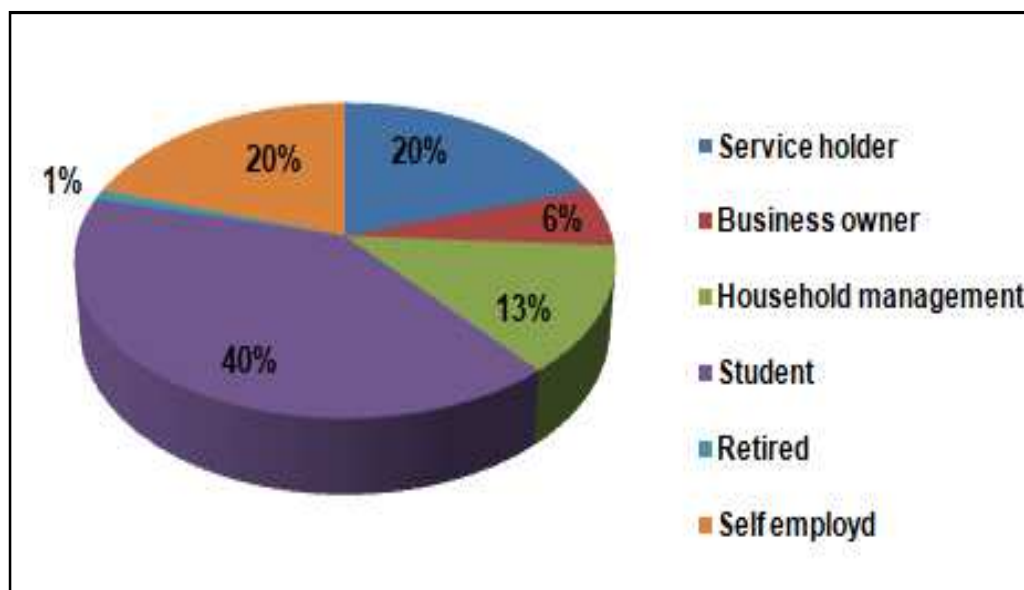


Fig 16: Occupation pattern

Family income

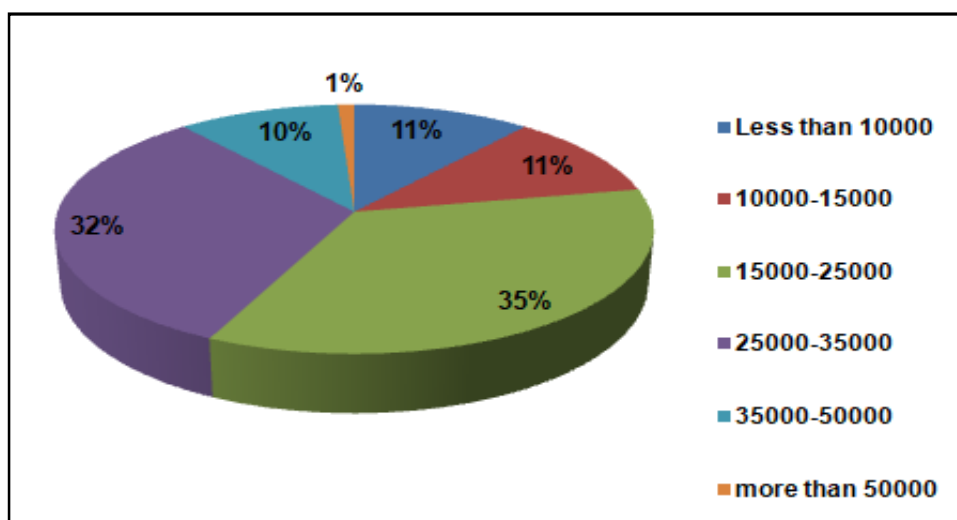


Fig 17: Family income

Two income group of visitors; income ranging from 15,000 to 25,000 and 25,000 to 35,000 got first and second highest percentage of visitors (35% and 32% respectively). 11% belongs to 10,000 to 15,000 income ranging group. So, middle income group (46%) and upper middle income group of visitors are considered to be the 11% of visitors for less than 10,000 income ranging group belong to lower income group and 10% belongs to 35,000 to 50,000 income group. So it can be said that all categories of income group like to make a recreation trip here.

6.3.3.2 River use characteristics

Visit of frequency

68% of visitors said that they come here occasionally 'especially for shopping from Jamdani Hat. 15% of them visit here for the first time and also want to come here again. 13% of them come here once a year for visit or shopping purpose. 3% of visitors irregularly come here and 1% of them come here in rare case.

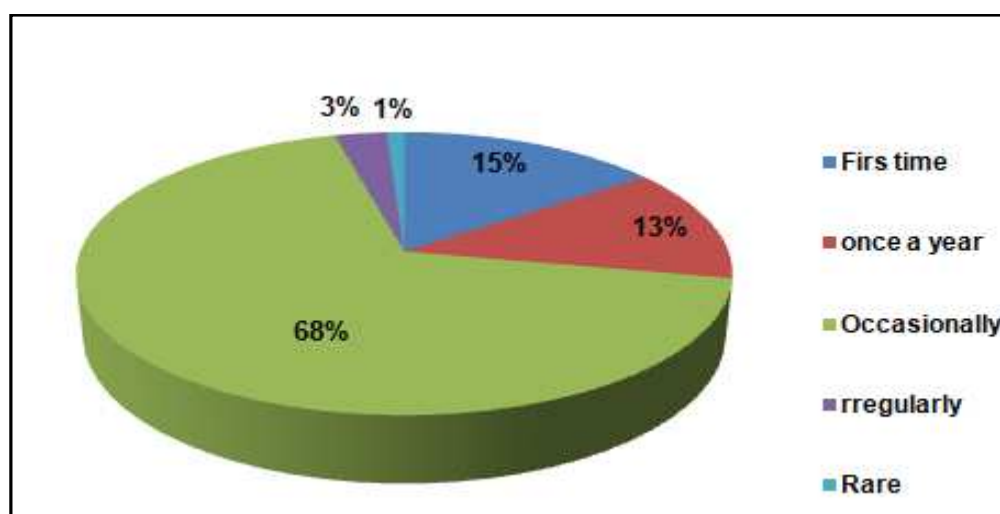


Fig 18: Visit of frequency

Visit time

Visitors come here only in weekend and maximum numbers of people come here to attend Jamdani Hat that is held at “Jamdani Palli” which starts from 4.00 am and end at 8.00 am. Beside this, because of the long commute and large distance from city center, maximum people prefer to come here at morning; 85% of visitors agree with that. 15% of visitors especially who live in the surrounding areas of this route come here at afternoon. Evening is totally not preferred by visitors as recreation period.

Transport Patten

Some respondents lived or worked near the site where survey was done (Ruposhi ghat) and they came here on foot or by bike or rickshaw, but others who traveled miles from their homes (city center) usually reached here by public transport or boat or using both type of transportation or private vehicles. After ‘Tarabo Bridge’ has been constructed; usage of land transportation has increased, but many people still prefer both water ways and roads to get here. The second “Sitalakhya Bridge” is locally known as “Demra Tarabo Bridge”

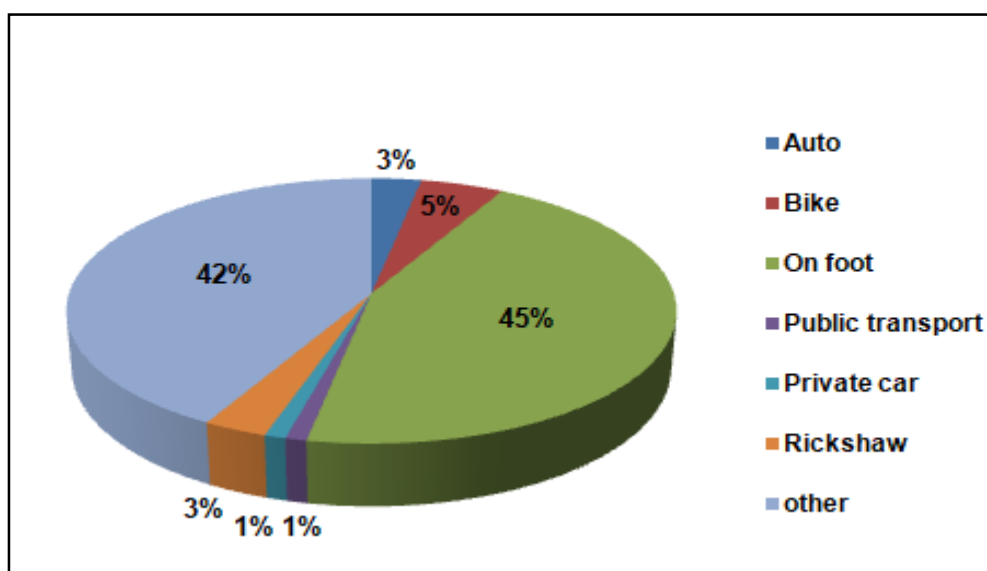


Fig 19: Transport Patten

Importance of river

According to 40% of visitors, river is very important for making their recreation trip. For 27% of visitors, river acted as a passive element for their recreation purpose and 33% of them agree with that it is not so much important for their recreation activities.

Recreation activities

Survey has identified three major groups of recreational users’ –who come for shopping (25%), visit Jamdani Palli (28%) and boating (25%). People also involve here in other type of recreation act ivities like-site seeing (10%), walking on riverbank side (1%), roaming with friends (2%), photography (8%) and fishing (1%). For outing with family member or picnic this place is not suitable because this site is totally undeveloped for recreation purpose but has great potentialities to flourish as a recreation attraction point.

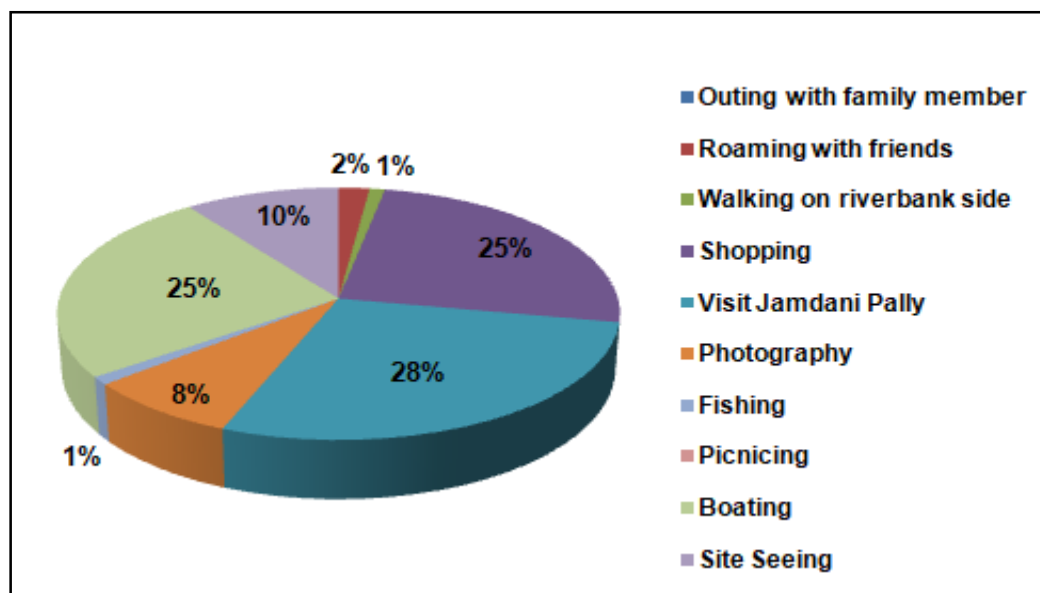


Fig 20: Recreation activities

Enhancement of attractiveness of the route

People have not showed any interest to provide some suggestion against those problems they felt but they started answering with full spirit when they were provided with some option or closed ended questions. Most of the respondent agreed with the fact that the necessity of enhancing the attractiveness of the route. 1% of them suggested about provision of planting seasonal flowers and plants, 24% of them supported about regular cleaning and maintenance initiatives, 18% of them suggested taking initiatives about increased facilities to the site and 20% and 6% of them recommended respectively about commercial outlets and reserved area for vegetation and wildlife along the route. 14% of them went with landscape water way, 16% suggested to improve the condition of the water way and 14% supported including fishing facilities for recreational users’.

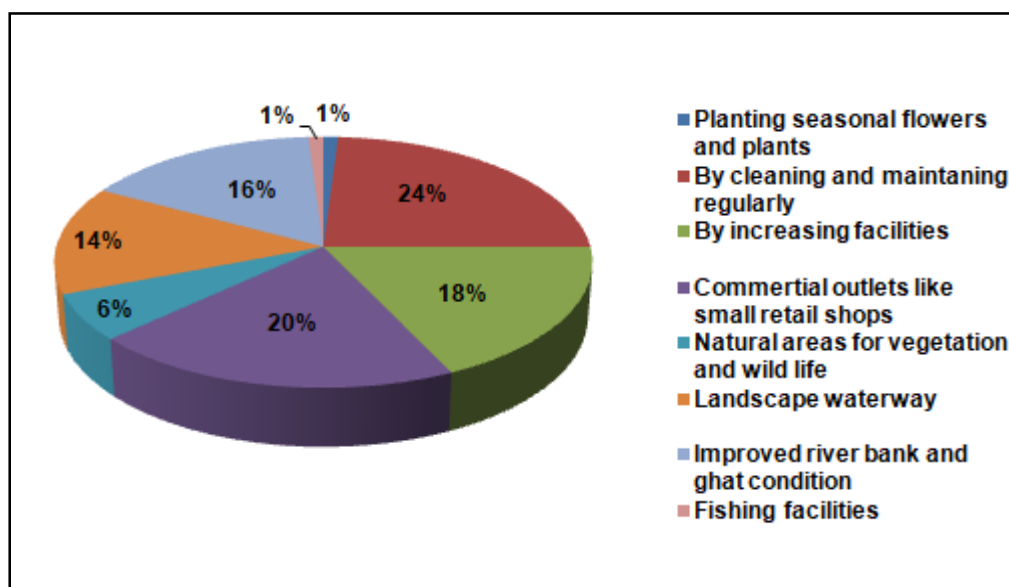


Fig 21: Enhancement of attractiveness of the route

Quality of river for recreation

According to 85% respondents, over the last several years rivers in and around Dhaka have gotten worst for recreation purpose and 7% respondents had answered that river condition remained same as past condition. 5% of respondent opined that river condition has gotten better than before for recreation purpose and 2% of them had no idea about this statement. Other attractive water way recreation place for visitors' are Ashulia, Beribadh, Gulshan Lake, Dhanmondi Lake, and Crescent Lak.

6.3.3.3 Likings, disliking, Problems and Suggestions

Likings disliking

The respondents like 'Jamdani Hat' the most where they can buy Shares at reasonable price, atmosphere of 'Jamdani Palli', scenic beauty of river and the surrounding areas. Rural environment of this route also attract them. Poor water quality and odor, Demra slum, river bank pollution and especially poor ghat condition and absence of fixed ghat all are identified as negative characteristics of this route. Visitors don't like the monotonous type of country boat and its existing conditions. Boating is their preferred recreation activities here but poor vessel type and condition often discourages them. Existing vessels are all country boat type which has no shade; so they have to come here for boating at morning or evening. During wet season they fall into awkward situation. Visitors who come here with beloved ones and want some privacy, due to these problems they become uninterested and sometimes return without completing the journey. Identified problems by the users'

- ❖ According to them hijacking by local goons is the common problem for visitors here and it has no solution because this site is mainly a rural area with no police protection and if visitors complain about it at concerned police stations they show unwillingness to take such types of cases.
- ❖ According to visitors especially who like to boating here water accident is identified as a problem because this route is used by passenger carrying boats and sand carrying vehicles (Bolgates).
- ❖ Water pollution by spilling oil from mechanized boat, dumping human waste from boats and by villagers, dumping domestic waste into river and rotten water hyacinth.
- ❖ Absence of BIWTA provided landing station and scattered distribution of ghats.
- ❖ Poor ghat condition and absence of fixed ghat identified as an important problem here.
- ❖ Poor vessel quality
- ❖ Due of lack of information many visitors sometime miss the 'Jamdani Hat'
- ❖ According to female visitors most common problem is absence of basic requirements, especially like toilet facilities. Because of lack of safety in this area they are scared to come here or visit for a long time. Female visitors are not comfortable to come here without male partners or relatives.

Suggestions

They suggested that basic requirements for visitors' like toilet facilities, retail outlets etc. should be provided here. The visitors also wanted food corner and sitting

arrangements along the river side. The basic prerequisites should be improved for the development of the ghat, as boating is common activities for both passenger and recreational users. According to the visitors safety issue should be considered as high priority. Although they have high desire to visit 'Jamdani Palli', because of such incidence they don't feel safe to come here again. They also want proper development of this site as true recreational attraction point and hope that safety issues would automatically be solved then. Safety and security of visitors should be taken into attention by concerned authority. Visitors suggested and demanded for a responsible authority who will take charge of this route to establish it as an attractive recreation point. Authority should take initiatives to flourish 'Jamdani palli' as an attractive tourism spot and will take initiatives for wider range of publicity and advertisement through media.

6.3.3.4. Performance level analysis of different domains at "Demra- Noapara" Route

Recreation experience domain showed the highest scores (2.92) and 'Information' domain showed lowest satisfaction levels and its mean value is 1.37. This site is totally undeveloped and especially for recreation purpose this site is not able to provide its basic requirements. But this area has high potentialities to explore as attractive recreation site because from survey it has been identified that without any facilities this site already has a great number of visitors. For this reason items under each domain contain very low satisfaction scores and except few items all of them expressed as unsatisfactory or highly unsatisfactory item.

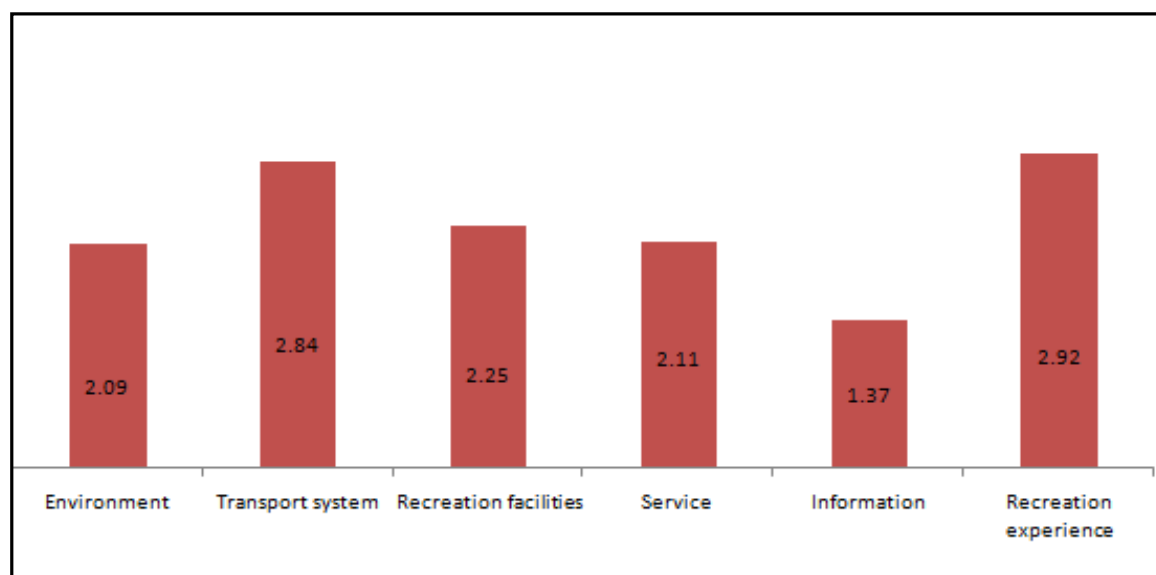


Fig 22: Performance level analysis of different domains at "Demra- Noapara" Route

Visitors who like to shop here

Main aim of this group of visitors is shopping at 'Jamdani Hat' and for this reason they have to come to the Hat at 4.00 am when Hat starts and ends at 8.00 am on Friday. But absence of well informative system about Hat and its schedule, some of the visitors come here after the Hat has already over and they fail to shop from the Hat. After Hat is over, they like to visit its surrounding area or villages. But safety issue identified as most common problem to a great portion of the visitors. From

survey it has been realized that, goons from local areas are mainly involved with hijacking; as this area has no police protection, local goons get plenty chances to seize money or any valuable things from visitors. This area has no basic facilities such as sitting arrangements, food or drink corners. Environment of river is most detest feature for them, many of them prefer water way for travel but poor water quality often discourages them to have a trip by river. As a result visitors use road way rather than water way. This group of visitors provides emphasis mostly on cleaning and maintenance initiatives (35%) as an option for enhancing attractiveness of the route. 23% of visitors has demanded for improved river bank and ghat condition, 19% of them want to increase facilities in this site and 17% of them suggest for establishing commercial development. Visitors who come here for visit Jamdani palli For this group main attraction point is 'Jamdani Palli'. Occasionally they come here with friends or family members. This group of visitors mainly comes here at morning after the Hat is over because they only come here for site seeing and visit 'Jamdani Palli' and the surrounding area. Open and refreshing atmosphere of this route is also attracting visitors most. According to them water pollution is identified as problem of this site. Hijacking by local goons is common issue for visitors. Due to this reason many visitors feel insecure about visiting this place again. Poor ghat condition, deprived river bank condition all act as negative characteristics of this route.

Visitors who come here for Boating

Couples mainly come here for boating and arrive here at morning. For this group of visitors river is the most important element for their recreational purpose. This group of visitors has mentioned some specific problems which bother them most when they come for recreation.

- ❖ Absence of BIWTA provided landing station and scattered distribution of ghat,
- ❖ Meager ghat condition and absence of fixed ghat,
- ❖ Poor vessel condition is a problematic issue for boating as recreational activity here.
- ❖ Type of vessels is monotonous and has no variation. Only country boats are found here which have no shades. So during wet season it is risky for boating here.
- ❖ According to visitors 'water quality, water odor and water holding capacity' are totally unsatisfactory.

Because of poor quality of water this group of visitors can not enjoy boating and after awhile they turn back from river. 54% of visitors are unsatisfied and 46 % of them are highly unsatisfied with that. This group of visitors provides equal importance on cleaning and maintenance initiatives (30%) and commercial development (30%) as options for enhancement of attractiveness of the route. 26% of visitors vote for increased facilities and 7% of them want development and improvement of river bank and ghat condition. According to all groups of visitors, over the last several years' rivers in and around Dhaka have gotten worse for recreation purpose. They suggested that government should take initiatives immediately and this site should

function under any government or ganization like Porjotan Corporation or any private organization.

6.4 Analysis of the Overall Sample

This section presents highlights of the overall sample. A total of 180 respondents were surveyed; 100 in 'Tongi- Ashulia- Mirpur' route, 50 in 'Sadarghat- Washpur-Basila ' route and 30 in 'Demra- Noapara' route. Among the 180 samples, 100 (56%) samples were surveyed on weekends and 80 (44%) samples were surveyed on weekdays.

6.4.1 Demographics

Table 8: Demographic characteristics of overall recreational users at a glance:

Demographic characteristics by area (% reporting)			
	Tongi-Ashulia- Mirpur route (Sample size-100)	Sadarghat- Washpur- Basila (Sample size- 50)	Demra- Noapara (Sample size-30)
Gender			
Male	75	78	66
Female	25	22	34
Mean Age group	Age between 20 to 25	Age between 20 to 25	Age between 20 to 25
Education			
M.degree	2	22	30
B.degree	79	26	30
Higher secondary	9	17	20
Secondary	6	26	15
Primary	3	9	4
Illiterate	1		1
Occupation			
Service holder	2	2	20
Business owner	1	17	6
House hold management	5	9	13
Student	81	48	40
Retired	1	1	1
Unemployed	1	-	-
Self employed	9	23	20
other	-		-
Family income			
Less than10000	3	4	11
10000-15000	25	23	11
15000-25000	49	30	35
25000-35000	5	17	32
35000-50000	11	22	10
More than 50000	7	4	1

For the three groups of visitors demographic characteristics are more or less same. The majority of visitors interviewed for this study were males; almost two-thirds (74%). The mean age of study respondents was ranging between 20 to 25 years old, that means young group of visitors represent these sites and almost two third (68%) reported that their income is in between 15,000-25,000 /- taka. This group of respondents was highly educated, 45% reporting that they completed a bachelor's degree or studying at this level and 18% of visitors completed master's degree. 15% of the respondents indicated that they had a high school degree or less. More than half of the visitors are student. About half of the interviews (52.8%) took place during 8:00 am--12:00 pm shift, and the remaining ones during 3:00pm--6:00 pm shift.

6.4.2 River use characteristics

During survey, recreational users were asked some question about their river use characteristics like what activities they engage in during their visit, how long they plan to stay on site, how often they visit, how they get there, and what size their group is. Highlights of those results are given below. Activities varied considerably by the area and available facilities affected this to some extent. Respondents of “Tongi-Ashulia-Mirpur” route were involved in ‘outing with family member’, ‘take food in the restaurant’, ‘long driving’, ‘roaming with friends’, ‘walking on riverbank side’, ‘go to park, zoo, mela’, photography, fishing, picnicking, boating, and ‘site seeing’. This site mainly contains three group of recreational user's site seeing group, boating group, and roaming with friends group. Recreational users of “Sadarghat-Washpur-Basila” route were involved with site seeing, roaming with friends, outing with family member, walking on riverbank side and photography. Boating is the most popular activity in “ Tongi- Ashulia- Mirpur” route and “Demra- Noapara” route. Though it is most preferred by the visitors of “Sadarghat-Washpur-Basila”, but the absence of adequate boating facilities and poor arrangements have resulted in very disappointed customers. During the wet season some boating activities are held here by private initiatives. This site is consisted of mainly two groups of recreational users- site seeing groups who like to visit with friends and family member here. Respondents of “Demra- Noapara” route were mainly involved with visiting ‘JamdaniPalli’, and go for shopping and boating. People also like site seeing, walking on riverbank side, roaming with friends, photography, and fishing. This site mainly contains three group of recreational users- Jamdani Palli visitors, shopping and boating group. So, most common activities done by the respondents of these three routes are - site seeing, outing with family members, roaming with friends, walking on riverbank side and photography.

Table. 9: Major Activities reported by overall respondents.

Activities reported by respondent		
Tongi-Ashulia-Mirpur route	“Sadarghat-Washpur-Basila”	Demra - Noapara route
1.Outing With Family Member	1. Site seeing,	1. Visit Jamdani Palli
2.Take Food in the Restaurant	2. Roaming with friends ,	2. Shopping
3. Long Driving,	3. Outing with family member,	3. Boating
4. Walking on River bank	4.Walking on riverbank side	4.Walking On Riverbank Side
	5.Photography	5. Roaming With

Side, 5. Go to Park, Zoo, Mela, 6. Photography, 7. Fishing, 8. Picnicking, 9. Boating, 10. Site Seeing 11. Roaming With Friend		Friends, 6. Photography 7. Fishing 8. Site Seeing
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Transportation, visit length and frequency

Transportation type to the site, their visit length and frequency of visiting the river - all these aspects are more or less same for three groups of visitors. Respondents traveled to the route by a variety of means, stayed from a half hour to four hours, came here as couples or in groups and had come occasionally. Usage pattern highlights include:

- ❖ Visit lengths varied considerably by area and activity; visits of one hour or more were most common overall. Visits of less than an hour are common in “Sadarghat-Washpur-Basila” route. The longest visit reported in the ‘Tongi-Ashulia-Mirpur’ route was about four hours.
- ❖ One third of the respondents were occasional visitors. Daily visits were absent in these three routes.
- ❖ Most of the visitors lived at city center and traveled over four and a half miles to reach the area. Respondents varied greatly in their transportation to the sites. To visit the route of ‘Tongi- Ashulia- Mirpur’, recreational users prefer public transport; to visit the route of “Sadarghat-Washpur-Basila” recreational users prefer auto and public transportations; and to visit the site of ‘Demra – Noapara’, recreational users prefer public transport and boat.
- ❖ Most of the recreational users who come here are young couples; they love to visit here with their beloved ones.
- ❖ Visitors of these three groups mostly arrive here at morning; recreational users found only in weekend at ‘Demra- Noapara’ route. But other two routes generate visitors at both weekdays and weekends

Table 10: River use characteristics of overall recreational users at a glance

River use characteristics by area (%reporting)			
Transportation to the site	Tongi-Ashulia-Mirpur route (Sample size-100)	“Sadarghat-Washpur-Basila” (Sample size-50)	Demra- Noapara (Sample size-30)
Auto	10	39	3
Bike	16	2	1
On foot	-	2	5
Public transport	40	35	45
Private car	20	15	1
Rickshaw	14	7	3
Boat	-	-	42
Distance traveled			

Visit length			
30 minute	-	5	-
1 hr	20	48	20
2 hr	45	36	55
3hr and above	35	11	25
Visit frequency			
First time	20	48	15
Once a year	9	-	13
Occasionally	65	39	68
Nearly every week	2	-	3
Irregularly	3	4	1
Rare	1	9	-
Nearly everyday	-	-	-
Number of people come with respondent			
One	78	65	41
More than one	22	35	59

6.4.3 Perception of the river

Open-ended questions were asked to the recreational users concerning what they liked and disliked about the route where they were interviewed. Respondents were also asked closed-ended questions about the importance of the river to their recreational activities enjoyment and about their perceptions of problems such as water quality interfering with their use and enjoyment of the river. Questions about river in general were used to assess what they thought most needed changing to improve the rivers for recreation, and whether they felt river recreational quality had improved, stayed the same or gotten worse in the past few years. Highlights from the sample include:

- ❖ The majority of the respondents indicated that the river was “very important” for their enjoyment. River was particularly important to the respondents of the route of ‘Tongi-Ashulia- Mirpur’ but for the visitors who gather at “Sadarghat-Washpur-Basila” route, it was somewhat important.
- ❖ The visitors like most the scenic beauty of river, it’s quite and calm environment, peacefulness, refreshing at mosphere and other nature-related features etc.
- ❖ When asked what they did not like about the river, 55% respondents said “nothing”. Others who did express a dislike cited issues like water pollution, odor, poor facilities and service, safety etc. Water pollution, odor and poor water quality was mentioned the most in all three routes. Poor facilities also were mentioned as a problem in all those area.
- ❖ Water quality was the most-cited problems that might interfere with the use and enjoyment of the site; they were mentioned by entire sample group. Water quality was rated more of a problem in the ‘Tongi-Ashulia- Mirpur’ route and ‘Demra- Noapara’ route. Waste dumping was rated a problem by recreational users of ‘Demra- Noapara’ route. Deprived river bank condition

was also considered as problem by the visitors “Sadarghat-Washpur-Basila” and ‘Demra- Noapara’ route.

- ❖ Respondents wanted clean water of river. When asked what changes were needed to improve the river recreation, 39% said to take cleaning and maintaining initiatives, 31% said by increasing facilities. Commercial outlets and river bank-related improvements were also mentioned frequently.

Table 11: Perception of quality of river in and around Dhaka for recreation (%reporting)					
	Sample size	Gotten better	Gotten worse	Remain same	Not sure
Tongi-Ashulia-Mirpur route	100	13	44	3	40
Sadarghat-Washpur-Basila	50	2	77		21
Demra-Noapara route	30	5	86	7	2

6.4.4 Importance of river use

The river was very important to most of the visitors; few rated the river as somewhat important to their recreational enjoyment. The importance of the river was related with river access. Where access was greatest, the significance of the river was highest to the recreational users there. This discussion is based on several survey items about the river at the interview site, including ratings of the river's importance and of some specific problem areas, the likes and dislikes mentioned, and comments about desired changes for rivers

Table 12: Importance of river for recreational enjoyment by area

Importance of river for recreational enjoyment by area				
Route	Very important	Some what important	Not important and detrimental	Sample size
Tongi-Ashulia-Mirpur route	91(91%)	9(9%)	-	100
Sadarghat-Washpur-Basila	9 (18%)	30(60%)	11(22%)	50
Demra-Noapara route	17(57%)	8 (27%)	5 (16%)	30
Total	117(65%)	47(26%)	16 (9%)	180

When asked “how important do you feel the river here is to the enjoyment of your recreation activities today (very important, somewhat important, not important, or

detrimental) the majority of the respondents, (65%) said 'very important'. While most of the respondents in "Sadarghat-Washpur-Basila" route and 'Demra- Noapara' route reported river is somewhat important for their recreation. Water-based activity groups like boaters were most likely to rate the river very important and river was also important to walkers and who come here for site seeing or for roaming with friends. The river was rated very important to more than 50% of the respondents in each activity group.

Table 13: Importance of river for recreational enjoyment by activities

Importance of river for recreational enjoyment by activities (%reporting)			
	Very important	Some what important	Not important or detrimental
Outing with family member	64	36	
Take food in the restaurant	92	8	
long driving, roaming with friends	94	6	
roaming with friends	37	40	23
Walking on river bank side	83	17	
Gotopark, zoo, mela	83	10	7
Photography	75	25	
Fishing	50	50	
Picnicking	72	15	13
Boating	98	2	
Site seeing	74	20	6
visit Jamdani Palli	13	37	50
Shopping	14	43	43

6.4.5 Water quality

Table 14: Perception of water quality deterioration, by area

Perception of water quality deterioration ,by area (%reporting)							
	Sample size	*WQ mentioned by respondents	*WQ rated a problem	Dumping rated a problem	Wate rodor rated a problem	Want improved water quality	Overall WQ deterioration index
Tongi-Ashulia-Mirpurroute	100	76	76	44	62	70	66
Sadarghat-Washpur-Basila	50	85	85	69	84	82	81
Demra-Noapararoute	30	88	88	82	82	85	85
*WQ=WaterQuality							

Water quality is a major issue to the recreational users who were interviewed. 95% of visitors mentioned that water quality of river had gotten worse. Water quality and dumping garbage in the river and along the banks were very important issues to

many people interviewed in every area. Water quality perception is differing by demographic group. Respondents, especially young group of visitors not considered water quality a serious problem than older age groups.

5.4.6 Facility and development issue

Facilities were important to the respondents but reality is facilities and developments are totally or partially absent in these three routes. Ashulia landing station has some facilities like- boating facilities, small food corner. Except 'Tongi- Ashulia- Mirpur route', other two routes are under developed and unimproved for recreation purpose.

6.4.6 Crime and safety

Table 15: Safety related issue by area

Safety related issue (%reporting)				
	Sample size	Hijacking/ vandalism	Personal safety a problem	Annoying attitude of drug addicted people or hijra
Tongi-Ashulia-Mirpur route	100	25	22	48
Sadarghat-Washpur-Basila	50	20	45	44
Demra-Noapara route	30	77	55	

Concerns about crime and safety issues could affect the recreational use of the river corridors. Hijacking, vandalism are mentioned as major problems at 'Demra-Noapara' route most; these are also identified as emerging problems at "Sadarghat-Washpur-Basila" because of the large size slum area located along the embankment where unsocial activities have always been taken place. Safety is also an important issue for the site of 'Tongi- Ashulia- Mirpur' route but due to hesitation they did not responses properly

6.4.7 Natural area and scenic quality

The opportunity to experience nature was important to all respondents, and scenic qualities were also important to them. These qualities were most often mentioned as the most attractive attribute about the interview site. Only because of scenic beauty of those site respondents gather there in a great numbers and this is an important element of these sites for attracting huge a mount of visitors here. But lack of greenery along the river was rated a problem by at least two quarter of the respondents everywhere and 55% rated lack of space for vegetation and wildlife a problem and they have high demand to have this type of initiative at these routes corridors.

Table 16: Nature related issue by are

Nature related issue (%reporting)					
	Sample size	Like scenic quality	Like natural area	Lack of greenery and trees a problem	Suggested improved natural area
Tongi-Ashulia-Mirpur route	100	94	77	68	46
Sadarghat-Washpur-Basila	50	90	70	65	51
Demra- Noapara route	30	90	57	72	55

Table 17: Recommendation of recreational users for enhancement of attractiveness of the route

Recommendation for enhancement of attractiveness of the route (%reporting)									
	Sample size	Plantig seasonl flower and plant	By cleaning and maintaining regularly	By incresing facilites	Commercial outlets like small retail shops	Natural area for vegetaton and wildlife	Landscape water way	Improved river bank and ghat condition	Fishig facilites
Tongi-Ashulia-Mirpur route	100	5	40	50	4	1			
Sadarghat-Washpur-Basila route	50	15	55	27	2	1			
Demra-Noapara route	30	1	24	18	20	6	14	16	1

Table 18: Perception of river recreation at a glance

Item	Perceptionof river(%reporting)		
Importance of river for enjoyment	Tongi-Ashulia-Mirpur route(Sample size100)	Sadarghat-Washpur-Basila(Sample size 50)	Demra Noapara(Sample size30)
Very important	91	18	57
Some what important	9	60	27
Not important and detrimental		22	16
Most liked attribute			
Scenic quality	90	82	90
Refreshing atmosphere	90	77	88
Peacefulness	89	65	72
Most disliked attribute			
Water qualityand odor	71	90	94
Ghat condition	65	88	86
Limited orabsence of trees and greenery	77	55	52
Perceived problem area			
Water pollution	95	96	89
River bank condition	55	90	76
Absence of basic facilities	85	78	72

Safety problem	42	75	88
Desired changes			
Increase recreation facilities	80	82	75
Various type of activities	51	56	35
Government initiatives to take the area under Porjoton corporation or other private organization	65	70	68
Improved water quality	80	86	86

Table 19: Suggestion of three groups of visitors

Suggestion of three group of visitors		
Tongi-Ashulia-Mirpur route	Sadarghat-Washpur-Basila route	Demra –Noapara route
1. Provide basic facilities like sitting arrangement, toilet facilities and food corner 2. Improvement of ghat landing and river bank condition 3. Improved water quality 4. Route should be taken by any government or private organization for its development 5. Include parking facilities and kids corner 6. Safety provision like-guarding system or mobile police protection to ensure staying at night to enjoy river beauty	1. Make link between recreational users and river by providing water recreation slike; Boating facilities, fishing etc. 2. Provide basic facilities. 3. Improvement of river bank condition and water quality 4. Government's initiatives to stop illegal encroachment because it impacts on aesthetic view of the river 5. Prevent encroachment by developing this site as a recreation point.	1. Organized and improvement of ghat condition and landing facilities. 2. Well information system to inform starting and overtime of Jamdanihat. 3. Government's initiatives to develop this area as a tourist spot on basis of Jamdanihat. 4. Improved quality and condition of vessels. 5. Discourage villagers to dumping household waste and human waste into river. 6. Police or guarding initiatives because hijackings by local goons are common complain of most of the visitors.

6.4.8 Gap Analysis

The gap score is simply the difference between the performance and importance scores for any given item. In general, gap scores can be either positive scores or negative scores. A positive gap occurs when performance is greater than expectation, i.e., an item exceeds a visitor's expectations, and the positive score represents satisfaction with these items. The term "strong" or "weak" refers to the magnitude of the difference between the user's expectation regarding an item and the performance of that same item. Strong gaps indicate a significant difference between expectation and performance, while weak gaps indicate a smaller difference. Conversely, a negative gap score denotes an item where the performance is less than visitors' expectations. Such an item is not meeting visitors' expectations and the negative score represents the lack of satisfaction for that item. A negative gap can be either "large" or small".

Overall gap analysis

- ❖ Among all the domains 'Recreation Experience' domain has got the smallest negative gap scores and 'Information' domain has shown the largest negative gap scores.
- ❖ Among the three routes 'Tongi-Ashulia-Mirpur' route has shown the overall smallest negative gap scores and "Demra- Noapara" route has shown the largest negative gap scores comparatively.

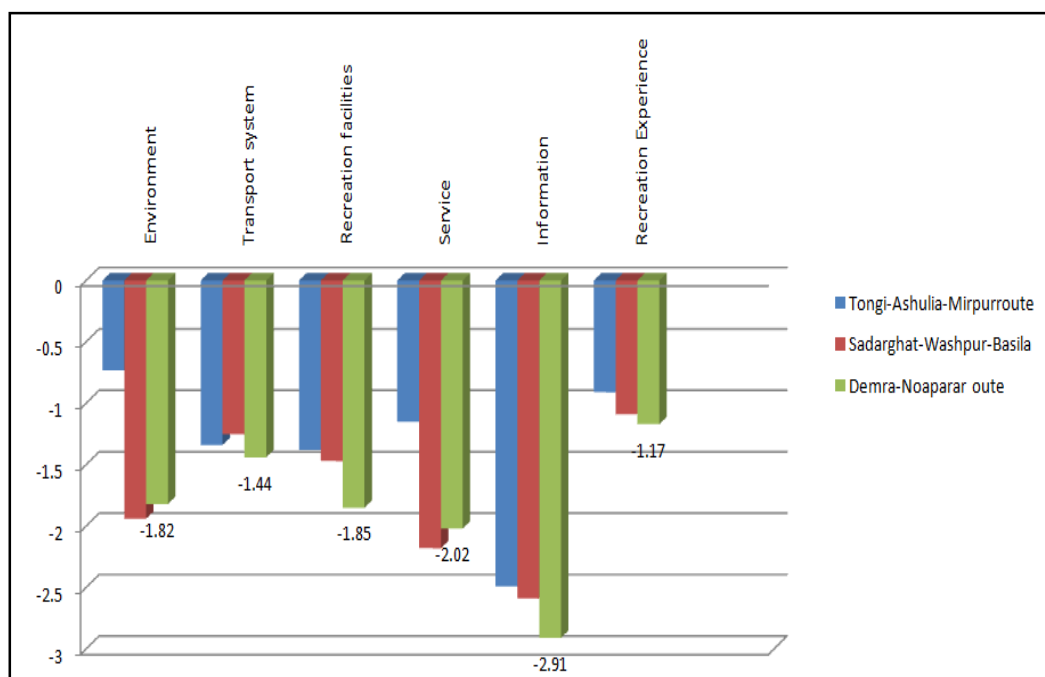


Fig 23: Overall Performance level analysis of different domains

Table no. 20 Average Importance and Performance scores for each domain

Environment	Mean Importance			Mean Performance		
	R1	R2	R3	R1	R2	R3
Water quality, water odors & water holding capacity	4.00	4.19	4.35	2.10	1.91	1.42
Water odors	3.78	3.71		2.18	1.52	
Water holding capacity	3.74	3.32		2.2	2.65	
Noise from boats, industry or traffic	2	3.22	4.25	3.84	1.39	1.89
Garbage dumping on bank	3.71	3.91	3.57	3.45	1.82	2.36
Mosquitoes and other insects	-	-	3.74	-	-	2.53
Illegal encroachment	3.00	4.18	3.60	2.04	1.60	2.26
Total mean score	3.37	3.76	3.91	2.64	1.82	2.09
Transport system						
Integration with other mode of transport	4.02	4.18	4.30	3.78	3.73	3.84
Access roads	3.82	4.13	4.26	2.25	2.69	1.84
Pedestrian link	3.98	4.07	-	1.78	2.21	-
Total mean score	3.94	4.13	4.28	2.60	2.87	2.84
River bank recreation facilities						
No. & types of vessels	3.25	-	3.96	3.45	-	2.84
Amount of public open space	3.60	3.89	4.10	2.96	3.09	2.73
Green area & landscape	4.17	3.78		2.33	2.57	
Trees & vegetation	4.20	4.22		2.24	3.22	
Trail, path & walkways	3.70	4.25	4.31	1.89	3.22	1.89
Public equipment like-benches, shade, pavilion, lighted, Fountains, sitting arrangements, drinking water, toilet facilities	4.33	4.28	4.30	1.98	2.56	2.05

Physical & visual connectivity	4.00	4.00	3.91	3.04	3.30	1.68
Boat landing/ Ghats condition	3.98	3.77	4.09	1.91	1.74	1.63
Fishing facilities	3.48	-	-	1.87	-	-
Maintenance & cleanliness	4.25	4.33	4.22	1.74	2.73	2.00
Commercial developments (Functions like-food kiosk,drink corner, small restaurants, community boat club,community health club, open air theatre and children's play area)	3.66	3.95	4.30	2.04	2.21	1.63
Fare	3.56	-	-	3.80	-	3.21
Ticketing system	3.25	-	-	-	-	-
Total mean score	3.80	4.05	4.09	2.43	2.58	2.25
Service						
Condition of vessels	3.70	-	4.05	3.38	-	2.68
Boating system	3.51	-	3.91	3.14	-	3.10
Public safety-water accidents & personal safety from crime/ unsociable activities graffiti & vandalism	4.18	4.27	4.35	3.15	1.43	1.73
Availability of regular services	3.75	3.90	4.28	1.35	2.04	1.42
Management's role	3.53	3.85	4.10	1.89	2.04	1.63
Total mean score	3.73	4.01	4.13	2.58	1.83	2.11
Information						
Modern & well informative (web site, route maps, printable time table)	4.15	4.17		1.25	1.73	1.56
Route definition (Well defined route)	4.08	4.25		1.87	1.82	1.84
Total mean score	4.12	4.21	4.28	1.63	1.62	1.37
Recreation experience						
River bank condition	4.00	4.02	4.20	2.47	1.82	2.05
Natura larea for vegetation & wildlife	3.72	3.88	4.00	1.87	2.17	2.42
Crowding & conflicts among boater & recreationists onshore	3.65	3.82	3.97	3.78	3.60	3.52
Relaxing & aesthetically pleasing atmosphere	4.20	4.21	4.19	4.07	4.00	3.68
Total mean score	3.89	3.98	4.09	3.04	2.89	2.92
(R1=Tongi-Ashulia-Mirpur route; R2=Sadarghat-Washpur-Basila route;R3=Rampura-Demra-Noapara route)						

6.5 Expectations

Depending on the responses of both open ended and close ended questions and satisfaction analysis of the visitors of these three routes, specific expectations anticipated by the recreational users are given below.

- ❖ Pollution free and accurate level of water for water holding capacity
- ❖ Encroachment and illegal settlement free well defined river banks.
- ❖ Well defined and landscaped paths, trails, walkways and bike trails.
- ❖ Adequate amount of trees, vegetation and green spaces along river side
- ❖ Developed park space and river walk promenade along river bank side and provision for connect them close to the water.
- ❖ Well equipped route corridors containing public equipments and facilities likesitting arrangement, waiting space, shades, sufficient food and drinking corners, toilet facilities etc.
- ❖ Well accessed link roads and pedestrian connected to the water routes.
- ❖ Proper and fixed distribution of ghats and landing stations
- ❖ Improved ghat area and appropriate boat landing facilities
- ❖ Modern and different types of vessels and organized boat hiring system
- ❖ Specific parking space for parking vehicles
- ❖ Separate zone for young couple
- ❖ River recreation activities like boating, fishing, walking promenade, and other riverside destinations reachable by foot or boat.

- ❖ Commercial developments (like-food kiosk, drink corner, small restaurants, community boat club, community health club, open air theatre, children's play area, small gift shops, fishing club and fishing arrangements like-specific spot and sitting arrangements for fishing, fishing instruments etc.
- ❖ Clean and maintained water routes and corridors.
- ❖ Availability of regular services
- ❖ Improved, Modern and well informative information system including web sites, route maps, printable timetable, brochure containing current information, natural historical information, educated and knowledgeable staffs and volunteer to help recreational users'
- ❖ Reasonable cost of food and drinks
- ❖ Ensured safety and security of the visitors
- ❖ Responsible Management authority to take care of the routes and visitors

6.6 Concluding remarks

Statistics established that for middle income people these routes are ideal recreation spots specially "Tongi- Ashulia- Mirpur" route. Young people, particularly aged between 20 to 25 years old, are key focus group of recreational users in these routes. Prominent group of visitors are students that means young people are very much interested to visit these routes with their friends and beloved ones to enjoy natural beauty, fresh air and boating and these types of recreational spots are mainly supported by youth group of society. From the analysis it is found that the items related to natural beauty and atmosphere satisfied visitors the most and create a relish incitement into their mind rather than the facility related items. These routes are deprived of proper facilities and services. That's why these routes have not revealed any positive gap scores except the two items under 'environment' and 'recreation facilities' domain of "Tongi- Ashulia- Mirpur" route. That means the items are not meeting visitors' expectations. The respondents have appreciated water based recreation activities here like boating; fishing etc. but absence of proper arrangements in "Sadarghat-Washpur-Basila" route respondents are not able to relish these kinds of activities. As we have seen that the 'Recreation Experience' domain has got the highest satisfaction level of the recreational users and lowest negative gap scores among all the domains it can easily be said that the recreational users come to these three routes for relaxation and aesthetic beauty and atmosphere of the routes though the provided facilities and services are not up to the mark and sometimes absent. If facilities and services are provided and basic requirements of the recreational users are fulfilled, the routes will be flourished. From the analysis it is found that ' Tongi- Ashulia- Mirpur' route has the true essence of a water based recreation route. People gather here for water based recreation and River is their main attraction for them for enjoying their activities. Among the three routes only this route provides some facilities to its recreational users. The river is "very important" to the maximum respondents (91%) and they were not there if the river was not there. In addition to 9 % respondent "Somewhat important" that the river plays some part in the enjoyment of their recreation there. On the other hand, "Sadarghat-Washpur-Basila" route has the huge potentialities to expose as an ideal recreation area because this site already contains an attraction point 'Martyred Intellectuals Memorial' which generates a great number of visitors. Although they want to come closer to the river but due to absence of proper service and facilities they are not be able to do that. That's why this route has got large negative gap scores. According to 60% respondents the river plays some part in the enjoyment of their

recreation and to 22% river just happens to be there and plays no part of their recreation. But according to 18% the river is “very important” and they were not there if the river was not there. Without any facilities this site has ability to generate huge number of visitors, if necessary facilities and service is provided in this site this place can be developed as an outstanding river side recreation place

‘Demra- Noapara’ route is comparatively busy from the other two selected routes; this route is mainly used for transportation –passengers and goods carrying transports. ‘Jamdani Hat’ and ‘Jamdani Palli’ are the two main attractions for the recreational users which also indirectly encourage them to engage in river based recreation. 57% respondents thought that the river is ‘ very important’ to them while 27% and 16% thought that the river plays some part and plays no part to their recreation respectively. This route has shown the largest negative gap scores among the three routes because the route is not developed yet and absence of basic required facilities and services. From the analysis it is found that only 9 % respondents of the overall respondents’ thought that river is just happens to be there and plays no part to their recreation where as to 65% river is “very important” and to 26% it is “Somewhat important”. Consequently statistics established that river plays a very important role directly and indirectly to the enjoyment of their recreation.

Chapter 7: Proposed concept for recreational development along “Mipur-Ashulia-Tongi”route through place making

In the previous chapter the gaps between the visitors' expectations and reality as well as the importance of the river in their recreational enjoyment and the type of improvements they want to see along the water routes have been explored. Based on the result of the study, it is observed that **"Mirpur – Ashulia – Tongi"** is the best recreation site for the tourists and it also has the potentialities of riverbased transportation and communication. With the help of gathered informations some proposals and recommendations have been suggested for the recreational development of **"Mirpur – Ashulia – Tongi"** route in respect to the existing situation for enhancing the water based recreation for the city dwellers. Proposals have been suggested through photographs to show how specific problems may be solved and to make them understandable to the reader. The CW can be developed as one continuous route and could be performed like an entity which has the immense scope for providing water recreation facilities and tourism in the inner part of Dhaka as well as the outer side. The CW can relate the whole city to its city dwellers through its continuity and water sensitive urban design which will improve places along the routes and offer various scenic places to its inhabitants. In this chapter some examples have been shown to give an idea how this route can be developed through place making and can make a contribution to the planning and urban design of the city.

7.1 Introduction

Place making is an approach that aspires to create a place that has a strong sense of "placeness" and a comfortable image to its dwellers as well as outsiders. Identity of a place must be maintained as it is what makes a place unique when compared with other major places. Consistent themes to its form, materials, items, arrangements and symbolism will be more likely to produce positive place experience. Settings that can trigger off memories and fantasies will be more likely to provide rich place experience; but still depending on the users themselves. However, place making can help to refine the memorable experience of visitors through activities that give an impact to them. Water bodies can serve as an attraction, a place where people gather and enjoy the calm that viewing and hearing the splashing of water creates. Water can be integrated into cities in many ways, thereby enhancing the beauty and pleasure of living in that city. The river front could be exclusively developed as a park and recreational space. Along with that the river itself can provide various recreational facilities, like boat racing and boat riding in the afternoon and the riverbank can be developed as parks and garden for the citizen to enjoy afternoon promenades and holiday picnicking. It could be extended and designed in details with addition of parks, gardens and trees. This promenade may enhance the use of the river as boating events can take place on them while the spectator will be able to watch from the embankment.

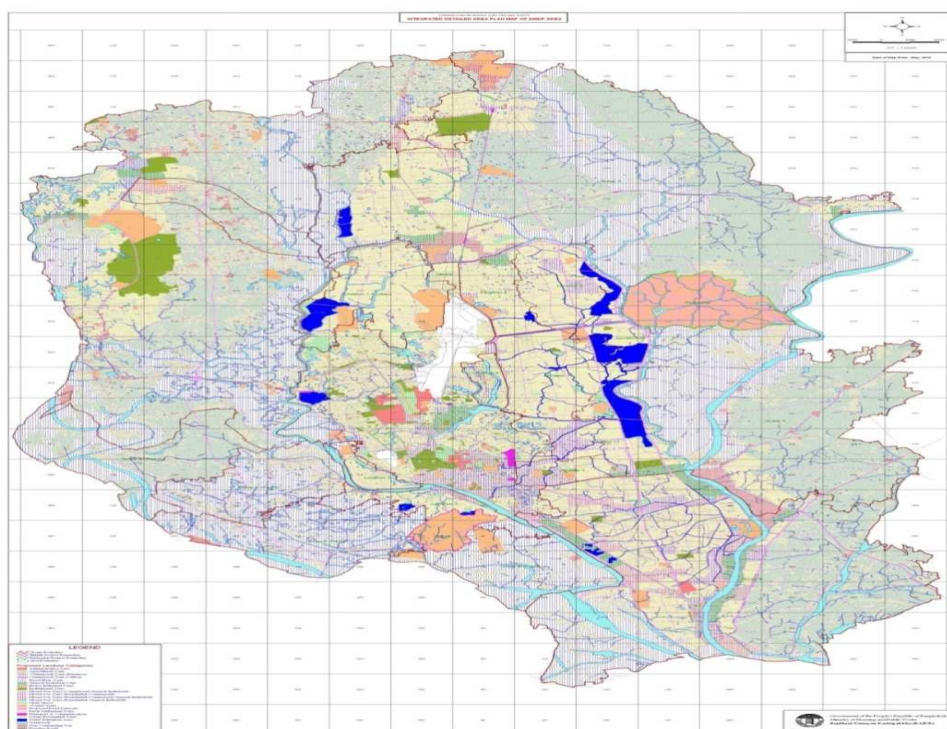
7.2 Concepts appropriate for the Selected site (Aminbazar to Ashulia)

The selected site (Aminbazar to Ashulia) can be a good location for waterborne recreation activities for the city dwellers. It is observed that the building of embankment all around the city was not the right way to solve the problem of flooding. A single bund along the river makes people unable to connect with the river. The existing embankment is such an example for that type of case where the river was totally neglected during planning, design and construction phase. When the banks of the river were stabilized for flood protection few years ago, little thought could be given to either aesthetics or public enjoyment. But still the

selected site has the potentiality to connect the people with rivers and make proper utilization of the resources and provided with a significant amount of accessible open spaces.



Map-15: Existing Dyke around Dhaka



Map-16: Detailed Area Plan, RAJUK

7.2.1 A series of small embankments Concept instead of a single bund along the river A series of small embankments concept instead of a single bund along the river could be a good option for multipurpose use. The idea and practice of

embankment needs creative expansion. Instead of a single bund along the river, a series of small embankments can be created to develop a matrix of spaces and functions can be arranged throughout the route in some specific points. The idea behind such miniembankments is to link the built and natural environments, as well as to control and retain water for agriculture and everyday human needs. The embankments also act as dynamic circulation paths. Producing these embankments will also help to restore the natural dynamics of the river and create interesting recreational landscapes and gardens.



Photo 34: River Protection Project work in progress (River Turag) (BIWTA)



Photo 35: Walkway Construction in Progress (River Turag) (BIWTA)

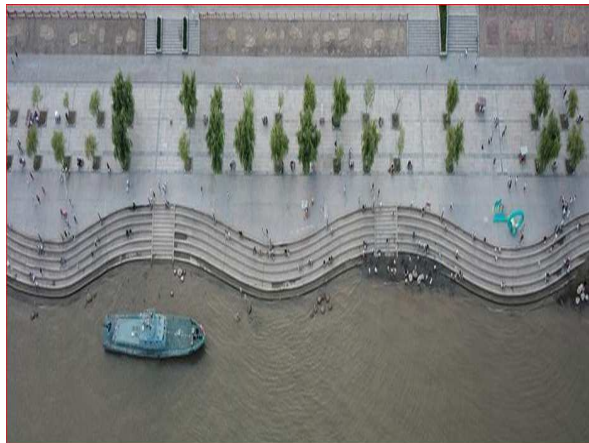
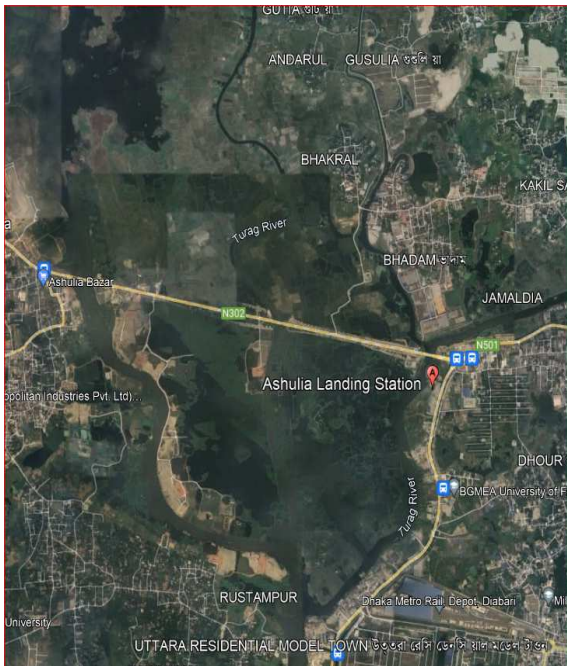


Photo 36: Proposed Cascaded Retaining wall

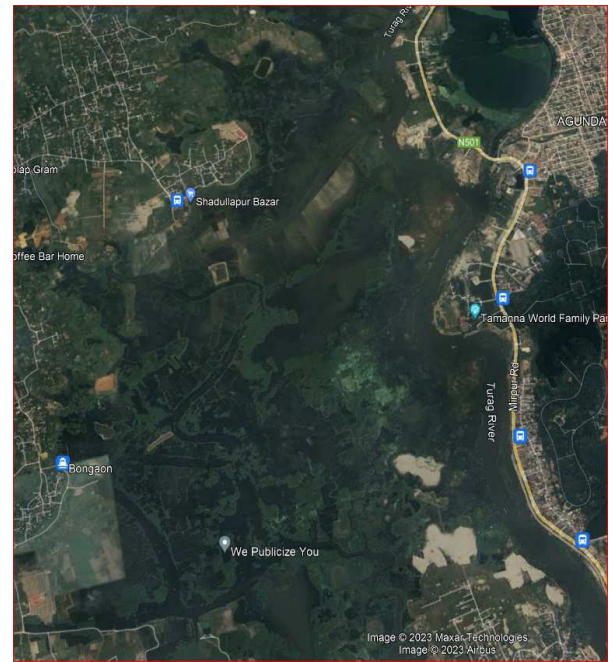


Photo 37: Proposed Sitting Arrangement on riverbank

7.2.2 Creating an extra channel concept Building an extra channel of the river to take excess water; the island produced as a result and channel will act like a large recreational park. To avoid disastrous floods, the city can build an auxiliary channel of the rivers to flow the length of the city. This channel, and the long island separates it from the surrounded rivers, the new channel can be claimed exclusively for recreational use. Instead of allowing the channel and its banks to be developed privately, the city will carefully regulate how the buildings, roads, sidewalks and plazas are designed and placed in the new area, guaranteeing the waterfront as a public amenity.



Map-17: Ashulia Bridge and Adjoining area



Map-18: Tamanna Park and Adjoining area

7.2.3 Visitors' demands as per expectations

Activities are the basic essential of a place. Offering things to do give people a reason to come to that place and possibly return again. The water itself draws attention, is the greatest asset of any waterfront, and should become the centerpiece for programming and activities. Activities may include water-taxis, boat tours, restaurants or shops on anchored boats, fishing, floating pools, and swimming. Many of these activities not only attract users to waterfront but also generate interest among onlookers. Embracing the natural uses of a waterfront leads to thematic programming such as boat festivals, fish markets, bait and tackle shops, and performances on floating stages. Rain or cold is no reason for a waterfront to sit empty. Indeed river front places are often known for their chilly winds and gray skies. Waterfront programming should take rainy-day and winter activities into account, and amenities should provide protection from inclement weather. Waterfronts that can thrive in year-round conditions will reap the benefits of greater economic activity and higher attendance at public facilities. The following demands are desired by the visitors to be fulfilled.

- ❖ Improved ghat and Landing facilities
- ❖ Public equipment and facilities like-sitting arrangement, waiting space, shades, toilet facilities, food and drinking corners, resting place
- ❖ Separate zones like kids' recreation zone and zone for young couple etc.
- ❖ Trail system or walking ways and facilities like Platforms and stools that can bring people close to the water
- ❖ Seasonal plantation and vegetation and river walk promenade along river side
- ❖ Regular safety and security services like lighting, patrol police and guard arrangements
- ❖ Parking facilities
- ❖ Modern type of boating facilities
- ❖ Recreational facilities like Cinema Hall ,develop more restaurants and other riverside destinations reachable by foot or boat

- ❖ Fishing club and fishing arrangements like-specific spot and sitting arrangement for fishing, fishing instrument, fishing pier etc.
- ❖ Commercial outlets like-retail shops, food, drink and gift corners, etc.
- ❖ Bike trails, bicycle storage facility

In addition to that, open recreational space for daily recreational use and public plaza and open air theatre for festivals, badminton court, elevated pier, outdoor seating and events pavilion. To provide the visitors with their demanded facilities the following design elements can be used.

- ❖ Different kinds of paths: footpath, sidewalks with steps, rock paths and plank boardwalks built along water
- ❖ Platforms and stools that extend into water encourage users to play in the water
- ❖ Elaborate plantings, gazebos, tiles with historic elements and graceful railing featuring aesthetic details
- ❖ Variety of pavement patterns all artfully designed and incorporating different materials
- ❖ Unique bridge designs
- ❖ Landscaping alongside the trails and walkways, pergolas and other features provide shaded rest areas

All these elements can give these places different identities as a place usually has a fixed location and features in forms that can be identified.

Design conceptsBased on recreational users' expectations of this route the below listed design concepts can be used to revitalize the river and the river side areas and offer various scenic places to its inhabitants. Main Considerations are:

- ❖ Main Focus has to be given to maintain the existing river width as far as possible.
- ❖ Use the waterfront as an amphitheater with the water as a natural stage.
- ❖ Facilitating and encouraging passive recreation where possible, ie, trails and walkways, jogging track, exercise space, cycling track, paddle boating, fishing etc.
- ❖ Minimum construction of permanent structures.
- ❖ Facilitating some income generation earn some revenue to support the maintenance cost of the river corridor.

Design decisions

- ❖ Bring people close to the water
- ❖ Encourage pedestrian friendly Dhaka city
- ❖ Places to celebrate water – learning places
- ❖ Allow children to play, increase knowledge and adults to socialize outdoors
- ❖ Convert the neglected embankment area to a popular meeting place.
- ❖ Physical and Visual Connectivity
- ❖ Continuation of 50m (one hundred fifty feet) wide green belt buffer zone
- ❖ Continuous route of walking and cycling track which connects both sides of the water body with resting pockets along the walkway track after some intervals

which consist, sitting arrangement, drinking water fountain, small exercise space, garbage bins, light post and toilets at every alternate point, and seating throughout the route, as well as steps where the walkway spaces is wide and green banks slope gently down toward the river's edge.

- ❖ The island can be developed as parks and gardens and can be connected by suspended bridge
- ❖ Less permanent establishments and movable vendors to maintain the natural essence
- ❖ Provision for small scale commercial outlets like, restaurants serving pre-cooked items, souvenir kiosks, food and drink corners, pottery stalls, paddle-boat club etc.
- ❖ Using the open space as a park and setting up temporary structures for nightly events.
- ❖ Unique identity of the Bridges
- ❖ Multi level traffic resolves idea
- ❖ Changing the overall environment through proper and adequate plantation.
- ❖ Providing necessary services
- ❖ Financially Self Sustainable

Encourage Pedestrian friendly Dhaka city

A good city is such a place where people can walk or ride bicycles and feel safe doing it. Not just safe, but find pleasure in the activity. People can exercise and recreate while transporting themselves. Instead of sitting in traffic, movement by foot, cycle or rickshaw could be pleasurable. Walking and cycling along waterways makes an unforgettable voyage of discovery and also offers ideal surrounds for fishing. According to Dhaka Urban Transport Project about 60% of all passenger movement is pedestrian and rickshaw account for about 19.2% of passenger tips. The green landscape along continuous waterways will encourage people to walk. The roads should design with lights, stools and steps which can make the environment closer to people.



Photo 38: Promenade Work in Progress



Photo 39: Proposed Promenade

Bring people close to the water.

A good footpath along water is very important to make people feel closer with water. The Grand Promenade in Jhinji Lake is a place special for this feeling. Platforms and stools extend into water encourage visitors to play in the water. The depth of water often changes, so the platforms should design in different steps or terracing system. When the water rises, people can play with water on the second step. Boardwalks provide opportunities for people to interact with wildlife along natural shoreline.



Photo 40: Proposed Riverside View

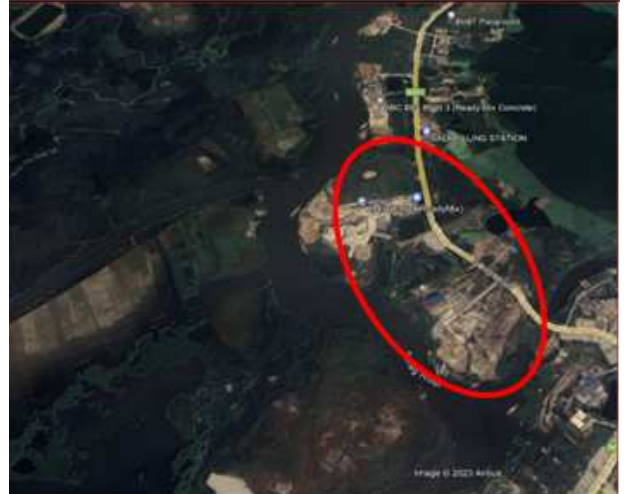


Photo 41: Proposed Development Site

Places to celebrate water – learning places

Through walking people could recognize the different plantation which changes the environment simultaneously changing with the seasons and get informed with the information related to them. Children could easily learn about wild life, fishes, trees while playing from which our children are deprived off. Terracotta reflecting cultural heritage with informative lessons could be used in the paving to inform people. Information and digitized route map containing retaining walls and monuments can be used to get acquainted with our surrounded waterways.



Photo 42: Terracotta Design on Historic Issue



Map-19: Information Map



Photo 43: Place Directing Indicator

Changing the overall environment through proper and adequate plantation

Trees play a vital part in urban life, offering visual delight, the sense of contact with nature, and relief from heat and flooding. Unattractive box like buildings and few malnourished trees by wide roads are an unappealing gesture towards the environment and aesthetics. If the roads are narrower, the footpaths wider, and more trees are planted the environment will be more appealing. More trees and water bodies also means more place for nature's creatures—fish, birds, even small animals, which are all key to the ecosystem.



Krishnachura Tree



Sunalu Tree



Photo: Jarul Tree



Photo: Bot Tree

Photo 44: Local Trees which bloom in different season



Photo 45: Proposed Canal system for Boat Cruise to Golap Gram



Photo 46: Proposed Canal System in Low Flood Zone Area inside the village



Photo 47: Proposed site (Low flood zone) for development

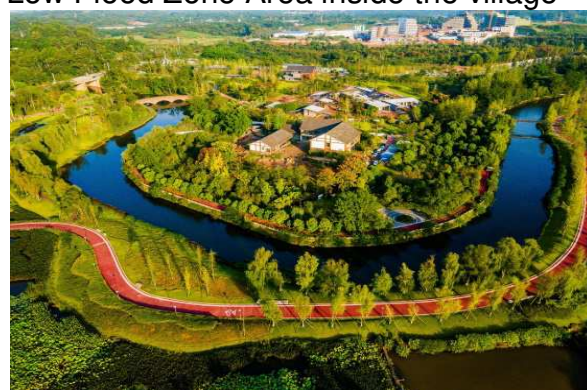


Photo 48: Proposed Canal system crossing local area

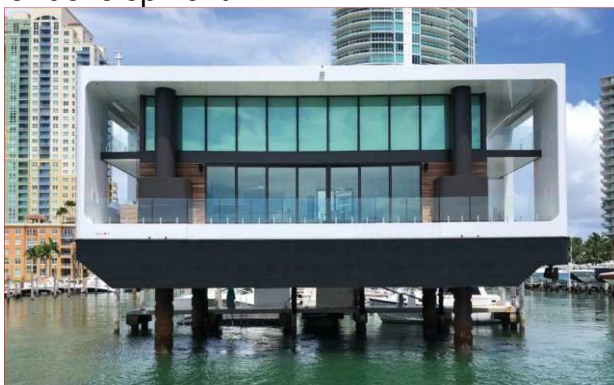


Photo 49: Water valley at Miami



Photo 50: Proposed Echo Resort (Amfibe woningen Maasbommel)

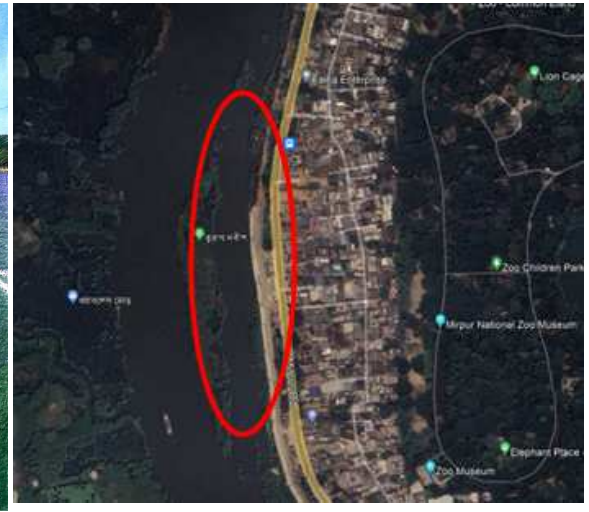
50m green belt buffer zone A 50 m (one hundred fifty feet) wide green belt buffer zone is proposed along the embankment on both sides to ensure the protection of the embankment from natural erosion as well as manmade destructions. Available open spaces in and around the area need to be integrated with the river side open areas. Landscape of the total recreational area and public spaces along the embankment needs to be developed in harmonizing with the above mentioned green belt.

Allow children to play, increase knowledge and adults to socialize outdoors Children and youth need places to run around and play sports; adults need pleasant places for recreation and exercise. Parks and playgrounds should serve these

purposes to some extent, though it is important to note that even in wealthy countries with pleasant parks, children often prefer playing on the lively streets than in quieter parks or playgrounds. To make the water adjacent walking routes livelier, producing fish tanks to recognize fishes, turtle, water creatures etc will encourage the little ones to spend their time around the water routes.



Fig: Proposed Recreation zone



Map-20: Proposed Site for Recreation Zone



Robondro Ashor (Dhaka)



Nobo Borsho Program(Dhaka)

Photo 51: Proposed Venue for Celebration of Cultural Program

Convert the neglected embankment area to a popular meeting place People need recreation and socializing—not just with friends and family indoors, but outdoors, where they can watch and sometimes interact with strangers, thus tightening social connections within the city. In Dhaka, people gather on footpaths, at Dhaka University's Teacher Student Center (TSC), and in other open spaces, but for many, the chief gathering place is in shopping malls. The outdoor environment is not conducive to meeting; almost nowhere are places set aside for people, and buffered from the noise, fumes, and risks from motorized vehicles. According to Peñalosa, "When a shopping mall replaces public space as a meeting place for people, it tends to be a symptom that the city's ill". There are a lot of ill cities in the United States and all over the world. Convert the embankment area into small recognizable spaces

according to our history, culture etc and name places after famous freedom fighters, flowers etc. which give the spaces identity, provides its individuality or distinction from other places, and serve as the basis for its recognition as a separable entity. One can comfortably find out the friends waiting for them at the decided place. People's fondness for their city also depends on the quality of public spaces. When people have the opportunity to recreate enjoyably and without expense in attractive places free from the noise, fumes, and risk from vehicles, they are, simply happier. Good public spaces are easily accessible by foot, bicycle, and rickshaw; large enough to accommodate many people, but not so large or empty as to be intimidating or feel unfriendly; provide plenty of places to sit, including benches, steps, low walls, and even statues, flower pots, and The visitors like most the serenity, relaxing environment, picturesque landscape, and tranquility provided by the river and open spaces. That is why the 'recreation experience' domain has got the highest satisfaction score. For this reason to keep up the raw essence of the space minimal use of permanent establishment has suggested on the model project area. Movable vendors and operable structures can be used to provide the facilities and maintain the natural fragrance of the route. At times, as per demand of visitors, electricity could be switched off and lanterns could be provided to create the rural setting or keep up the natural essence of that area. Thereafter, the visitors, especially the young people could sometimes try to enjoy the juvenile night's beauty under the full moon. Food and book corners, retail flower shops, gift corners, juice corners, and drinking water facilities even the toilet facilities could be mobile to keep untouched the natural fragrance of the scenic place by building less permanent establishments. The vendors could come to that place early in the morning and leave the place at night. The shelters and the shadings, rest places can be operable and use pen or remained closed when necessary according to the necessity of the users from protecting them from the sun and rain.



Photo 52: River Bank Restaurant (Bristol)



Photo 53: Holiday Market (Dhaka)

Increase facilities and encourage vendors to operate, as their presence prevents crime. Food corners, retail flower shops, gift corners, juice corners, toilet and drinking water facilities, permanent and temporary shades, information centers, well informed digitized route maps etc. are needed for these route areas. Certain basic conditions like sufficient lighting, clean up services, to ensure safety is also needed. Safety can also be increased by encouraging vendors to operate, as their presence prevents crime. To prevent crime and giving the service to the visitors, movable food vendors, book carrying vehicles from 'Bishwa Sahitto Kendro" and

other organizations may be encouraged to serve their vendors. A well drawn vendors' policy can be incorporated into the overall policy of developing these routes.

Providing necessary services

Public areas do not thrive without some sort of maintenance and security. The essential problem with recreational areas is that by being available to everyone, they are owned by no one. Lack of ownership means lack of maintenance; they can quickly become dirty and dangerous, inhabited only by people with nowhere better to go and avoided by most of the area's residents. There should have a direct authority that has responsibility to take care of these particular river side recreation spots to whom the recreational users can inform about their complains and also should have a modern and informative information system. In this regard, Bangladesh Tourism Corporation itself or Public Private Investment or any experienced Tourism Company may invest and provide services.

Multi level traffic solution idea

Traffic should be solved in multi levels. The walkway should below grade level in some places and screened from the adjoining road by flood walls in others. It must be easily accessible by stairs and ramps descending from the bridges, which mean pedestrian levels, are below the noise and traffic.

Financially Self Sustainable

Considering the management aspects of the project and to make it financially self sustainable, these facilities provided here would generate income and hence could be maintained modestly by a public private partnership. In reality, the idea will contribute to the restoration of the overall environmental quality of the river systems. To make it more sustainable and well balanced of visitors distribution along the route, total segment can be divided in two parts. One segment could be designed for mass people and there will be no entry fee and another segment could be exclusive where visitors are to pay for entry and every individual events.

Implications of the concepts on the study route

House boat Concept. Houseboats are the major attractions of the South Indian state of Kerala and draw numerous tourists to Kerala. Therefore, the houseboats are considered as prominent source to boost tourism in India and Kerala. Dhaka also encircled by 110km circular waterways with natural beauty. The inhabitants of this megacity are overloaded due to excess work stress. They desire a short trip close to the city which can refresh and boost them to rejoin in their work environment with a fresh mind. House boat concept can be a good option for them to make a short trip with family or dear one. During the rainy season tourists can make a day long or day-night package tour. To make this event more meaningful and memorable visitors may start their tour from Ashulia and visit Jamdai polli at Noapara and return back to starting point.



Photo 54: Kerala Houseboat, India

Shipment of Jamdani Polli and Jamdanir Hat

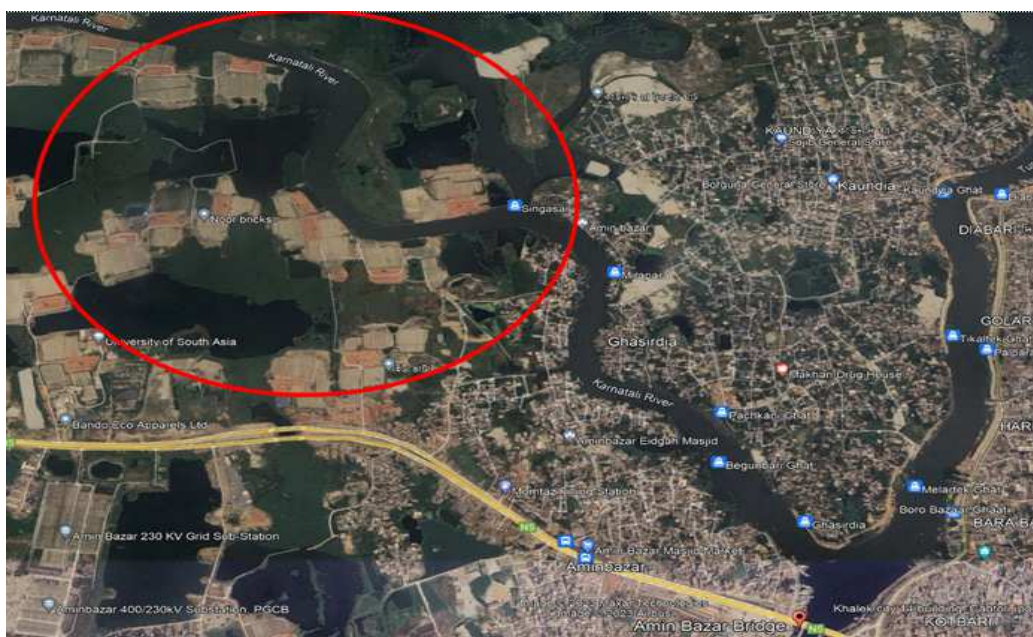
There are very limited opportunities in Dhaka for residents to spend their leisure time or short holidays within the city. House boat concept for CW of Dhaka city will make them able to solve this problem a bit. At present tourists are visiting 'Jamdanir hat' and 'Jamdanir polli' at Ruposhi Ghat, Noapara. Presently, the "Jamdani Hat" sits only on Friday morning (starts early in the morning at 4.00 am and finishes at 8 .00 am) which is not suitable for visitors who possess a kin interest to visit Jamdanir hat. To make this event more meaningful, easily accsesable and memorable, Govt. may take a step to shift the Jamdai polli to the adjacent village of River kornatok. if the recreational users come there on Thursday evening after work, they can attend not only the hat on Friday morning but also have the pleasant experience of staying on the house boats at night and can enjoy the divine night scene that the water offers to them. The boats will pick them from particular point and bring them back to the same point. There will be some specific cruises such as the one night cruise and two nights cruise. Specially for the foreign tourist it could be the best visiting place which will give the identity of our own heritage and meet their shopping options.



Photo 55: Existing Jamdanir Hat



Photo 56: Existing Jamdanir Polli



Map-21: Proposed Jamdani Hat Polli site

Science gallery

Bringing science, art, technology and design together, each Science Gallery delivers unique, transdisciplinary exhibitions, events and educational programmes that engage millions of inquiring minds every year in connective, participative, and surprising ways. These experiences enable young people to develop the skills they need for the 21st century, equipping them to thrive in the knowledge economy through the skills of STEAM (Science, Technology, Engineering, Arts and Maths) and the essential skills of creativity, problem solving, adaptability, resilience and communication. It is also increasingly important that the public understand and are actively engaged in university work and research. Science Gallery is at the forefront of interfacing cutting-edge research from the university with the wider public. It provides access to research participants in numbers and via methods not possible in a traditional university setting. Science Gallery inspires – and is inspired by – our global communities. By actively engaging with and involving students, faculty, researchers and the wider university and city in its activities, Science Gallery creates a porous membrane between the university and its locality.

National Museum of Science and Technology in Dhaka, Bangladesh was founded on April 26, 1965, by the Pakistani government and became a part of Bangladesh's Ministry of Science and Technology following the Bangladesh Liberation War. It was first based in the Dhaka Public Library, and moved a number of times before its permanent home was completed in 1981. The NMST serves as Bangladesh's only science museum and organizes science education activities at a national level. In this modern age this organization needs to update so that it can provide standard facilities to the visitors.

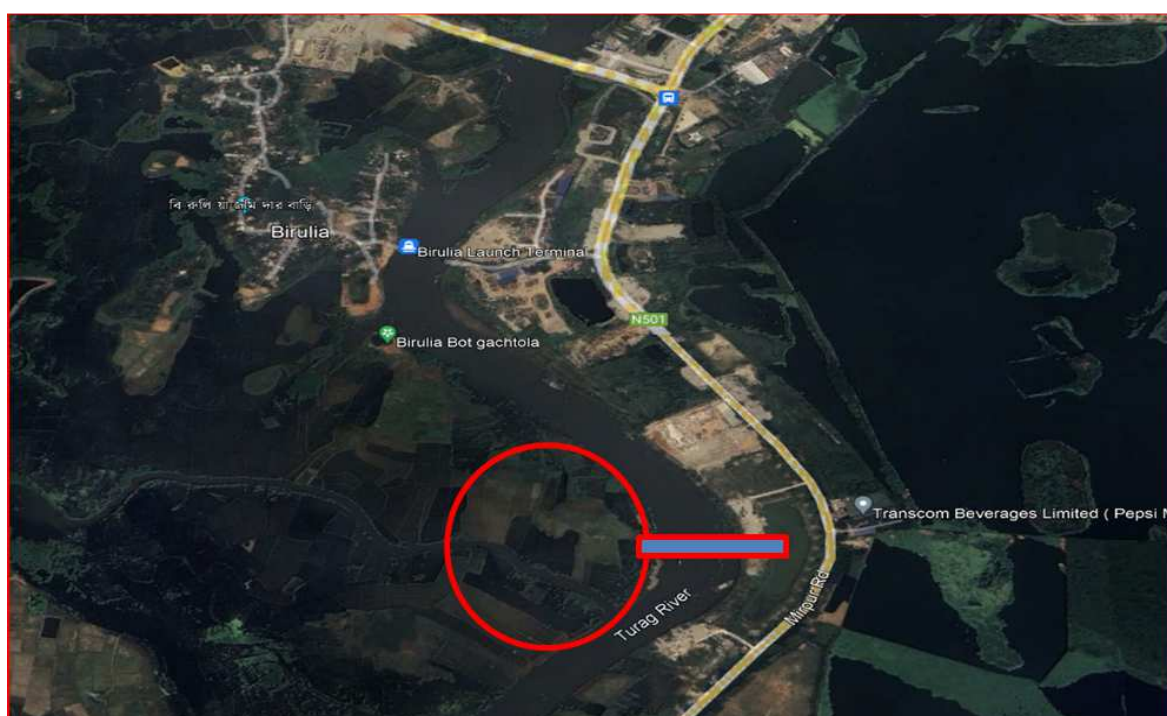
These types of organization should be located a bit apart from noisy and busy place. In this regard the concerned ministry maytake initiatives to establish a modern science gallery close to river Turag which will have natural beauty and calmness as well. It is to be considered as an infrastructure of pride for the nation.



Photo 57: Marina bay Science Museum, Singapore



Photo 58: Halix Bridge at Marina Bay (DNA Shape)



Map-22: Proposed location for Science Museum

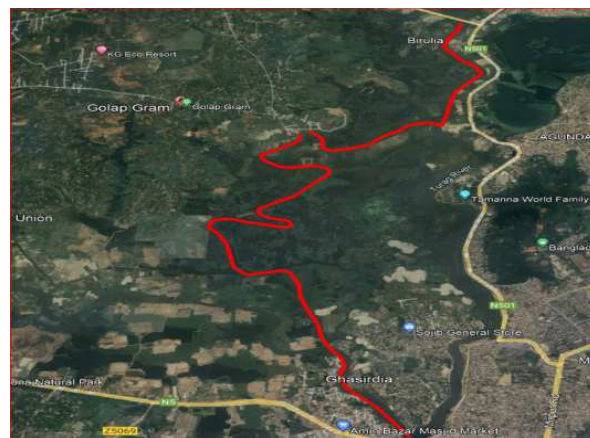
Day long trip adjacent to the route

The Birulia Union at Savar is known as Golap Gram or the village of roses because of rose garden. Almost 90% of all the villagers here make their livelihood from selling roses. The kind that they cultivate normally is called Miranda. Other flowers like gladiolus, gerbera, etc. also cultivated here. It is the only village in Bangladesh which has a unique identity as flower based agriculture. Tourists are very much interested

to come close to the nature to revive their mind with friends and family. To come to this village visitor may arrange a day long boat trip through different canals which are connected through river Turag. Especially foreign tourist will get a unique flavor while visit this village by boat. In this regard, existing canals from river Turag to Golap Gram are to be dredged and both banks of canals may be planted with beautiful trees. No doubt, it will contribute to the national economy as a tourist spot.



Photo 59: Rose Garden at Golap Gram



Map-23: Proposed Boat Cruise route to visit Golap Gram, Sadullapur

Most of the visitor agreed about the fact that river is key element for generating their recreation trip. Though water quality of river is terrible and causing detrimental effects of its surrounding area but it is not interfering visitor's use and enjoyment of the river. Most of them want to come near to the water but due to lack of facilities they are unable to do that. It is expected that with the help of these above suggested concepts the routes could provide quality public spaces for recreation to the city dwellers. The proposals however are not the footprint of every solutions but rather can be a starting point where the transformation can occur. The proposed concepts for the water routes development will offer things to do people and provide them with choices and options to come to that place and possibly return again. This experience would give the visitors' rich material for fantasies and memories. Also these concepts will offer these routes uniqueness which will provide a sense of identities to these routes corridors and serve as the basis for its recognition as a separable entity. Thus these routes can retain the essence of its place while improving its physical and psychological aspects so that people are attracted to that place.

7.3 Recommendation and policies Dhaka's water bodies have made the city unique, which required a different strategy for urban development and planning. But since the 1950s all that has been destroyed, either systematically or as the fall-out of one misplaced decision after another. To bring changes to a city like Dhaka, we need political will, bold imagination, and a serious commitment to carry that out. The planning of Dhaka needs imagination more than technocracy. People who understand the designing of cities should be brought to the helm and not bureaucrats and seemingly uninformed technocrats. For river recreation first of all we have to save our rivers and restore to their original condition as much as possible. For this we need to have proper policy and planning and their sincere implementation. To retain and enhance the aesthetic and recreational value of the model

project site (Aminbazar to Ashulia) some effective steps should be taken. Basic considerations are:

- a. Agencies involved in the matter should involve the local community in every stage of planning, implementation, operation and maintenance.
- b. Connections of the Circular Waterway with various inner channels should be improved and no development plan should impede such continuity.

Restoration and Conservation of the Water body

To restore and Conserve the waterbody the following steps may be taken:

- a. Defining and demarcation of the route area and fixing the boundary by the concerned authority is the prime requirement. In this route it is observed that BIWTA has been demarketed their boundary with marked pillars which is a remarkable initiatives. However, it might be cross checked by DLRS and Survey of Bangladesh whether it has been marked properly or not. To preserve and protect the water route as from encroachment some landscape measure felt urgent. DAP proposes to keep at least 2-4 m of buffer zone with paved area around the small sized wetlands in the built up areas of Dhaka. However, in case of large areas of wetlands or for scattered and congruous pockets of wetlands large areas of green belt are proposed. In such cases 5-15 m buffer zone with green belt is proposed which can serve as neighborhood recreational spot for local people.
- b. Ensuring buffer space (50 meter) surrounding the water route by implementing existing laws and regulations, Establish green areas within the buffer zone, both new areas and areas recovered from encroachment, with planting of trees shrubs, gardens and development of walkways. Moreover it is suggested to acquire land where necessary to create the 50 meter buffer zone either on river side/banks or canal banks. A number of temporary structures are there within this 50m belt which should be demolished and the river bank needs to be recovered. However, there are few permanent structures within this reserved landscape zone, among which only the mosques and important public services should be kept. Besides, the number of the permanent structures within this belt is very few and most of those are illegal development or encroachments. Those structures are to be identified and demolished.
- c. Increasing water holding capacity by excavation of sludge from the water-bed.
- d. Preventing encroachment by strictly implementing laws and regulations. Consider hard banking of canals to reduce the risk of encroachment.
- d. Improving the water quality by
 - Preventing dumping of garbage into the water
 - Redirecting the sewer lines out of the water body
 - Increasing dissolved oxygen in the water by means of biological, chemical and mechanical ways; such as, controlled hyacinth growing, fishing, paddle boating, mechanical oxygen inducing, adding chemicals like phosphorus etc.

- Bulrushes plant in the land along water in order to clean the water.
 - Preventing industrial waste and toxic materials releasing into water.
- e. Embankment protection by adopting any of the following type of treatment
- Staging, where the river width is enough
 - Retaining walls, where river width is minimum
 - Layering of embankment by using Geo-textile fabric.

Type of Physical Development on the river shore

- a. The river should never become a commercial extravaganza, however lucrative the money spinning offers may appear to be.
- b. Avoiding construction of permanent structures. The essential structures should be of minimum height and ground area coverage and can be operable.
- c. The route area should be used mainly for passive recreation like, jogging, cycling, boating, fishing, community gathering place.
- d. Facilities that would generate lesser waste and garbage must be allowed to establish.
- e. Provision of essential facilities like, public toilets, drinking water fountains, proper lighting, and recycling bins.
- f. Walkways and cycling tracks should be continuous in this route.
- g. Mobile vendors should be encouraged to prevent crime and maintaining the natural fragrance of the route.

Landscaping and Plantation type A good landscape plan protects water quality and encourages native plants, fish and wildlife close to shore.

Riparian Zone - This zone extends about two feet up the bank from the edge of the water. Fluctuating water levels and the wave action from boats and wind impact this zone. Plants here must tolerate wet soils for long periods and have deep root systems to minimize erosion. Low-growing plants are best, so the view from the residences is unobstructed. Examples of plant varieties suitable for this zone are: lady fern, sedges (many species), and blue flag iris.

Lower Bank - This 02 to 10 foot zone is adjacent to the riparian zone. The soil here tends to be moist but not wet. Plant for this zone should include at least three shrubs (such as red osier dogwood, red elderberry, and evergreen huckleberry) and two ground cover varieties (such as lady fern, bunchberry, and sword fern).

Upper Bank - This zone extends from the end of the lower bank zone toward home. The landscape here should include at least three shrubs (such as serviceberry, mock orange, and red flowering currant) and two ground cover plants (such as salal, sword fern, and pig-a-back).

- a. Screening from pollution and noise can be done by planting appropriate kind of trees.

- b. Proper drainage system for surface runoffs should be a major concern.
- c. Large shady and deciduous trees are not suitable for water boundary.
- d. Plant types which would strengthen the banks and prevent erosion should be used.

Management and maintenance

Lack of maintenance can make any area unattractive and under-used. Recreation associations at ward level are recommended for Dhaka City. Recreation associations should work in partnership with local authority/ward commissioners to identify gaps in local level water based recreation services and develop a plan to provide these services. Agencies involved in the matter should involve the local community in every stage of planning, implementation, operation and maintenance. Local authorities should budget for operation and maintenance. Safety and security should be monitored by them and providing security and regular service like lighting, guard arrangement etc. Proper maintenance of the route areas by local area committees, preventing the bank areas from encroachment is necessary. BIWTA is upgrading the rivers and canals under their existing Circular Waterway project in order to make them navigable and provide some berthing and landing facilities. It is the appropriate time for taking initiatives to incorporate water based recreation through planning and urban design. By providing recreation facilities along it, the navigable route will also protect the rivers and canals from encroachment and enable people to enjoy and recreate along the route side while experiencing and understanding the historic waterway environment as part of a managed and protected landscape. Initiative will have to be taken to introduce fast moving vessels and water bus system circling the city, following the natural course of rivers framing Dhaka. The circular waterway does not require extensive infrastructure and can connect with major transfer nodes for other modes of communication. Different types of boats should be introduced to attract visitors. As design and planning are absent from every development sectors concerning urban design and development, design solutions can be provided by the students of different educational institutions having architecture, planning and urban design discipline. Specific problems concerning recreational route development can be given to them as class projects or arrange some competition by the authorities to get some nice designs and concepts from them. This will not only produce good designs but also build the sense of belonging among the future nation builders. An integrated approach to protect the rivers has always been missing. Every govt. should be very keen to save the rivers, improve the environment of Bangladesh and reduce the impacts of climate change. Lack of Institutional Co-ordination between different agencies and overlapping of tasks fades the water related projects' potentials and makes the total system inefficient. The institutions which are involved for waterway transportation planning and implementation of the projects are not capable of undertaking their mandated functions due to lack of trained and experienced manpower. An effective separate or "Unitary Authority" needs to be formed to monitor and coordinate agencies related in the river-saving projects. The authority should work sincerely not for show off. BIWTA, Tourism Board, PWD, BWDB, DCC, WASA and RAJUK should take the decisions together and should be the part of this Unitary Authority. The authority should take initiatives to develop a website containing modern and well informative information about the waterways in and around Dhaka. The concerned authorities have failed to prevent developers and traders from occupying river banks around the city. Local goons, in league with a section of concern authority officials are allegedly backing the illegal encroachers, defying warnings of the Prime Minister and the High Court.

Encroachers have already grabbed the embankments of Turag River to run their sand and stone chip business in different point of this route. According to as and trader at Dour, local businessmen continue to grab river embankments by paying money to a section of the concerned officials and local goons. When the custodians act such outrageous offenses ruthless handling of this matter is required. Properly developed and well managed river corridor can lessen the illegal encroachment of the river bank. Authority should provide defined land use permitted in the river corridor. That can alleviate the illegal encroachment of the river bank and give the rivers land back to them. The area besides river banks must be surveyed as per CS map and the existing land use has to be recorded in CS Mouza Map. But since the feature found in CS mouza map is often distorted now (often it is seen that river banks has turned into plots and used for residential or commercial purposes or river banks which existed in CS maps no longer exists, instead they are in different location). In this case, both the CS and RS maps should be consulted before any physical feature survey made and final decision is taken. To encourage people for using water route modern boat with high speedis must as riverside road at Mirpur side is well developed and well connected with Ashulia Bridge. Majority foreign tourists come to visit Bangladesh for her natural beauty. From aforesaid finding, it is revealed that the domestic tourists firstly choose to tour to see places which are famous for scenic beauty. On the other hand to the foreign tourists they choose to see archeological and historical places as a first causative reason while second choice to them is scenic beauty. In spite of having the asset and knowing the truth tourism board did not incorporate the waterways in the tourism plan though waterways can play a significant role in tourism and recreation activities. There should be a separate department under BIWTA that is responsible for the formulation of policy based on needs assessments for water based recreation according to age, gender and socio-economic groups at ward level. The committee should comprise government, non-government organizations, and other community-based and local organizations. The authority should make a waterways initiate action—research to make them more attractive for recreation purposes. Based on ward-level needs, the authority should prepare a yearly plan; this should consider the provision of adequate financial support from government, establishment of new water recreation facilities, improvement of landscape, security, regular maintenance and management aspects. Planner's aim should be to bring people close to the water. Measures should be taken to ensure that while planning housings near water bodies' water based recreation should be provided for that local area. Land owners who have waterways or wetlands in or near their properties should be aware of enhancement schemes. Encourage beautification programs, with planting of gardens by individual residents and businesses. Architects, landscape and interior designers, planners, teachers, and recreation specialists should increase their knowledge of water based recreation. Programs should be organized by the professionals for capacity building of the general one. Water based recreational users can sensitize decision makers, urban officials and community leaders to their needs and priorities for recreation facilities through workshops, demonstrations, action research and public events. Such awareness-raising can bring water based recreational users together with city officials and community leaders to discuss issues and draft action plans. Planners and decision makers should apply a water friendly lens to policy affecting water based recreational users particularly in the design and planning of water corridors. It is hoped that these recommendations will make Dhaka more water-friendly, ultimately producing happier recreational users, better water corridors and green open spaces in community areas as well as city dwellers.

7.4 Creating an Exclusive Recreation Zone (ERZ)

Dhaka, the world's most densely populated megacity with a population of 23.21 million, boasts an unenviable record. The shortage of entertainment spots becomes particularly evident on the occasion of different festivals like Eid Festival, Durgapuja, New Year, Christmass etc. Those Dhaka residents who cannot get out of Dhaka during such holidays have reasons to count them miserable as the handful of recreational venues available in the capital get overwhelmed by heavy rushes of crowds. In most cases, the visitors return home disappointed, exhausted and with bitter experiences. The fact is that there are not enough facilities in this city for a family to relax together in a peaceful environment. So, overcrowded the few outdoor venues here become on holidays that even fun-loving children have to jostle for a space in an amusement park, let alone the elders in a peaceful pristine surrounding.

The options for visitors are not many. The national zoo, botanical garden, national museum, Dhanmondi lake, Ramna Park, Suhrawardy Udyan, Hatir Jheel, Bangabandhu Sheikh Mujibur Rahman Novo Theatre, Bangabandhu Military Museum are the places of public attraction. Long queues are seen in front of privately-run entertainment centres including Jamuna Amusement Park, Toggi Fun World, Fantasy Kingdom, Nandan Park, Tamanna Park and Babuland. Historical places such as Lalbagh Fort, Ahsan Manjil, Panam Nagar and Sonargaon museum also experience a mad rush of recreation-seekers every important festival. They find themselves virtually at a war with each other while buying tickets, entering recreational centres and have a look peacefully inside the centres. Some of them sometimes give up in the middle and make a rush for another entertainment centre. Many of them, however, hardly become successful, end up wasting hours in this process and return home without visiting any place.

The spots, which do not require tickets, see huge crowds in front of entry and exit gates and often women and girls feel threatened to be molested and harassed in such crowds. Those who are fortunate to enter recreational centres feel disappointed because the heavy rush does not give them any time for relaxation or peace of mind. There is almost nothing new to experience in Dhaka's recreational venues. People are tired of visiting zoo animals of particular good health and in the best of environment and the same old places around the city. The national zoo in Mirpur hardly boasts the standard of such world-class facilities. It has a large area but it does not seem to be attractive and organised to the visitors. Cinema halls have now become a thing of the past and many of them have already been demolished to give in to shopping malls. Theatre is concentrated centrally and posh areas like Gulshan, Banani, Uttara and even Dhanmondi have no theatre halls.

Public recreational centres do not seem to take any preparatory measure before important holidays for managing huge gathering of visitors. Also, the authorities concerned appear to be least bothered about the service they provide. Shishu Park in Shahbagh area used to be a prominent centre of recreation for families in the past. Once, Eid festival seemed to be quite incomplete if children could not visit this place. Instead of outdoor playgrounds, children now want to spend their time in indoor play-zones. But there too, people experience long queues during Eid holidays. Even after paying a notable amount of money, children cannot experience all the rides of these zones on Eid holidays.

The problem lies with the mismatch between the city's space and its population size. In an ideal city, some 30-40 people live on each acre of land. But the number of people who live in this city is more than 500 in each acre of land. It is not easy to define whether or not an area for entertainment centre is adequate, yet recreation specialists have come up with

rough rules which are often used; one standard, for example, is that a city should have one acre of park or playground for every 100 inhabitants. Even this number of recreational spaces is not adequate unless they are well planned, well developed and well managed, according to the American Planning Association. In case of Dhaka city, if there is a park or playground even for its 1,000 people, it would be a matter of contentment and relief. For a population of over 23 million, Dhaka city does not seem to have more than 20 recreational sites for indoor or outdoor enjoyment. The lack of adequate entertainment centres is one of the factors that has kept Dhaka on the list of the least liveable cities in the world for years. It is still the seventh least liveable city in the world, according to the Global Liveability Index 2022.

Overcrowded recreational centres should prompt the authorities concerned to set up more such facilities across the city. It is time to address the problem of inadequate recreational arrangements in Dhaka. Otherwise, it will have adverse physical and psychological impacts on youngsters, who have nowhere to go to be close to nurture and stimulate their creativity or pursue interests in games and sports. Keeping the visitors problems and their suggestions this study finds need for developing an exclusive recreation zone for making balance on gathering of tourist in this site. The government may take initiative to welcome private investors to invest in this exclusive recreation zone.

Reason behind the selection of the exclusive recreation Zone

The following points have taken in account to select the site as an exclusive zone:

- ❖ Existing Ashulia Landing Station
- ❖ Parkig Facility for visitors
- ❖ Ashulia Elivated Expressway Connectivity
- ❖ Dhaka Bi-pass road approaching this site
- ❖ Dhaka Metro Rail Connectivity
- ❖ Mirpur Beriband existing road facility
- ❖ Aminbazar 08 lane bridge and road connectivity with Mirpur-Ashulia Road
- ❖ Low Flood Zone, No permanent Construction will be built like: Housing, industry etc.
- ❖ Flooded during wet season
- ❖ Waterborne recreation facility can be arranged
- ❖ Natural Beauty
- ❖ Navigavility in River Turag
- ❖ Huge open space on river bank for detail recreation arrangement
- ❖ Modern Housing very close to the site

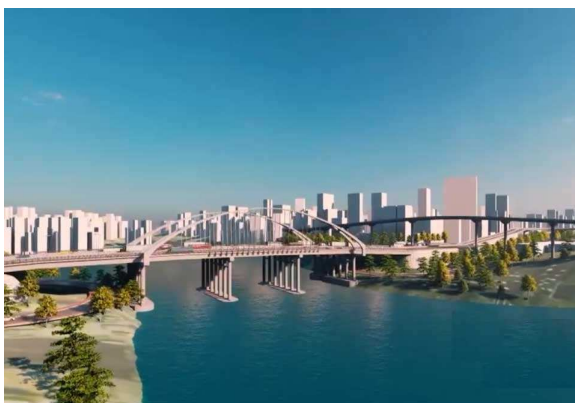
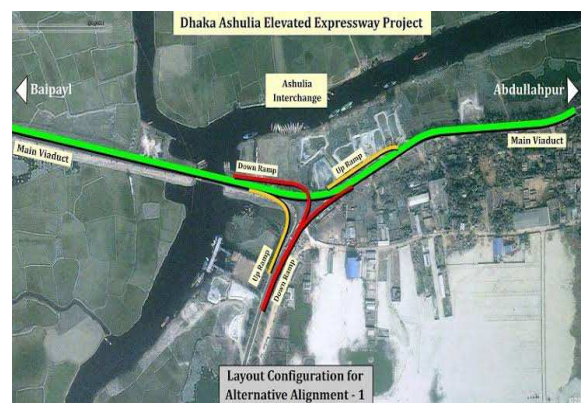


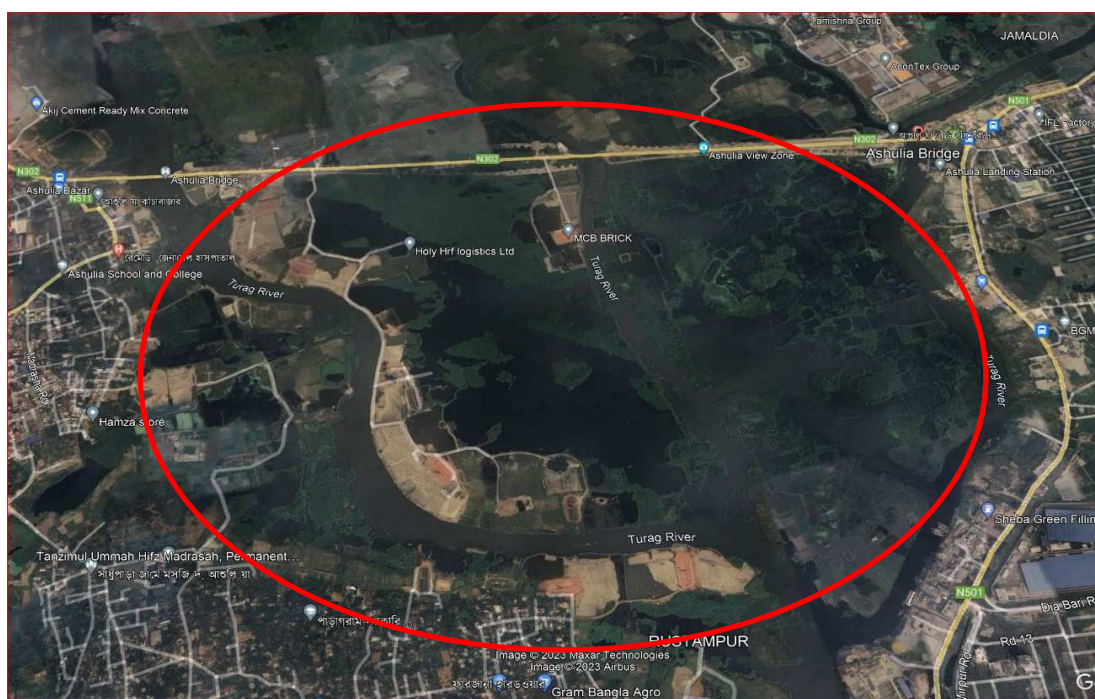
Photo 60: Aminbazar 08 lane bridge works in Progress



Map-24: Proposed Ashulia Elivated Expressway

Location of the proposed zone

The proposed exclusive recreation zone is located in the vicinity of Ashulia Bridge and its adjoining area. This area is acting as Low flood zone for Dhaka city which is totally unutilized. It becomes flooded during wet season and dried during dry season. Due to regulations of flood flow zone, this area can not be used for permanent structure. On the east side of the zone Dhaka- Ashulia expressway, on the north side Mirpur road, on the south Ashulia village area and on the west Rustampur local area is located. This place is becoming the hub of communication for visitors as it is having multiple types of transportation facilities like; Road, Rail and Water transportation system. The existing beriband namely Mirpur road is already acting as major road and it is also connected with main Dhaka city through Savar to Ashulia via Abdullapur route and Mirpur via Aminbazar to Savar route. Easterly close to this area flight route for Hazrat Shahjalal International Airport is demarcated. On the north side, the Metro rail last station located. Overall it could be a well connected and vibrant place for the visitors which they are expecting for prolong time.



Map-25: Proposed Location of Exclusive recreation zone at Ashulia Bridge area

Present Condition of River Turag at proposed site

At present, River Turag has three branches from Rustampur point. One branch connected with Tongi Khal as part of circular waterways, another small segment run through middle of the low flood zone and another branch run to upstream on left side of the proposed zone. Right side leg having width almost 70 meter, middle one 60 meter and left one 70 meter. Right and Left side branches having near 2-3 meter depth (Below MSL) and middle Canal has also minimum depth (less than 2 meter). During dry season, at Ashulia landing station is becoming almost dried. As such, circular waterways are not being exists during dry season due to lack of navigability. On right bank almost more than 100 meter space is available for development of this zone for different purpose. For the left branch river, the left side sufficient space is available for development.



Map-26: Branches of River Turag

Need for Exclusive Recreation Zone

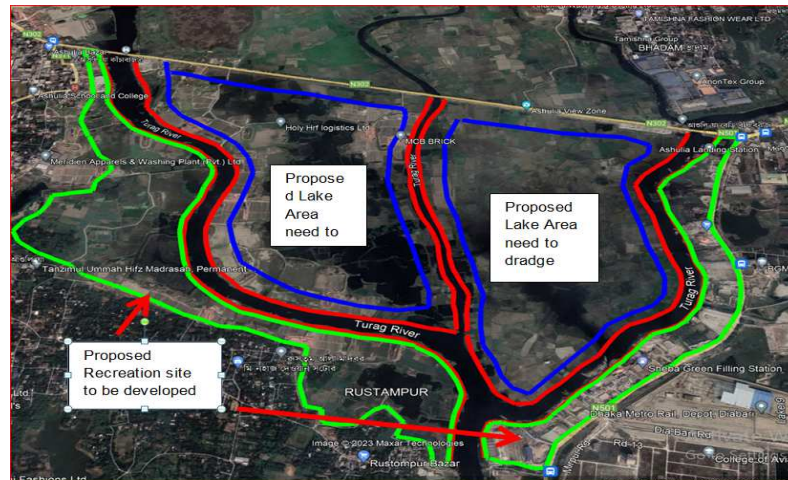
At present waterbased recreation zone is very limited in Dhaka city. The existing waterbased recreation zones are established based on isolated waterbody. Those recreation zones can not meet visitors multiple expectations like; Boating, Swimming, Enjoying Cinema, Couple corner, kids zone, Adult zone, Amphitheater, site seeing, enjoyment of waterfront etc. Although visitors are agreed to pay for recreation but Dhaka as a mega city could't arrange a multifunctional water based recreation zone. Bangladesh is becoming developing nation by 2041 but its megacity not yet ready to give some space to the foreign tourists for recreation within the vicinity of its perimeter.



Photo 61: France President Emmanuel visiting the River Turag

From the analysis of this study it is felt that to accommodate foreign tourists initially at capital city we need to create some space which will be free from beggars, third gender (Hijra), safe from eveteaser, free from hijack or theft case, free from pollution. The zone should have all the facilities which are expected from a foreign tourists and local tourists as well. Recently,

we have accommodated the HPM of France at river Turag for light refreshment which was his desire. It proves that a foreign tourist looks for such a place at his /her leisure period where he or she can spend some time in a meaningful way. To enhance the reputation of this megacity, it is a matter of requirement not just an investment.



Map-27: Proposed development site at Ashulia



Map-28: Proposed Development Plan



Photo 62: Proposed Water Barrier (Sluice Gate)
(Maeslantkering Barrier- Netherlands)

Map: Proposed Sluicegate

Design the Exclusive Recreation Zone

The proposed zone lies on low flood zone area. Considering the associated regulations of low flood zone and to meet visitors expectations, an exclusive recreation zone at Ashulia are designed which will provide standard level service to the visitors.



Map-29: Proposed for Creating New Connecting Canal with Tongi Khal

Proposed services of this Zone

Considering the requirements and suggestions of visitors, the following facilities may offer in this zone:

- a. **Boating Service** Ashulia is such a wonderful place with scenic beauty where usually people love to visit round the year. They always like to come to close to water. As the river turag has navigability and wide space for boating, an exclusive boat package can arrange for the visitors and Ashulia landing station can be used as starting

point. Different types of boat can be arranged like; Couple boat, Family boat. Air Condition, non Air Condition both options may be available. Boats are to cast off from ashulia landing station and giving a trip upto Turag north end and return to ashulia landing station as disembarkation point. On both the bank of river turag will be enough lighted at night so that day- night boating options will be there. In addition paddle boat and traditional wooden boat will be available inside the lakes. Dedicated boat Service Company may employ with proper training on boat handling. Boats are to be designed with modern facilities to serve maximum enjoyment.



Photo 63: Proposed River Cruise Boat



Photo 64: Proposed House Boat



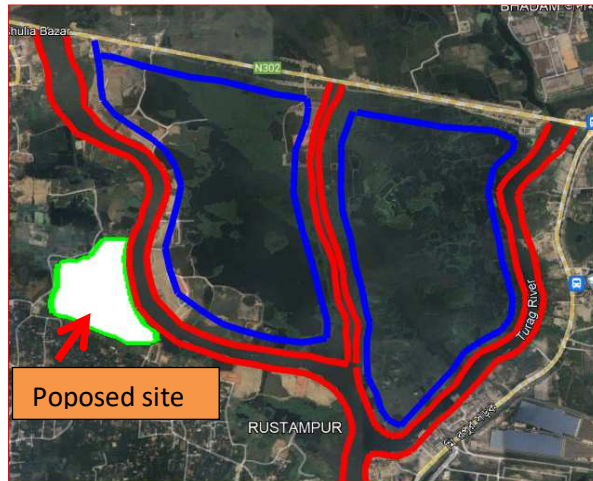
Map-30: Proposed Landing Station at Ashulia



Map: Proposed Boating route (Red Channel)

b. Amphitheatre Service In modern usage, an amphitheatre is an important venue for recreation specially close to river bank. Visitors usually like to sit somewhere

which is mindblowing with respect to place, site beauty and mind refreshing event. An amphitheatre could be the best options to meet the visitor's expectations. To set up this arrangement an open silent space is needed near to river bank. In this proposed site on the left bank of river turag (Left leg) there is a suitable corner with wide space. This corner can be established for amphitheatre settings. This site can also be used for different festival celebration point like; New Year celebration, Probarona Purnima, Pohela Boishakh etc.



Map-32: Proposed Amphitheatre Site



Fig 24: Proposed Amphitheatre Concept

c. **Restaurant Service** Modern riverside restaurant is very popular to the visitors. This segment having suitable site for establishing modern riverside restaurants which will meet the visitor's food service requirement. At the same time a traditional food corner may be established where different kinds of traditional village food like; Seasonal Pitha, Chittagong Mejbani item etc. will be available.



Photo 65: Riverside Restaurant at Bristol, UK



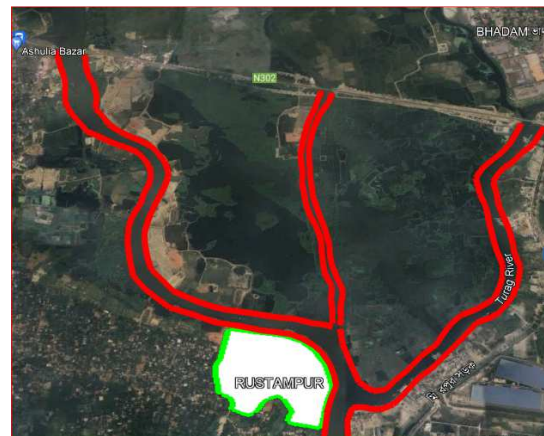
Map-33: Proposed site for Restaurant

d. **Cinema Hall and Theater Hall** The theater is the oldest entertainment medium in the world. For a long time, we have been fascinated, shaken and impressed by theatrical performances. Aside from film and television, the theater nowadays tends to lead a shadowy existence in the media world and yet a revival makes sense. Because the theater can do more than just bring dusty plays onto the stage. Due to its immediate, direct form of representation, it can have a special influence on us

spectators, which all other forms of media cannot achieve in this form. Going to the cinema is also a communal experience, sharing the emotions of the film with others in the audience and creating special moments that are lost through other viewing mediums. This site could be a best one for setting a multipurpose recreation building but not highrise. People can come here and enjoy movie time along with other recreation options.

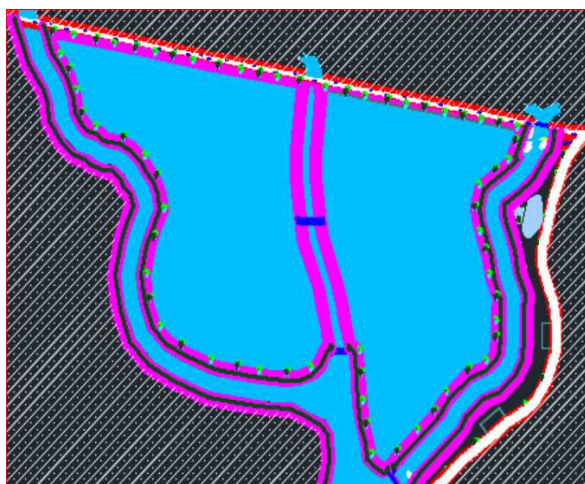


Fig 25: Multipurpose Hall for Recreation



Map-34: Proposed site for Multipurpose Hall

e. Fishing Facilities Recreational fishing involves considerable numbers of people around the world in both developed and developing countries. In Bangladesh visitors also love to fishing by fishhook. As per the proposed design of this recreation zone, the water catchment body will be locked for near about 06 months and Freshwater fishing is the most popular fishing activity among recreational anglers. So both lakes and river can be used for fish harvesting (Not Commercial) which will give immense pleasure to the visitors for fishing by using fishhook.



Map-35: Proposed Fishing Zone

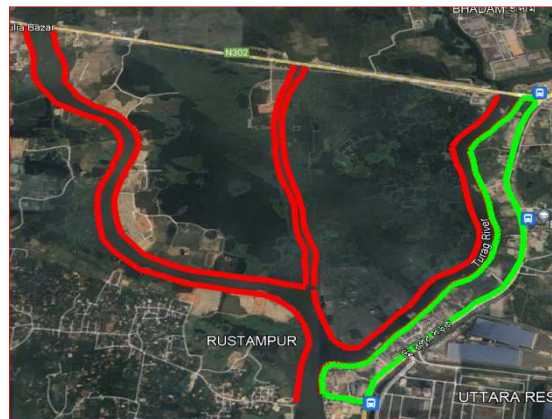


f. Shopping Mall Riverside Mall, which can play an important role to meet the visitor's expectation. Countrylike Bangladesh, It could be a sign of quality for the proposed recreation zone. Usually Riverside mall offers a high standard of shopping and a variety of activities for convenience and pleasure, ensuring the satisfaction of diverse shopper. All the local branded shop along with worldclass branded shop may

open their outlet here. For foreign tourists and local visitors few authorized drinking bar may be arranged in riverside part of the mall.

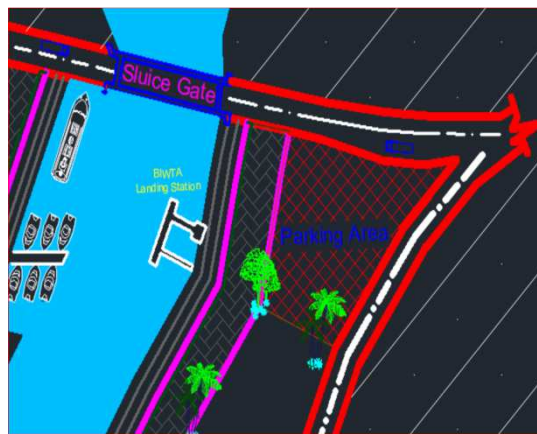


Photo 66: Rivercity, Bangkok

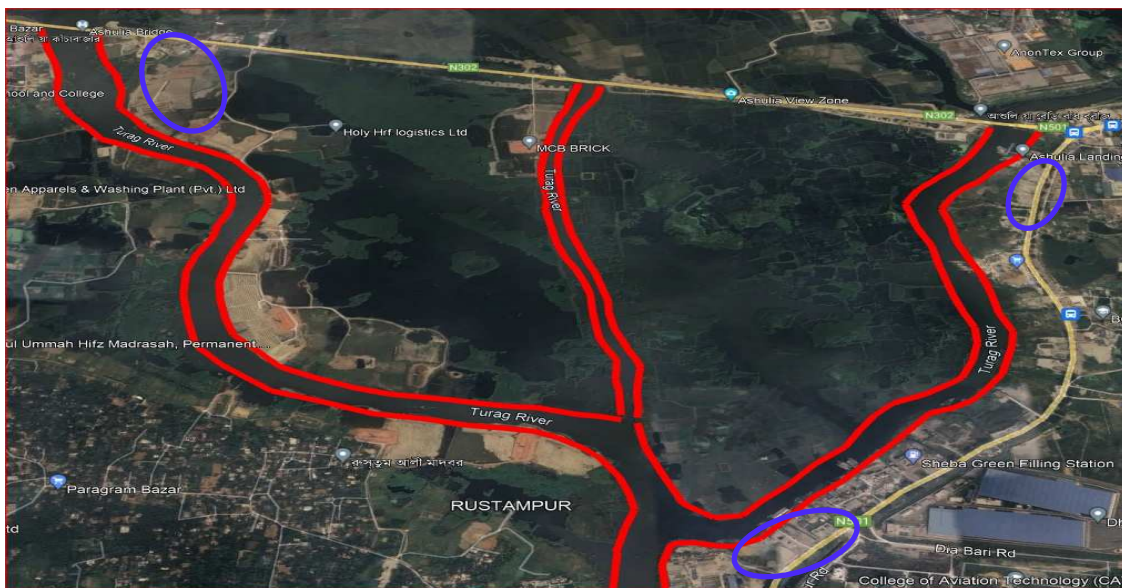


Map-36: Proposed site for Shopping Mall

g. Parking Facility Parking facility is very important in a standard recreation zone . As it is considered as an exclusive recreation zone, majority visitors will come with personal vehicle. Considering this factor three parking zones are proposed for this zone.



Map-37: Proposed Parking site at Ashulia Landing Station

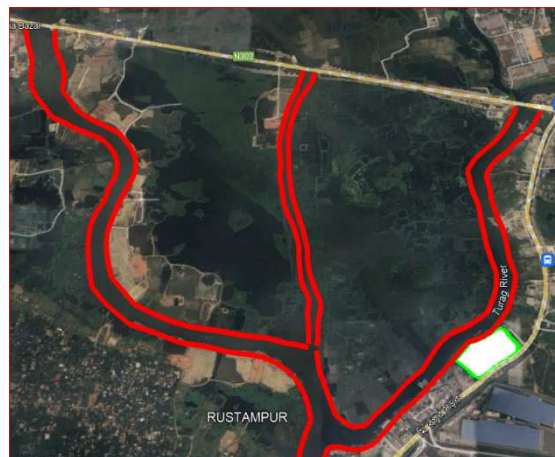


Map-38: Proposed parking site

h. Swimming pool Swimming pool is the ultimate expectation of visitors in an exclusive recreation zone. A well planned waterbased recreation zone can provide the utmost satisfactions of visitors. Considering this factor a modern swimming pool can be set up in this zone.



Photo 67: Jamsil Hangang Park Natural Swimming Pools Seoul, South Korea

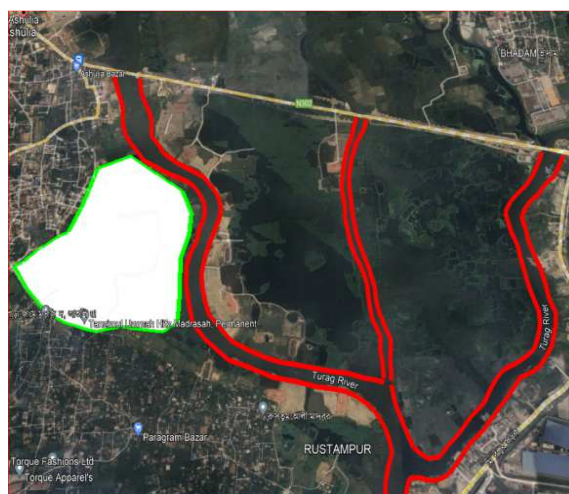


Map-39: Proposed site for Swimming Pool

i. Riverside Echo Garden To make echofriendly, a recreation zone should have some spaces with green park and trees which will definitely attract the concentration of visitors. Despite of having limitations of available land, a suitable corner may select for developing an echopark.



Photo 68: Singapore Garden at Marina Bay Sands

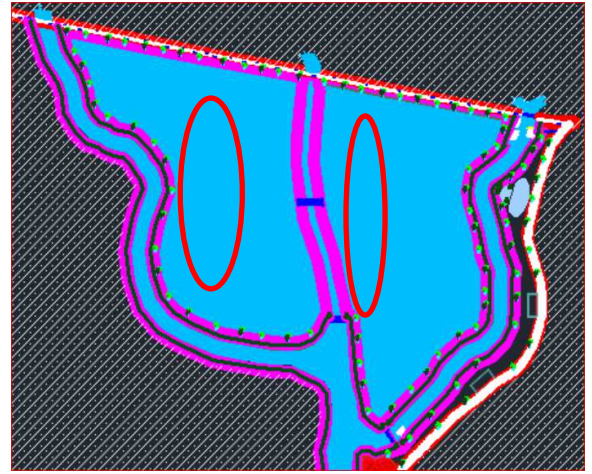


Map-40: Proposed site for Garden

j. Water Fountain Water fountain can add an extra image of a waterbased recreation zone. Visitors can enjoy a colorful night view from the riverbank which will blow their mind and help to pass some precious moments with near and dear one. Both the proposed lakes may be the suitable site to set waterfront in this exclusive recreation zone.



Photo 69: Waterfront at Marina Bay Sands, Singapore

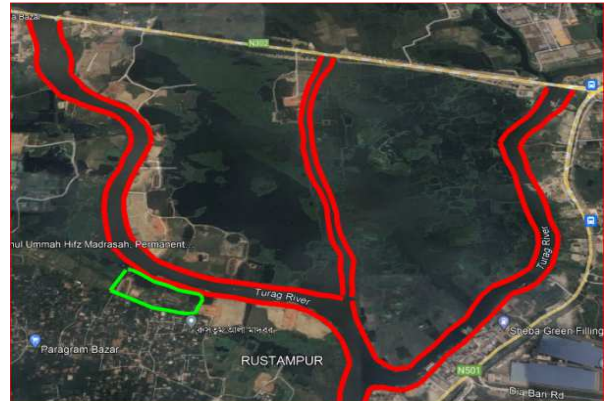


Map-41: Proposed site for Waterfront

k. **Club House** To meet the expectations of foreign tourists and local visitors as well, a modern club house can set up in this zone.



Photo 70: Night Club



Map-42: Proposed Site for Club House

l. **Kids zone** In a recreation zone kids are to be accommodate in a such a location which will help parents to pass their quality time with kids. Considering an exclusiveness of this zone all the modern facilities for kids like; indoor games, revolving observation wheel, floating playground etc. may be arranged.



Photo 71: London Eye

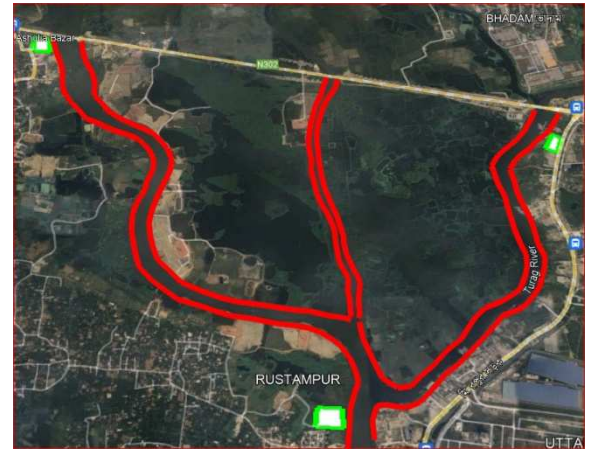


Photo 72: Floating trampoline Park in Texas

m. **Security Service** To enjoy inside the recreation zone, security is the main concern. In this exclusive zone, a well organized security system is suggested to set so that the visitors can feel free to roam around day and night without fear of safety and security. Whole area may need to be isolated and keep under surveillance by close circuit camera. Rapid action force needs to be ready round the clock for mitigating any security issue.



Photo 73: Proposed Security System

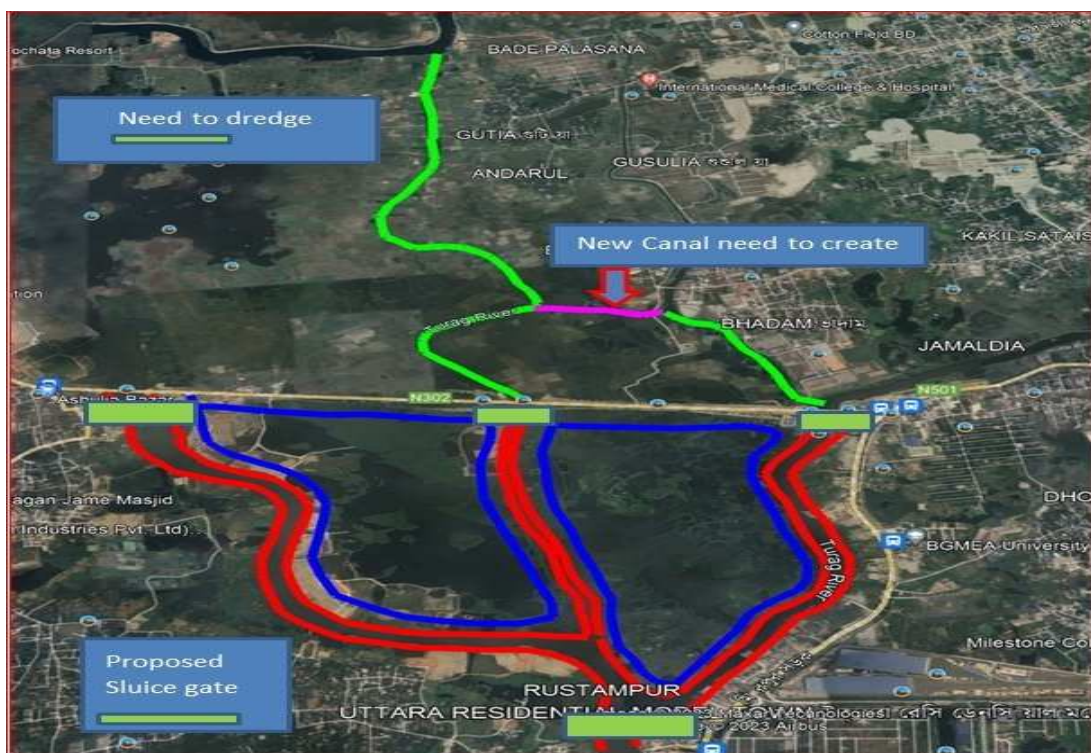


Map-43: Proposed Police Box station

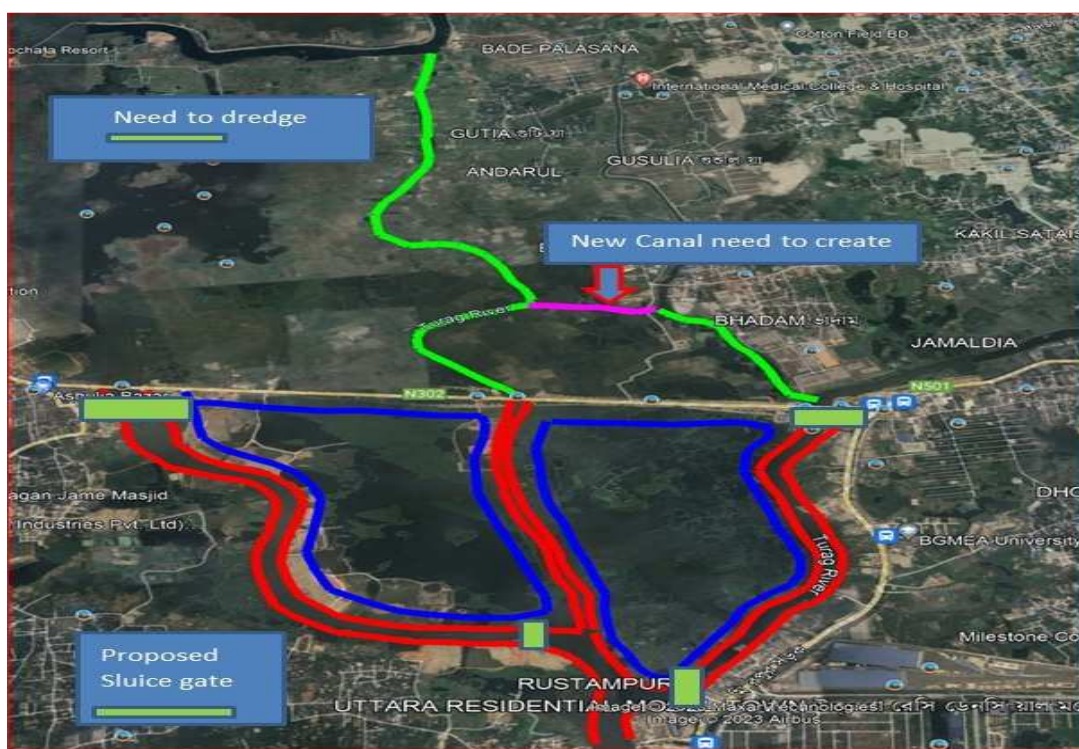
Challenges

The following challenges have been observed to implement the proposed Exclusive Recreation Zone:

a. **Maintain Circular Water Ways Round the Year** From the surveyed depth information and water level in this segment of the study route, it is observed that during dry season Ashulia landing station and its adjacent area almost becoming dried due to lack of water flow. During dry season, the water quality is becoming too poor that it looks like blackish color with bad smell. For water based recreation, fresh water with high quality and sufficient water is must. Tongi khal is almost dried with having depth 1-2 meter depth. Its water quality is being too poor during dry season due to pollution from industry and local users. This flow also passing through the Turag river which destroying the water quality of its own. As such, this study found that during dry season the upstream flow need to be diverted to save water quality from pollution. A sluice gate may be established at Ashulia Bridge near landing station which will be opened during monsoon and at the end of monsoon it will be closed upto fresh water observed on following monsoon. The same policy may applied at middle bridge and last bridge located on Ashulia express way. However, to maintain continuous water flow from upstream to downstream an extra chanal need to be created which will connect the mid channel and Tongi khal. During winter to preserve fresh water inside the low flood zone and adjacent river and to protect this exclusive recreation zone from polluted water, it is recommended to arrange another sluice gate at Rustampur point(See Map). It means that at the end of monsoon all 04 gates will be closed and fresh water will be locked into the low flood zone and in the river as well.



Map-44: Proposed Water Management System (Option -1)



Map-45: Alternate Options for water flow system (Option-2)

This water will be the source of waterbased recreation programs. During monsoon all the gates will be opened and this zone will act as low flood zone and water catchment area. However, if it deems necessary to maintain circular water flow of river system then alternative option may be followed. In that case, for option-2 both the branches (Left and Right) of river Turag are to be closed and mid channel is to be maintained for maintaining circular water system. In map 45 the green line is the existing canals which are to be dredged and the magenta line is the alignment which

is to be created to maintain connectivity with Upstream, Downstream and Tongi khal. During wet season all gates will be opened and during dry season 04 gates will remain close only mid channel will be operational.

b. Illegal Enchroachment

From the study it is observed that BIWTA has demarcated the boundary of river turag. However, on the left side the demarcation is visible and there is no enchroachment but on the right bank a lot of enchocher found who all are occupied upto river bank and conducting their business. To implement this zone, it is recommended to clear the entire riverside establishment. If there is a portion of land owned by private organization, they may encourage for shifting their business from here to another place and investing in this zone as partner. Government may aquire this zone compleately and handover to Tourism Corporation or Public and Private Partnership may welcome.

c. Investment

To implement this project it is a matter of investment. However, this is an exclusive recreation zone proposed for middle to high income group visitors, it will generate money. Starting from entry to everywhere, service will be provided by cost of money. Considering visitors demand, if it is possible to arrange all modern facilities, it is expected that investors will be volunteer to invest here. It is recommended that to motivate the land owners to engage with this program, they can jointly come forward as partner of this project. If the land owners can join as investors by donating their land then there is no extra cost of land acquisitions.

d. High limitation of Infrustructures

As it is a low flood zone so there is no possibility of designing highrise building. On the otherhand, due to the restrictions of CAAB, no highrise building is allowed beyond 500 feet. Considering those fact it is recommended to design eco-friendly and low height structure along the waterbody.



Map-46: Height Restrictions of CAAB

e. Requirement of Dredging

To enhance the navigability of River Turag, a Capital dredging is needed which will increase the depth of all 03 channels of river Turag up to 5meter from MSL at dry season. To create an environment for waterborne activities, it also recommended for dredging inside the low flood zone (Proposed Lakes) to have minimum 4meter water at dry season. By using the dredged materials surrounding river side of recreation zone can be developed.

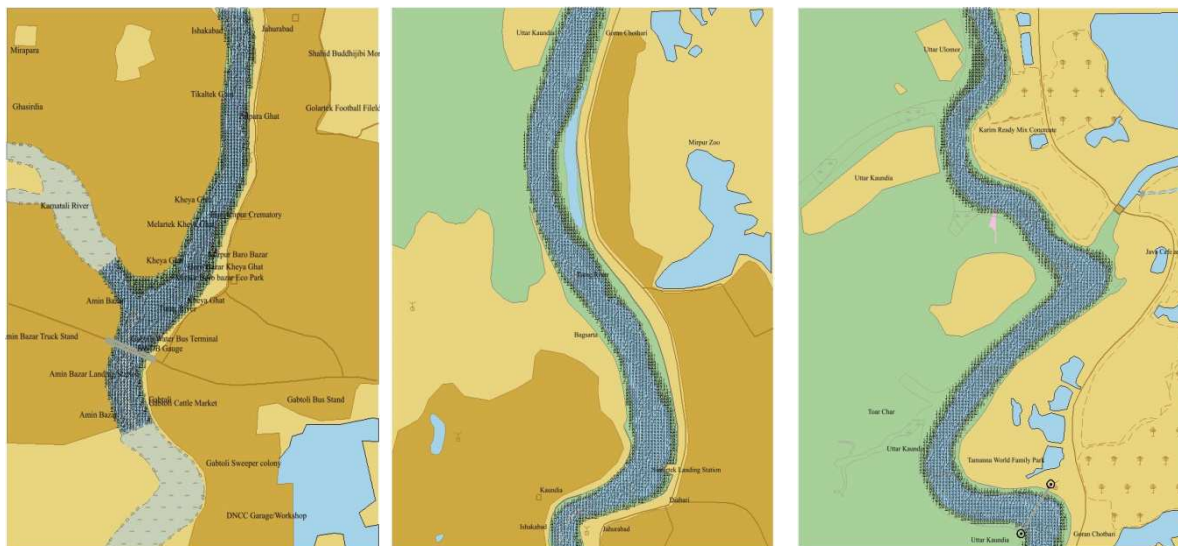
f. Assurance of Security

To maintain a standard recreation zone, security is the major issue. It is suggested that in association with law enforcing agencies, the local community head and other recreation club members may join to ensure the safety and security of this zone. Strict compliances of law and regulations is must. Whole zone are to be covered under CCTV surveillance and a security control room is to be established. Bangladesh Anser may provide assistance in this regard in addition with BD Police.

7.5 Output of the model Project

Based on thereconnaissancesurvey and field survey report, it is already proved that **“Mirpur-Ashulia-Tongi”** route has the best potentialities to meet the expectation of the visitors. However, keeping visitors expectation and surveyed result, water management group selected the model project site from **Aminbazar to Ashulia** and conducted Bathymetric and Topographic survey along the route. Data acquisition, processing and validation have been done with associated equipment and software. Finally 06 in number nautical paper chart and 06 in number electronic navigational charts have been designed which are consists of different geospatial data layers. Those layers can be used by stakeholders through NSDI platform to meet their own requirement. This map primarily will be used as navigational chart and secondarily its different layers will be shared in NSDI portal so that it will help the stakeholders by downloading their required information's. In future this mechanism will contribute to the development of navigation, recreation, transportation, environment and tourism sector along waterways which will indirectly contribute in the national economic growth. However, properly targeted, improvements to our waterways can make a contribution to improving the quality of life for those living in the deprived communities along the waterways as well as for other communities. In encouraging modern, integrated and sustainable approach to their use, this project intends to maximize the opportunities the waterways can offer for leisure and recreation and as a catalyst for urban regeneration. This model project intends to lead to a drive to re-open and revitalize abandoned and under-used waterways which can create such an environment that will meet the visitor's expectetions as they desire. On completion of this model project all the data layers of this model project will be uploaded in NSDI platform and the users may download their concern data for own use. Since NSDI platform offers geo-spatial data sharing from a single domain, definitely it would save not only public money but also precious time and labor. In addition, this model project also reccomonded for creating an exclusive recreation zone at Ashulia landing station and its adjoining low flood zonearea considering all the regulations concerned to environment. The proposed recreation zone is designed in such a way that it will preserve all the conditions of existing all acts related to

Nautical Paper Charts (Hard Copy) produced as outputs of this Model Project are attached as enclosures (06 Copy) with the report and Electronic Navigational Charts(ENC) also attached as soft copy (06 Copy) with the report. In addition, all the chart consisting geospatial data layers (Point, Line and Area) are also provided with this report in different format (.XYZ, .shape, .tiff etc). To activate NSDI portal, all the output data will be uploaded in NSDI portal and users may download their required information which is bounded within the selected site for model project (Aminbazar to Ashulia Landing Station).It is mentionable that the avobe mentioned 06 in number ENC is the first ever Electronic Navigational Charts produced by Water management Group for Inland safe Navigation in Bangladesh. BIWTA may preserve and use those charts for inland navigation, if they have Electronic Chart Display and Information System(ECDIS) or Electronic Chart System (ECS).However, for any research or project works, the provided data layers, Nautical paper charts and ENC's can be used by the concern users. Ultimately those products are the great achivements from this model project.



MAP-49 ENC-3: Goran
Chotbari to Digun

A detailed map of the Taring River area. The river flows from the top right towards the bottom left. Key locations labeled include Pungun, Binedop, Daul, Ransong, Daul, Taring Bridge, Taring Recreation World, Sam Kahor, Pandahut Bus Stand, Birela, and Taring Boat Club. Several lakes are shown, some with names like 'Lake' or 'Taring Cemetery Lake'. There are also symbols for trees and buildings. A pink star-like symbol is located near the center of the map.

[illegible]

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more economically and culturally vibrant riverfront and an endearing entrance to Dhaka city. The area close to the banks of the Turag, can be developed as an arts district. Dhaka's wetlands restoration can be termed as the life saving drug for the survival of our beloved city and its surrounds. Development authorities in collaboration with experts, NGOs, media personnel and civil society must undertake a dynamic role to protect the rivers around Dhaka and use of river as recreational element can do that in a praiseworthy manner.

References:

(2023). *Field Survey under NSDI Model Project*.

"Inland Waterways for Transportation and Tourism: A Journey through Parvathy Puthanar Canal, Kerala",
(2002). *ITPI*.

BISWAS, M. (2002). Pattern and Trend of Recreation Activities in Dhaka City. *An Unpublished Research Paper*.

BIWTA. (2001). *"Introduction of waterways around Dhaka city"*. BIWTA.

BIWTA. (2009). *"Introduction of Circular Waterways in and around Dhaka City (2nd Phase) (1st Revised)"*.
BIWTA.

BIWTA. (2010). *2 The Jamdani Hat is held at "Jamdani Palli" which starts from 4.00 am and ends at 8.00 am. every Friday. Visitors come here only in weekend and maximum numbers of people come here to attend Jamdani Hat. That's why Interviewers were at "De*.

BIWTA. (2018-2022). *Bathymetric Sheet*. BIWTA.

BIWTA. (2020). *Introduction of Inland Waterways around Dhaka*. BIWTA.

BIWTA making 'eco park' filling Turag. (18 November, 2021). *The Daily Star*.

Dhaka needs more recreation centres. (25 Oct, 2021). *Bangladesh Post*.

Hossain, M. (2004). "Recreational Facilities in Residential Neighbourhoods in Khulna: A study of some selected areas". *An Unpublished NURP Research*.

Nabi, A. M. (n.d.). *"An Investigation to Water Transport Potential: A Case Study of Amin Bazar to Sadarghat"*.
Unpublished.

RAJUK. (n.d.). *DAP FINAL REPORT*.

RAJUK. (n.d.). *Final Report Chapter-V: Project Plan Preparation of Detailed Area Plan (DAP) for DMDP*.

Sun, T. D. (07 August, 2022). Lack of recreation facilities: City dwellers getting bored.

Appendix

Tongi-Ashulia- Mirpur” route Questionnaire Survey

Purpose: To measure the river users’ expectation/ satisfaction level of the selected routes

Target Group: On site recreational users and route trip makers

(All Information supplied will be used exclusively for Analysis purpose only)

1. Identification of the respondent

a) Name:

b) Sex : Male..... Female.....

c) Age:..... years

d) Education: M. Degree/B. degree /Higher Secondary Secondary/ Primary /Technical Literate /Illiterate /Underage/ N.A Others

e) Occupation: Service holder/Business owner/ Household management /Student/ Retired/ Unemployed/ Self-employed/ Other

f) Family income per month: Less than 10,000 10,000 - 15,000 /15,000 - 25,000/ 25,000 - 35,000 /35,000 – 50,000 /more than 50,000

g) How many years have you lived in Dhaka and where? Years in total

Address: Area

2. River users’ characteristics First I’d like to ask you some questions about your recreation and leisure at this place today...

a) How many people are you here with today in addition to yourself? ____ others

b) How many of these are 12 years of age or younger? ____ 12 or younger

c) Are you here as part of an organized grouping? ____ no ____ yes

d) How did you get to this place today? Auto Bike/ On Foot/ Public Transportation/ Private car /Rickshaw /Other

e) About how long did it take you to get to here today? _____ Minutes

f) About how far is that in miles? Less than ¼ mile /¼ - ½ miles/ 1 mile /2-4 miles

g) How often do you visit this place?

First time / Once a year /Occasionally/ Nearly /every week/ Irregularly / Rare/ Others/ Nearly /every day

h) When do you visit this place?

Morning /Afternoon / Evening

i) About how long do you plan on being at this place today? _____ hours

j) How important do you feel the river here is to the enjoyment of your recreation activities today?

- ❖ Very important;(I would not be here if the river wasn't here)
- ❖ Somewhat important;(river plays some part in the enjoyment of my recreation here)
- ❖ Not important;(river just happens to be here and plays no part in the enjoyment of my recreation)
- ❖ Detrimental;(river detracts from the enjoyment of my recreation)

k) Which season do you like best? Dry/ Monsoon

l) What kinds of activities are you doing here today?

- ❖ Outing with family members
- ❖ To take food in the restaurant
- ❖ Long driving
- ❖ Roaming with friends
- ❖ Walking on river bank side
- ❖ Go to park, zoo, mela(fair)
- ❖ Photography
- ❖ Fishing
- ❖ Picnicking
- ❖ Boating
- ❖ Site seeing
- ❖ Others
- ❖ No activities

m) What things do you like best about this route of the river and the areas around it?

.....

n) What things you do not like about this route of the river and the areas around it?

.....

o) Do you feel the necessity of enhancing the attractiveness of the route?
Yes No If yes, then how?

- ❖ Planting seasonal flowers and plants
- ❖ By cleaning and maintaining regularly
- ❖ By increasing facilities
- ❖ Commercial outlets like small retail shops.
- ❖ Natural areas for vegetation and wildlife

p) What kinds of problems do you feel here?

.....

.....

.....

.....

q) What are the suggestions to overcome these problems?

.....

.....

.....

.....

.....

3. The next few questions refer in general to rivers in the metropolitan area...

a) Are there any other places on waterways in and around Dhaka that are especially important to you for recreation or other reasons? Yes_____ No..... If yes, then where and why?

.....

b) Over the last several years, do you think the quality of rivers in and around Dhaka has changed for recreation? _____ gotten better _____ gotten worse _____ remained about the same _____ not sure

c) What changes do you think most need to be done to make rivers in the Dhaka area better for recreation? (Suggestions—development & facilities, land policies, programs, etc.) Not sure.....

To be filled out by respondent

.....

.....

.....

.....

.....

4. To measure the river users' expectation/ satisfaction level of the selected routes, what extent do you feel each of the following items are satisfactory and important and fulfill your expectations with your use and enjoyment for this route of the river? For each satisfaction level and importance level please indicate if it is Highly Satisfactory(HS), Satisfactory(S), Neutral(N), Unsatisfactory(U), Highly Unsatisfactory(HU) and very Important(VI), Important (I), Neutral(N), Unimportant (U I), Highly Unimportant (HUI) according to your importance and satisfaction.

No	Item	Performance					Importance				
		HS	S	N	U	H U	VI	I	N	UI	H UI
1.	Environment:										
	• Water quality										
	• Water odors										
	• water holding capacity										
	• Noise from boats, industry or traffic										
	• Garbage dumping on bank										
	• Illegal encroachment										
2.	Transport System										
	• Integration with other mode of transportation										
	• Access roads										
3.	• Pedestrian links										
	River bank recreation facilities:										
	• No.& type of vessels										
	• Amount of public open space										
	• Green area and landscape										
	• Trails, path and walk ways										
	• Trees and vegetation										
	• Public equipment like benches, shade, pavilions, lighted, fountains, sitting arrangements, drinking water, toilet facilities										
	• Physical and visual connectivity										
	• Boat landing/ ghat condition										
	• Maintenance and cleanliness										
	• Commercial developments										
	• Fishing facilities										
	• Fare										
	• Ticketing system										
4.	Service										
	• Condition of vessels										
	• Boat hiring system										
	• Public safety-water accidents etc and personal safety, crime/ unsociable activities graffiti and vandalism										
	• Availability of regular services										
	• Management's role										
5.	Information										
	• Modern and well informative (Websites, routemaps, printable time table)										
	• Route definition (Well defined routes)										

6.	Recreation experience										
	• River bank condition										
	• Natural area for vegetation & wildlife										
	• Crowding & conflicts among boaters and recreationists onshore										
	• Relaxing and aesthetically pleasing atmosphere										

Data Product Specifications (DPS) on
Rice Area Mapping of Manikganj Sadar
Upazila under NSDI Model Project

24 July 2023

NSDI Model Project

Agriculture Management Team, Funded by JICA

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1. Overview

1.1. Information about the creation of the data product specifications

- a. Title: Rice Area Mapping of Manikganj Sadar Upazila under NSDI Model Project
- b. Date: 15 July 2023
- c. Responsible organization: NSDI Model Project, Agriculture Management Team, funded by JICA
- d. Language: English
- e. Topic category: Agriculture
- f. Document format: Microsoft Word

1.2. Objectives

The Department of Agricultural Extension (DAE) is responsible for making annual crop production target and area estimation for different crops. But cultivable crop land of different crops is calculated based on eye estimation by Sub-Assistant Agricultural Officer (SAAO) and farmers' traditional knowledge. As a result, precise crop area statistics based on scientific method are not available which is creating a big problem in making proper plans at national policy level.

In this scenario a more scientifically accurate method of data collection is needed for the national food related policy and planning. So, through this model project, funded by JICA, a remote sensing-based crop estimation pilot work has been done on Manikganj Sadar Upazila of Manikganj district. The findings and methodology of this model project will greatly help to implement the large-scale crop area estimation in Bangladesh in near future and also will help the government's various planning processes. Furthermore, this technologically advanced workflow will help DAE to contribute to building a smart Bangladesh.

1.3. Extent of the data

Manikganj Sadar Upazila of Bangladesh.

The projection system is BUTM2010:

Top: 2,645,610.178400 m

Bottom: 2,622,269.673900 m

Left: 494,188.621800 m

Right: 512,905.118500 m

1.4. Normative references

- ❖ Report for the NSDI Model Project (NSDI-MP) Workshop
- ❖ Final report on Model Project: Rice Area Mapping of Manikganj Sadar Upazila using Medium Resolution Satellite Image
- ❖ Agricultural Extension Manual 2016
- ❖ National Agriculture Policy 2018
- ❖ National Agriculture Extension Policy 2020
- ❖ National ICT policy 2018
- ❖ Guidelines for Data Product Specifications (BD NSDI)
- ❖ Guidelines for Data Quality (BD NSDI)
- ❖ Guidelines for Metadata (BD NSDI)
- ❖ 8th Five Year Plan
- ❖ 4th Industrial Revolution (4IR)

2. Scope

2.1. Scope identification

Dataset of the model project named “Rice Area Mapping of Manikganj Sadar Upazila using Medium Resolution Satellite Image” funded by Japan International Cooperation Agency (JICA).

The work of model project has been implemented using Sentinel 1 and Sentinel 2 satellite images for Rabi Season (Winter Season) rice area mapping of Manikganj Sadar Upazila of Manikganj district. Both optical and SAR satellite images are utilized from 15 November 2022 to 30 April 2023. For this reason, the output of this analysis (crop classification raster file) will be produced in 10 m spatial resolution.

3. Data Product Identification

3.1. Name

Rice Area Mapping of Manikganj Sadar Upazila under NSDI Model Project

3.2. Date of data creation

Data have been analyzed from November 2022 to May 2023 (Rabi Cropping Season or Winter Season) of Manikganj Sadar Upazila).

3.3. Contact information

Dr. Farida Perveen
Deputy Director & In-charge of GIS & RS Lab
Department of Agricultural Extension (DAE)
Ministry of Agriculture, Bangladesh
Cell:
E-mail:
Web: www.dae.gov.bd

3.4. Geographic description

The area of interest is the Manikganj Sadar Upazila which is under Manikganj District of Bangladesh.

4. Data Content and Structure

Detail data structure is attached in the Annex 1.

Spatial Database Summary Table:

Spatial Database Theme	Data Type (Vector/Raster/Table)	Dataset	Feature Class/Data Name
Classified crop map			Boro rice (1) Mustard (2) Maize (3) Potato (4) Mustard + Boro (5) Potato + Boro (6)

5. Reference Systems

5.1. Spatial reference system

Geographic Coordinate System: WGS 1984
 Angular Unit Degree (0.0174532925199433)
 Prime Meridian Greenwich (0.0)
 Datum WGS 1984

Spheroid	WGS 1984
Semimajor Axis	6378137.0
Semiminor Axis	6356752.314245179
Inverse Flattening	298.257223563

5.2. Temporal reference system

Reference system identifier: Gregorian Calendar

Note: It is created for Rabi or winter season (rice crop) of Bangladesh (November 2022 to May 2023)

6. Data Quality

The Satellite imagery used:

Optical satellite image Sentinel-2 (NDVI and SAVI) and SAR satellite image Sentinel-1 (VV and VH); Spatial resolution is 10 meter by 10 meter.

Secondary data:

1: 25,000 scale base map data of Survey of Bangladesh

Ground truth data

Ground truth data/crop signature data: Accuracy of RTK GPS (Horizontal accuracy: 5-10 cm, Vertical accuracy: 10-30 cm) approximately.

Smart Phone's GPS (Horizontal accuracy: 1-5 m) approximately.

7. Data Product Delivery

7.1. Name of data formats

Vector data: ArcGIS Shapefile format

Raster data: Tagged Image File Format (.tif)

Table: xlsx

7.1.1. Unit

The dataset has the following layers:

Administrative shape file

Road shape

River shape

Forest coverage

Land use/cover

GCP

7.2. Spatial reference system

Projected Coordinate System:	BUTM2010
Projection	Transverse Mercator
Projection parameters	
False Easting	500000.0
False Northing	0.0
Central Meridian	90
Scale Factor	0.9996
Latitude Of Origin	0.0
Linear Unit	Meter (1.0)

7.3. Structure of the delivery file

- 7.3.1. Encoding rules
 - ArcGIS Shapefile and Tagged Image File Format
 - MS Excel format

- 7.3.2. Language
 - English

8. Metadata

To be prepared and registered on NSDI-PF according to the Guidelines for Metadata (BD NSDI).

9. Additional Information

(Not available)

Annex 1 Detail Data Content and Structure

Table Data (Field Questionnaire Survey)

Question No	Field Name/ Questions	Description	Example	Field Type
1	start	Survey Start Time		Date
2	end	Survey End Time		Date
3	Surveyor Name	Name of the surveyor		String
4	Location Name	Local name of a location like village (if any)		String
	_A1_latitude	Latitudes and longitudes of a homogeneous crop field (it will help to delineate the field)		Double
	_A1_longitude			Double
	_A1_altitude			Double
	_A1_precision			Double
	_A2_latitude			Double
	_A2_longitude			Double
	_A2_altitude			Double
	_A2_precision			Double
	_A3_latitude			Double
	_A3_longitude			Double
	_A3_altitude			Double
	_A3_precision			Double
	_A4_latitude			Double
	_A4_longitude			Double
	_A4_altitude			Double
	_A4_precision			Double
	_A5_latitude			Double
	_A5_longitude			Double
	_A5_altitude			Double
	_A5_precision			Double
5	Union Name	Name of the Union under Manikganj Sadar Upazila		String
6	Crops type	Crop that was in the field during the survey time	Boro ice	String
7	How many crops types did you get from November to April?	Total number of crops standing in the field during November 2022 to April 2023		Short integer
8	What was the date of showing for 1st crop?	1st crop's sowing date from November 2022 to April 2023		Date
9	What was the date of showing for 2nd crop?	2nd crop's sowing date from November 2022 to April 2023		Date

Question No	Field Name/ Questions	Description	Example	Field Type
10	What was the date of showing for 3rd crop?	3rd crop's sowing date from November 2022 to April 2023		Date
11	What was the name 1st crop?	Name of the 1st crop cultivated during November 2022 to April 2023		String
12	What was the name 2nd crop?	Name of the 2nd crop cultivated during November 2022 to April 2023		String
13	What was the name 3rd crop?	Name of the 3rd crop cultivated during November 2022 to April 2023		String
14	Picture_URL	Picture of the crop field		String

Vector Data

File name: crop_signature_data.shp

File format: shapefile

Geometry type: Polygon

Contents: Crop signature data in the field

Feature Name	Field	Geometry Type	Definition	Field Type
crop_signature_data.shp	FID	Polygon	Object ID	OID
crop_signature_data.shp	start	Polygon	Survey Start Time	Date
crop_signature_data.shp	end	Polygon	Survey End Time	Date
crop_signature_data.shp	Surveyor_Name	Polygon	Name of the surveyor	Text
crop_signature_data.shp	Location_Name	Polygon	Local name of a location like village (if any)	Text
crop_signature_data.shp	Shape	Polygon	Geometry of a crop homogeneous field	Geometry
crop_signature_data.shp	Union_Name	Polygon	Name of the Union under Manikganj Sadar Upazila	Text
crop_signature_data.shp	Crops_Name	Polygon	Crop that was in the field during the survey time	Text
crop_signature_data.shp	total_c_nov_apr	Polygon	Total number of crops standing in the field during November 2022 to April 2023	Short integer
crop_signature_data.shp	showing_D_of_1st	Polygon	1st crop's sowing date from November 2022 to April 2023	Date

Feature Name	Field	Geometry Type	Definition	Field Type
crop_signature_data.shp	showing_D_of_2nd	Polygon	2nd crop's sowing date from November 2022 to April 2023	Date
crop_signature_data.shp	showing_D_of_3rd	Polygon	3rd crop's sowing date from November 2022 to April 2023	Date
crop_signature_data.shp	1st_crop_Nam	Polygon	Name of the 1st crop cultivated during November 2022 to April 2023	Text
crop_signature_data.shp	2nd_crop_Name	Polygon	Name of the 2nd crop cultivated during November 2022 to April 2023	Text
crop_signature_data.shp	3rd_crop_Name	Polygon	Name of the 3rd crop cultivated during November 2022 to April 2023	Text
crop_signature_data.shp	Pic_URL	Polygon	Picture of the crop field	Text

Raster data

File name: Crop Map of Manikganj Sadar Upazila

Spatial resolution: 10 m by 10m

File format: Tagged Image File Format (.tif)

Extend

Top: 2645610.178400 m

Bottom: 2622269.673900 m

Left: 494188.621800 m

Right: 512905.118500 m

Pixel depth: 8 bit

Contents: Classified crop map

Legends of classified crops (Crop Map Prepared From Both Sentinel 1 and 2 Imagery)

Crops	Color	Remarks
Boro Rice	Green	
Mustard	Yellow	
Maize	Brown	
Potato	Red	
Mustard + Boro	Gray	
Potato + Boro	Light Green	

Table of the Satellite Imagery Specifications

Sl.	Satellite	Spatial & Spectral resolution	Revisit time	Sensor Type	Agricultural Application
1	Sentinel 2	10m Spatial resolution i. Band 2 - Blue ii. Band 3 - Green iii. Band 4 – Red iv. Band 8 - Near Infrared (NIR) It also has additional 4 Vegetation Red Edge bands of 20m Spatial resolution	Sentinel 2A and Sentinel 2B two sensors combined 5 days. Single sensor 10 days	Optical	The available best option for optical imagery (in terms of Spatial resolution and revisit time)
2	Sentinel 1	10m Spatial resolution in two polarization options: i. Vertical-Vertical (VV) ii. Vertical-Horizontal (VH)	12 days	SAR or RADAR	The available best option for SAR or RADAR imagery (12 days revisit time is also good for agricultural applications)

Data Product Specifications on

Geological and Geomorphological Spatial Database of GSB-Purbachal
City

20 November, 2023

Geological Survey of Bangladesh (GSB)

Overview

Information about the creation of the data product specifications

- a. Title: Geological and Geomorphological spatial database of GSB-Purbachal City
- b. Responsible organization: Geological Survey of Bangladesh
- c. Language: English
- d. Category: Geological and Geomorphological Map
- e. Document format: Microsoft Word

Objectives

Geological layers of Purbachal Town are required for several purposes:

- Geological mapping of Purbachal area and surroundings.
- Geophysical, geotechnical, geo-hazards study and
- Support for public and private organizations relating geo-scientific activities.

This data might help organizations to perform geo-scientific activities for sustainable development.

Extent of the data

Projection: WGS 1984 UTM Zone 46N

The spatial extent in respect to UTM:

Top: 2631170.621100m

Bottom: 2643265.463200m

Left: 544673.551600m

Right: 559456.379700m

Normative references

Guidelines for Data Product Specifications (BD-NSDI)

Guidelines for Data Quality (BD-NSDI)

Guidelines for Metadata (BD-NSDI)

Final Report: Model Project on Disaster Management for National Spatial Data Infrastructure (NSDI) Utilization Project

ASTM Standard D-422 (1998) Standard Test Method for Particle-Size Analysis of Soils

Scope

Scope identification

Geological and Geomorphological Spatial database of GSB-Purbachal. Area, geological and geomorphological description.

Data Product Identification

Name

Geological and Geomorphological data of Purbachal Town

Date of data creation

November 2023

Contact information

Officer in Charge: Syed Nazrul Islam

Designation: Director

Mobile:

Email:

Organization: Geological Survey of Bangladesh, 153 Pioneer Road, Segunbagicha, Dhaka-1000.

Geographic description

The database covers Purbachal Town and Adjoining Area [Map/Aerial Photo in 1954]

Data Content and Structure

Vector Data

Shapefile Name: Geology_Purbachal_BL.shp, Geomorphology_Purbachal_BL.shp,
LULC_Purbachal_BL.shp, Boundary_Purbachal_BL.shp

Geometry Type: Polygon

File name: Geology_Purbachal_BL.shp

Field	Field Type	Definitions
FID	OID	Object ID
Shape	Geometry	Polygon

Map_Unit	Text	5 geological categories: Active Channel Deposits Alluvial silt Alluvial silt and clay Madhupur clay residuum Marsh clay and peat
----------	------	---

File name: Geomorphology_Purbachal_BL.shp

Field	Field Type	Definitions
FID	OID	Object ID
Shape	Geometry	Polygon
Geomorphic category 11 categories	Text	11 geomorphologic categories: Active Channel Deep Gully Depression Flood Plain Lateral Bar Madhupur Slope Madhupur Terrace Natural levee Perennial Stream Point Bar Shallow Gully

File name: LULC_Purbachal_BL.shp

Field	Field Type	Definitions
FID	OID	Object ID
Shape	Geometry	Polygon
Bar_HV_SW	<u>Text</u>	5 Land Use/Land Cover classifications: Agriculture land Bareland Home_steat_Veg River Stagnant_WaterBody

File name: Boundary_Purbachal_BL.shp

Field	Field Type	Definitions
FID	OID	Object ID
Shape	Geometry	Polygon
Name	Text	<u>Legends of boundaries:</u> Purbachal_Boundary

Raster data:

File name: Elevation

Ground Sampling Distance (spatial resolution): 10 m by 10m

File format: Tagged Image File Format (TIF)

Extent:

23.8882068387361	Top (Latitude, north end)
23.817453083264	Bottom (Latitude, south end)
90.4460990152641	Left (Longitude, west end)
90.5489879425441	Right (Longitude, east end)

Pixel depth: 8 bit

Contour Lines: 2-meter Intervals

Elevation (meter): 3.2 – 23.76

Borehole Data:

File format: Microsoft Excel

File name: BH0100.xlsx, ..., BH1500.xlsx

Field	Definitions
Lat	Latitude (Accuracy ± 10 m)
Long	Longitude (Accuracy ± 10 m)
Depth from(m)	Depth of the layer top from the surface
Depth to (m)	Depth of the layer bottom from the surface
Elevation	Height from Mean Sea Level. Accuracy ± 2 m
Sand	Diameter larger than or equal to 0.125 mm (Mesh # 120)
Silty	Diameter larger than or equal to 0.045 mm (Mesh # 325)
Clay	Diameter less than 0.045 mm
SPT	N-value of Standard Penetration Test

Data Product Specification
for
GEOSPATIAL DATA
Based On
“Feasibility study on Circular Waterways for Dhaka City”
(AMIN BAZAR TO ASHULIA)
Prototype Ver.0.1

This Data Product Specification was prepared by referring to the following documents:

- IHO Transfer Standard for Digital Hydrographic Data (Edition 3.1.0, November 2000)
- Regulations for International (INT) Charts and Chart Specifications of the IHO (English: Edition 4.9.0, March 2021 - Publication date: April 2021)

Water Management Group
(Updated by Water Management Group: 31 December 2023)

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1. Overview

1.1. Information of this Data Product Specification

Title	Data Product Specification for Geospatial data of model project on “ Feasibility study on Circulr Waterways around Dhaka City ”
Date	31/12/2023
Preparer	Water Management Group
Language:	English
Sphere	National Database
Type of Document	PDF

1.2. Objective

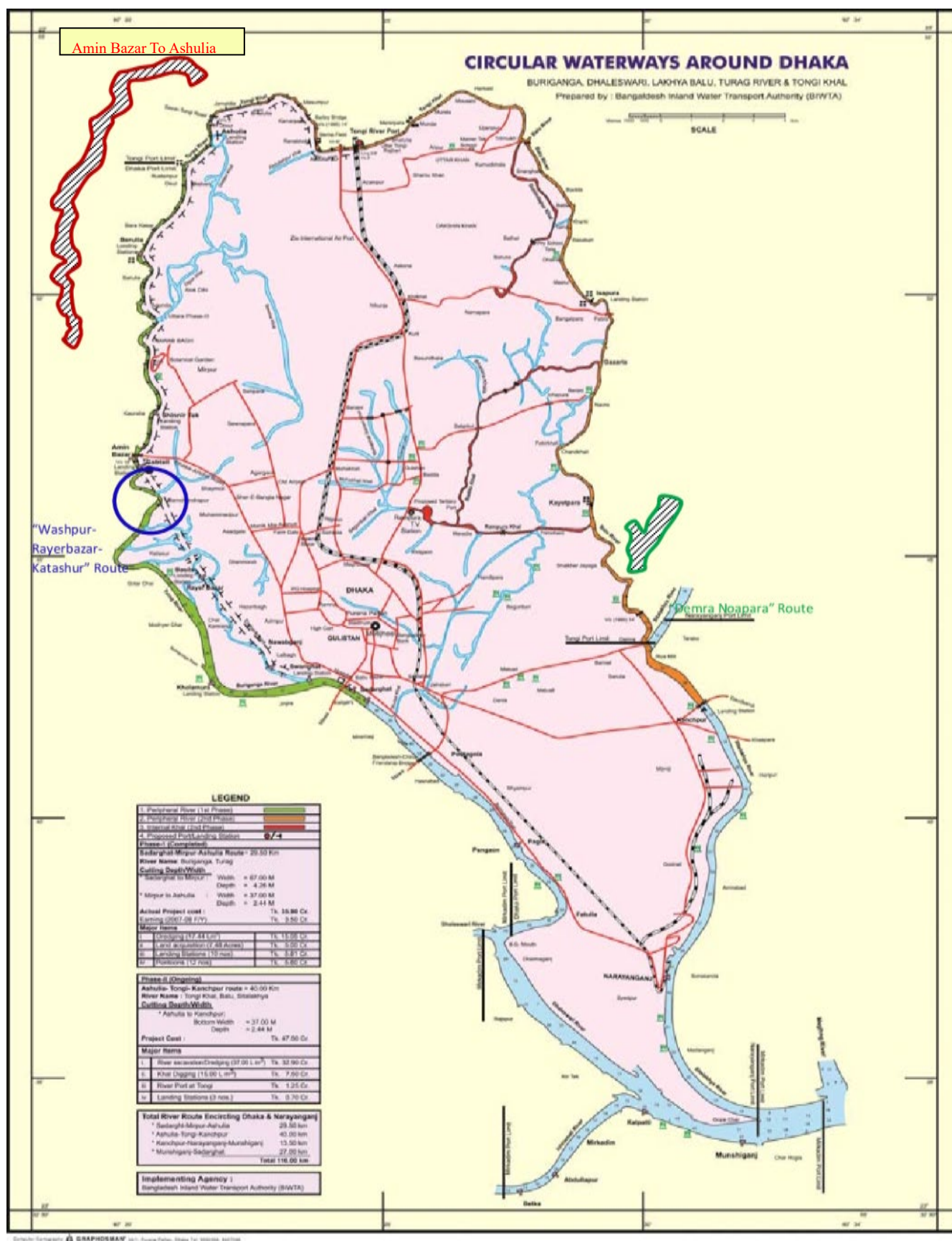
The main objective of this Data Product Specification is to give a precise technical description which characterizes a geospatial data product. It includes general information for data product identification as well as information on data content and structures, reference systems, data quality aspects, data capture, maintenance, delivery, and metadata.

1.3. Geographic Scope

The city is blessed with so many rivers and canals, such as the River Buriganga, Turag, Sitalakhya, Balu and the Tongikhal, which encircles the city and forms a 110 km Circular Waterway (CW) around Dhaka. As model pilot project, a small segment (Tongi-Ashulia- Mirpur Route) of this circular water ways has been selected as target area. The geographic location of this site is appended below:

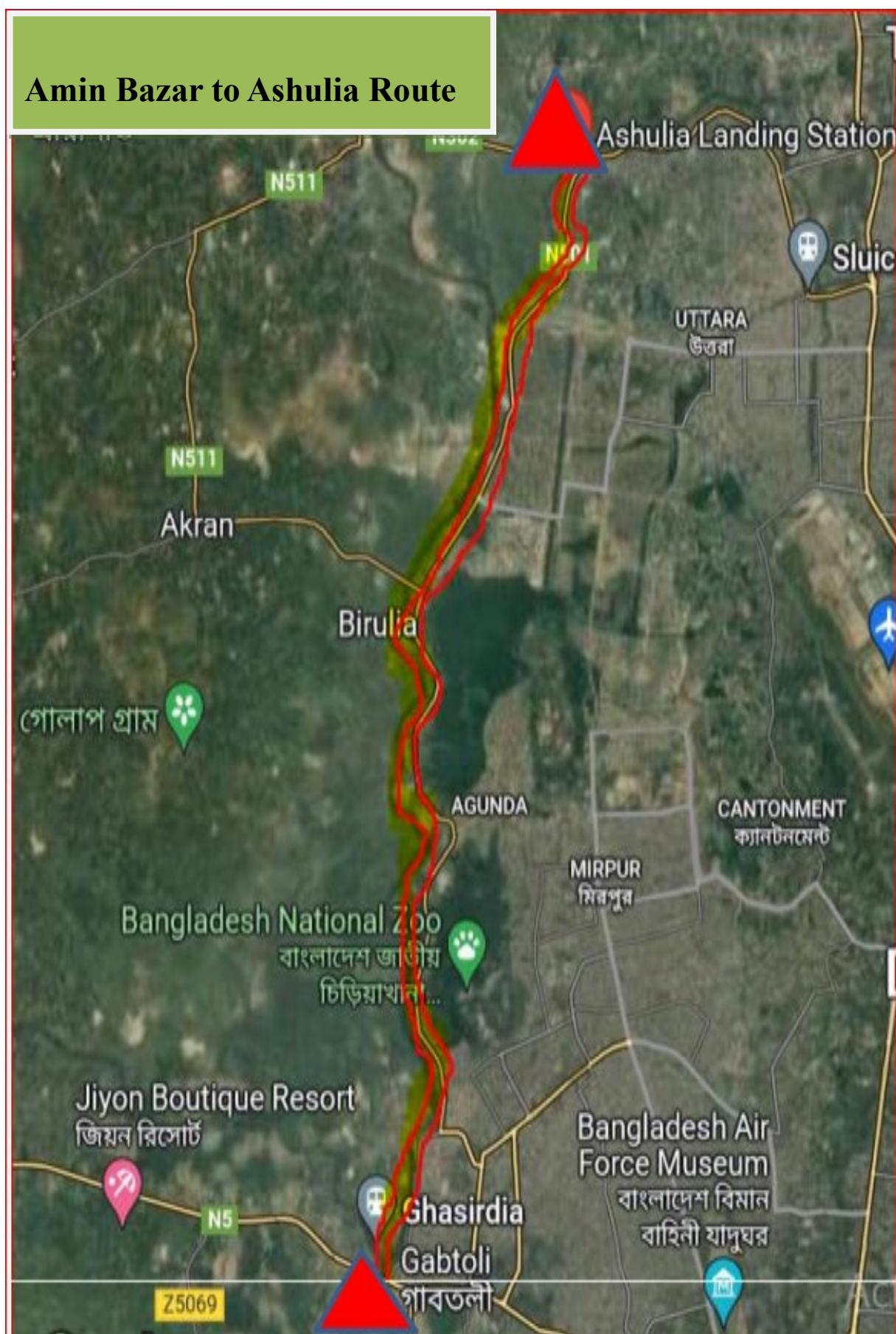
North East	23°53.450'N 090°20.058'E	North West	23°53.450'N 090°21.510'E
South West	23°47.027'N 090°20.058'E	South East	23°47.027'N 090°21.510'E

(WGS84 is the coordinate reference system)



Circular Waterways Around Dhaka City (BIWTA MAP)

Amin Bazar to Ashulia Route



Model Project Site

1.4. Temporal Scope

In Circular Waterways of Dhaka city, few routs are having tidal effect. Specially, the selected site is influenced by seasonal effect. During monsoon the river Turag are becoming flooded and water level raising near to coast and during winter season water level getting reduced and a minimum water level is always maintained round the year which is observed sufficient for safe navigation. To observe the lowest water level the survey was conducted during winter season.

Start	2023-03-01
End	2023-05-10

1.5. Reference Standard

The model project for water management group is to conduct a feasibility study on Circular Waterways around Dhaka City. Based on the study and collected Bathymetric information two main products are published i.e: Nautical Paper Chart and Electronic Navigational Chart. Both the products are consisting of geospatial informations. As nautical charts are used for general navigation, the chart should be designed by following internationally recognized standards. In that case International Hydrographic Organisations (IHO) published standards are the best practiced provisions to use as reference to design this DPS. The following IHO standards are followed:

S-57	IHO Transfer Standard for Digital Hydrographic Data (Edition 3.1.0, November 2000) - Main Document
S-57 Appendix B	ENC Product Specifications
S-57 Appendix A	IHO Object Catalogue
S-57 Appendix A- Chapter 2	Attributes
S-57 Appendix B.1 Annex A	Use of the Object Catalogue for ENC
S-57 Appendix B.1 Annex D	INT1 Symbols and Abbreviations to S-57/52
S-58	ENC Validation Checks (Edition 7.0.0, October 2022)
S-11	Guidance for the Preparation and Maintenance of International (INT) Chart and ENC Schemes and Catalogue of International (INT) Charts

S-4	Regulations for International (INT) Charts and Chart Specifications of the IHO (English: Edition 4.9.0, March 2021 - Publication date: April 2021)
S-32	Hydrographic Dictionary
S-44	IHO Standards for Hydrographic Surveys (Edition 6.1.0, October 2022)
S-53	Joint IMO/IHO/WMO Manual on Maritime Safety Information (January 2016)
S-60	User's Handbook on Datum Transformations involving WGS 84 (July 2003 - Last correction August 2008)
S-65	ENCs: Production, Maintenance and Distribution Guidance (Edition 2.1.0, May 2017)

1.6. Terms and Definitions

The terminology used in this specification refers to the following attached document.

- a. S-57 Appendix A (IHO Object Catalogue)
- b. S-57 Appendix A (Chapter 2 - Attributes)

1.7. Abbreviations

The Abbreviations used in this specification refers to the following attached document.

- a. S-57 Appendix A (IHO Object Catalogue)
- b. S-57 Appendix A (Chapter 2 - Attributes)

2. Specification Scope

2.1. Specification Scope Identification

Data Product Specification for Geospatial data of model project "Feasibility study on Circular waterways around Dhaka City"

2.2. Hierarchical Level

Datasets are as follows:

1. Sounding	21. Pipeline
2. Depth Area	22. Smallcraft Facility
3. Depth Contour	23. Embankment
4. Coastline	24. Lake
5. Road	25. Important Place
6. Administrative Boundary	26. Landarea
7. Building	27. Hulks
8. Causeway	28. Lights
9. Pontoon	29. Production area
10. Landing Station	30. Wrecks
11. Bridge	31. Daymarks
12. Phylon	32. Canals
13. Overhead Cable	33. Unsurveyed Area
14. Landmark	34. Signal Station
15. Buoy	35. Radio Station
16. Vegetation	
17. Beacon	
18. Rescue station	
19. Police station	
20. Sluicgate	

3. Data Product Identification

3.1. Name of Product

“ Feasibility Study on Circular Waterways around Dhaka City”

3.2. Date

31-12-2123

3.3. Contact

Bangladesh Navy Hydrographic and Oceanographic Center

TEL:

FAX:

e-mail:

3.4. Geographic Description

The following Coordinates are the boundary of the selected site of the model project :

North East	23°53.450'N 090°20.058'E	North West	23°53.450'N 090°21.510'E
South West	23°47.027'N 090°20.058'E	South East	23°47.027'N 090°21.510'E

4. Data Content and Structure

Detail data structure is attached in the Annex 01.

5. Reference Systems

5.1. Spatial Reference Systems

Item	Description
Geographic Coordinate Systems	WGS-84
Authority	EPSG
Projection	Transverse_Mercator
Horizontal Datum	WGS-84
Prime Meridian	Greenwich (0.0)
False_Easting	500000
False_Northing	0.0
Central_Meridian	90.0

Semimajor Axis	6378137
Inverse Flattening	298.257223563
Scale_Factor	0.9996000000
Latitude_Of_Origin	00.00
Linear Unit	Meter
Depth unit	Meter

5.2. Temporal Reference Systems

Reference system identifier: Gregorian Calendar

6. Data Quality

Data quality is ensured by following IHO guidelines S-44.

Data quality contents	Descriptions
data quality scope	Topographic map (shapefile, point)
data quality measure	Definition of error: The point which its attribute in the data is different from the reference data (ground truth by the field survey).
data quality evaluation method	Visual inspection Count the number of points which their attribute is different from the reference data.
conformance quality level	pass: the error of all point is zero (0). fail: at least one point has the error.

Data quality contents	Descriptions
data quality scope	Topographic map (shapefile, line)
data quality measure	Definition of error: The line which its attribute in the data is different from the reference data (ground truth by the field survey).

Data quality contents	Descriptions
data quality evaluation method	Visual inspection Count the number of lines which their attribute is different form the reference data.
conformance quality level	pass: the error of all line is zero (0). fail: at least one line has the error.

Data quality contents	Descriptions
data quality scope	Topographic map (shapefile, polygon)
data quality measure	Definition of error: The polygon which its attribute in the data is different from the reference data (ground truth by the field survey).
data quality evaluation method	Visual inspection Count the number of polygons which their attribute is different form the reference data.
conformance quality level	pass: the error of all polygon is zero (0). fail: at least one polygon has the error.

7. Data Product Delivery

7.1. Format Type

Final data formate is .SHAPE file, .XYZ, .prdetc

7.2. Structure of the Dataset

The data set files are named according to the specifications given below :
CCPXXXXX.EEE

The main part forms an eight character identifier where:

- the first two characters identify the producer.
- the third character indicates the navigational purpose).
- the fourth to eighth characters are used for the cell code. This code can be used in any way by the producer to provide the unique file name. If characters other than numbers are used only uppercase letters are allowed.

7.3. Language

English

7.5.Delivery Unit

Paper Chart and Electronic Navigational Chart(ENC)

7.6. Delivery Media

Paper Chart Hard Copy, CD, DVD, EMAIL

8. Metadata

Metadata will be created with the help of NSDI metadata guideline.

Annex 1: Data content and structure document of Water Management Group Model Project

Point Vector Data

Shapefile Name: topography_point.shp

Geometry Type: Point

Field	Field Type	Description
FID	OID	Object ID
Sounding		
Sewerage Outfall		
Beacon		
Police Station		
Auto Tide Gauge		
Tower		
Fire Station		
Inportant Location		

Line Vector Data

Shapefile Name: topography_line.shp

Geometry Type: Line

Field	Field Type	Description
FID	OID	Object ID
Depth Contour		
Sluice Gate		
Canal		
Road		
River Bank		
Coast Line		

Field	Field Type	Description

Polygon Vector Data

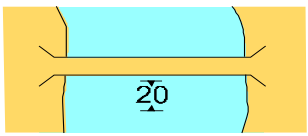
Shapefile Name: topography_polygon.shp

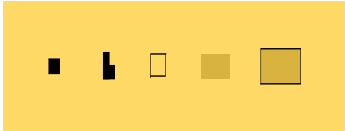
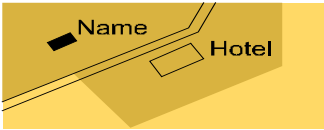
Geometry Type: Polygon

Field	Field Type	Description
FID	OID	Object ID
Depth Area		
Pontoon		
Landing Station		
Canal		
River Bank		
Administrative Area		
Vegetation Area		
Bridg		

Ser	Object Name	Object Accronym	Attributes	Primitive	Priview on Chart
1	Administration Area	ADMARE	JRSDTN	A	
2	Beacon,lateral	BCNLAT	BCNSHP;	P	

			CATLAM; COLOUR; COLPAT; CONDTN; CONRAD; CONVIS; DATEND; DATSTA; ELEVAT; HEIGHT; MARSYS; NATCON; NOBJNM; OBJNAM; PEREND; PERSTA; STATUS; VERACC; VERDAT; VERLEN;		
3	Beacon, safe water	BCNSAW	BCNSHP; COLOUR; COLPAT; CONDTN; CONRAD; CONVIS; DATEND; DATSTA; ELEVAT; HEIGHT; MARSYS; NATCON; NOBJNM; OBJNAM; PEREND; PERSTA;	P	  

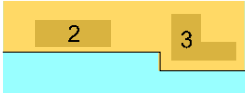
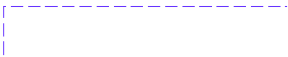
			STATUS; VERACC; VERDAT; VERLEN;		
4	Beacon, special purpose/general	BCNSPP	BCNSHP; CATSPM; COLOUR; COLPAT; CONDTN; CONRAD; CONVIS; DATEND; DATSTA; ELEVAT; HEIGHT; MARSYS; NATCON; NOBJNM; OBJNAM; PEREND; PERSTA; STATUS; VERACC; VERDAT; VERLEN;	P	 
5	Bridge	BRIDGE	CATBRG; COLOUR; COLPAT; CONDTN; CONRAD; CONVIS; DATEND; DATSTA; HORACC; HORCLR; NATCON;	P	

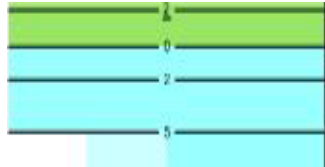
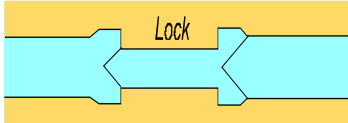
			NOBJNM; OBJNAM; VERACC; VERCCL; VERCLR; VERCOP; VERDAT;		
6	Building, single	BUISGL	BUISSH; COLOUR; COLPAT; CONDTN; CONRAD; CONVIS; ELEVAT; FUNCTN; HEIGHT; NATCON; NOBJNM; OBJNAM; STATUS; VERACC; VERDAT; VERLEN;	P	
7	Built-up area	BUAARE	CATBUA; CONDTN; CONRAD; CONVIS; HEIGHT; NOBJNM; OBJNAM; VERACC; VERDAT;	A	
8	Buoy, isolated danger	BOYISD	BOYSSH; COLOUR; COLPAT; CONRAD;	P	

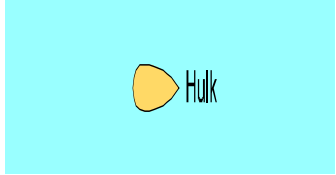
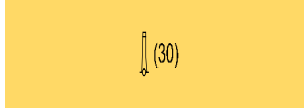
			DATEND; DATSTA; MARSYS; NATCON; NOBJNM; OBJNAM; PEREND; PERSTA; STATUS; VERACC; VERLEN;		
9	Buoy, lateral	BOYLAT	BOYSHP; CATLAM; COLOUR; COLPAT; CONRAD; DATEND; DATSTA; MARSYS; NATCON; NOBJNM; OBJNAM; PEREND; PERSTA; STATUS; VERACC; VERLEN;	P	
10	Buoy, safewater	BOYSAW	BOYSHP; COLOUR; COLPAT; CONRAD; DATEND; DATSTA; MARSYS; NATCON; NOBJNM;	P	

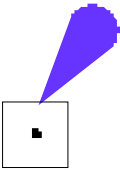


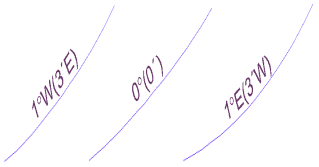
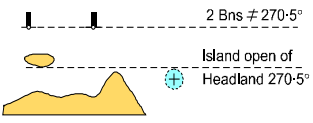
			OBJNAM; PEREND; PERSTA; STATUS; VERACC; VERLEN;		
11	Buoy, special purpose/general	BOYSPP	BOYSHP; CATSPM; COLOUR; COLPAT; CONRAD; DATEND; DATSTA; MARSYS; NATCON; NOBJNM; OBJNAM; PEREND; PERSTA; STATUS; VERACC; VERLEN;	P	
12	Cable, overhead	CBLOHD	CATCBL; CONDTN; CONRAD; CONVIS; DATEND; DATSTA; ICEFAC; NOBJNM; OBJNAM; STATUS; VERACC; VERCLR; VERCSA; VERDAT;	L	

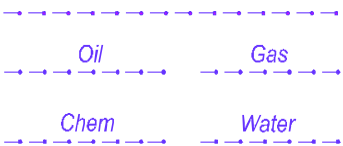
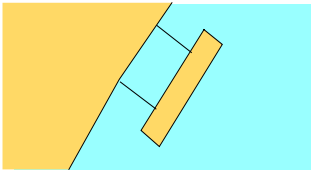
13	Canal	CANALS	CATCAN; CONDTN; DATEND; DATSTA; HORACC; HORCLR; HORWID; NOBJNM; OBJNAM; STATUS;	A	
14	Canal bank	CANBNK	CONDTN; DATEND; DATSTA; NOBJNM; OBJNAM;	A	
15	Causeway	CAUSWY	CONDTN; NATCON; NOBJNM; OBJNAM; STATUS; WATLEV;	A	
16	Caution area	CTNARE	DATEND; DATSTA; PEREND; PERSTA;	A	
17	Coastline	COALNE	CATCOA; COLOUR; CONRAD; CONVIS; ELEVAT; NOBJNM; OBJNAM; VERACC; VERDAT;	L	
18	Daymark	DAYMAR	CATSPM; COLOUR;	P	

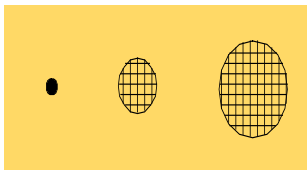
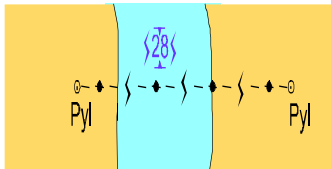
			COLPAT; DATEND; DATSTA; ELEVAT; HEIGHT; NATCON; NOBJNM; OBJNAM; PEREND; PERSTA; STATUS; TOPSHP; VERACC; VERDAT; VERLEN;		
19	Depth area	DEPARE	DRVAL1; DRVAL2; QUASOU; SOUACC; VERDAT;	A	
20	Depth contour	DEPCNT	VALDCO; VERDAT;	L	
21	Gate	GATCON	CATGAT; CONDTN; DRVAL1; HORACC; HORCLR; NATCON; NOBJNM; OBJNAM; QUASOU; SOUACC; STATUS; VERACC; VERCLR; VERDAT;	P	

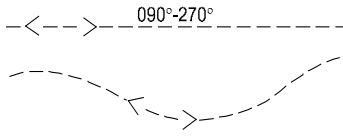
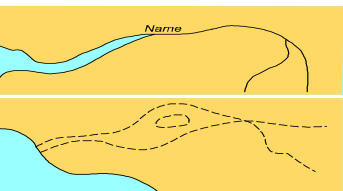
22	Hulk	HULKES	CATHLK; COLOUR; COLPAT; CONDTN; CONRAD; CONVIS; HORACC; HORLEN; HORWID; NOBJNM; OBJNAM; VERACC; VERLEN;	P	
23	Lake	LAKARE	ELEVAT; NOBJNM; OBJNAM; VERACC; VERDAT;	A	
24	Land area	LNDARE	CONDTN; NOBJNM; OBJNAM; STATUS;	A	
25	Land elevation	LNDELV	CONVIS; ELEVAT; NOBJNM; OBJNAM; VERACC; VERDAT;	P	
26	Land region	LNDRGN	CATLND; NATQUA; NATSUR; NOBJNM; OBJNAM; WATLEV;	A	
27	Landmark	LNDMRK	CATLMK; COLOUR;	P	

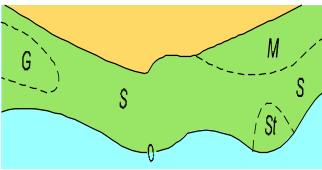
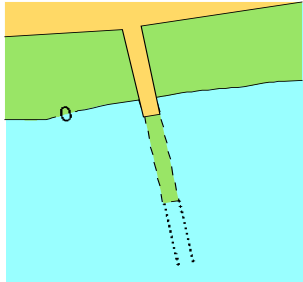
			COLPAT; CONDTN; CONRAD; CONVIS; ELEVAT; FUNCTN; HEIGHT; NATCON; NOBJNM; OBJNAM; STATUS; VERACC; VERDAT; VERLEN;		
28	Light	LIGHTS	CATLIT; COLOUR; DATEND; DATSTA; EXCLIT; HEIGHT; LITCHR; LITVIS; MARSYS; MLTYLT; NOBJNM; OBJNAM; ORIENT; PEREND; PERSTA; SECTR1; SECTR2; SIGGRP; SIGPER; SIGSEQ; STATUS; VERACC;	P	

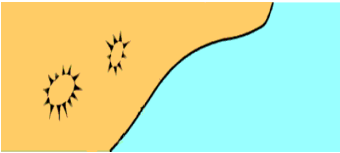
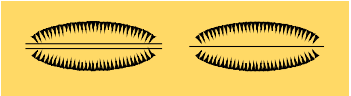
			VALNMR; VERDAT;		
29	Magnetic variation	MAGVAR	DATEND; DATSTA; RYRMGV; VALACM; VALMAG;	P	
30	Navigation line	NAVLINE	CATNAV; DATEND; DATSTA; ORIENT; PEREND; PERSTA; STATUS;	L	
31	Obstruction	OBSTRN	CATOBS; CONDTN; EXPSOU; HEIGHT; NATCON; NATQUA; NATSUR; NOBJNM; OBJNAM; PRODCT; QUASOU; SOUACC; STATUS; TECSOU; VALSOU; VERACC; VERDAT; VERLEN; WATLEV;	P	
32	Pile	PILPNT	CATPLE; COLOUR; COLPAT;	P	

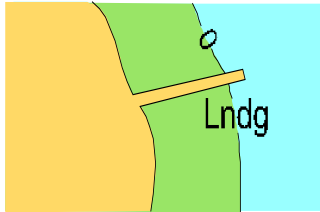
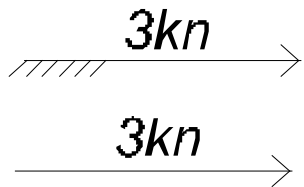
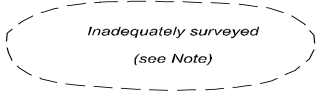
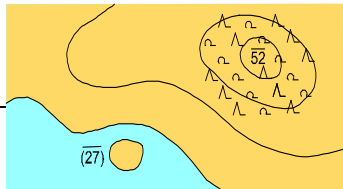
			CONDTN; CONVIS; DATEND; DATSTA; HEIGHT; NOBJNM; OBJNAM; VERACC; VERDAT; VERLEN;		
33	Pipeline	PIPSOL	BURDEP; CATPIP; CONDTN; DATEND; DATSTA; DRVAL1; DRVAL2; NOBJNM; OBJNAM; PRODCI; STATUS; VERACC; VERDAT; VERLEN;	L	
34	Pontoon	PONTON	CONDTN; CONRAD; CONVIS; DATEND; DATSTA; NATCON; NOBJNM; OBJNAM; PEREND; PERSTA; STATUS; VERACC;	P	

			VERLEN;		
35	Precautionary area	PRCARE	DATEND; DATSTA; RESTRN; STATUS;	A	 <i>Precautionary Area</i>
36	Production/storage area	PRDARE	CATPRA; CONDTN; CONRAD; CONVIS; DATEND; DATSTA; ELEVAT; HEIGHT; NOBJNM; OBJNAM; PRODCT; STATUS; VERACC; VERDAT; VERLEN;	A	
37	Pylon/bridge support	PYLONS	CATPYL; COLOUR; COLPAT; CONDTN; CONRAD; CONVIS; DATEND; DATSTA; HEIGHT; NATCON; NOBJNM; OBJNAM; VERACC; VERDAT; VERLEN; WATLEV;	P	

38	Recommended track	RECTRC	CATTRK; DATEND; DATSTA; DRVAL1; DRVAL2; NOBJNM; OBJNAM; ORIENT; PEREND; PERSTA; QUASOU; SOUACC; STATUS; TECSOU; TRAFIC; VERDAT;	L	
39	Rescue station	RSCSTA	CATRSC; DATEND; DATSTA; NOBJNM; OBJNAM; PEREND; PERSTA; STATUS;	P	
40	Restricted area	RESARE	CATREA; DATEND; DATSTA; NOBJNM; OBJNAM; PEREND; PERSTA; RESTRN; STATUS;	A	
41	River	RIVERS	NOBJNM; OBJNAM; STATUS;	A	

42	River bank	RIVBNK	NOBJNM; OBJNAM;	A	
43	Road	ROADWY	CATROD; CONDTN; NATCON; NOBJNM; OBJNAM; STATUS;	L	
44	Seabed area	SBDARE	COLOUR; NATQUA; NATSUR; NOBJNM; OBJNAM; WATLEV;	S	
45	Shoreline construction	SLCONS	CATSLC; COLOUR; COLPAT; CONDTN; CONRAD; CONVIS; DATEND; DATSTA; HEIGHT; HORACC; HORCLR; HORLEN; HORWID; NATCON; NOBJNM; OBJNAM; STATUS; VERACC; VERDAT; VERLEN; WATLEV;	L	
46	Signal station, traffic	SISTAT	CATSIT;	P	

			COMCHA; DATEND; DATSTA; NOBJNM; OBJNAM; PEREND; PERSTA; STATUS;		
47	Signalstation, warning	SISTAW	CATSIW; COMCHA; DATEND; DATSTA; NOBJNM; OBJNAM; PEREND; PERSTA; STATUS;	P	 SS(Danger)
48	Slope topline	SLOTOP	CATSLO; COLOUR; CONRAD; CONVIS; ELEVAT; NATCON; NATQUA; NATSUR; NOBJNM; OBJNAM; VERACC; VERDAT;	L	
49	Sloping ground	SLOGRD	CATSLO; COLOUR; CONRAD; CONVIS; NATCON; NATQUA; NATSUR;	P	

			NOBJNM; OBJNAM;		
50	Small craft facility	SMCFAC	CATSCE; NOBJNM; OBJNAM; PEREND; PERSTA; STATUS;	P	
51	Tidal stream - flood/ebb	TS_FEB	CURVEL; DATEND; DATSTA; NOBJNM; OBJNAM; ORIENT; PEREND; PERSTA;	P	
52	Topmark	TOPMAR	COLOUR; COLPAT; HEIGHT; MARSYS; STATUS; TOPSHP; VERACC; VERDAT; VERLEN;	P	
53	Unsurveyed area	UNSARE	INFORM; NINFOM; NTXTDS; SCAMAX; SCAMIN; TXTDSC;	A	
54	Vegetation	VEGATN	CATVEG; CONVIS; ELEVAT; HEIGHT;	P	

			NOBJNM; OBJNAM; VERACC; VERDAT; VERLEN;		
55	Wreck	WRECKS	CATWRK; CONRAD; CONVIS; EXPSOU; HEIGHT; NOBJNM; OBJNAM; QUASOU; SOUACC; STATUS; TECSOU; VALSOU; VERACC; VERDAT; VERLEN; WATLEV;	P	4₆ Wk 25 Wk

