

Government of Assam Assam Inland Water Transport Development Society (AIWTDS),

CONSULTANCY SERVICES FOR ENVIRONMENTAL AND SOCIAL ASSESSMENT STUDIES FOR ASSAM INLAND WATER TRANSPORT PROJECT (Part of NW-2 & NW-16)

Assam Inland Water Transport Project (P157929)

# **Cumulative Impact Assessment (CIA)**

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# **Table of Contents**

Chapter 1 : Introduction1	
1.1 Preamble	1
1.2 Objectives of CIA	1
1.3 Study Area	1
1.4 Approach and Methodology	3
1.5 Structure of CIA Report	3
Chapter 2 : Project Description	
2.1 Project Locations	4
2.1.1 North Guwahati	4
2.1.2 Gateway Guwahati Ghat	6
2.1.3 AphalamukhGhat	8
2.2 Project Development Objectives	10
2.3 Project Component	11
2.4 Conclusion	12
Chapter 3 : CIA Boundary and VECs13	1
3.1 Introduction	13
3.2 Delineation of the CIA Boundary	13
3.3 Valuable Environmental and Social Components	14
3.3.1 Approaches for Identification of VECs	14
3.3.2 Classification of VECs	14
3.3.3 Identification of Indicators to Assess Conditions of VECs	15
3.4 Assessment of Status of Identified VECs	15
3.4.1 Identification of Indicators to Assess Conditions of VECs – North Guwahati Ghat	16
3.4.2 Identification of Indicators to Assess Conditions of VECs – Guwahati Gateway Ghat	20
3.4.3 Identification of Indicators to Assess Conditions of VECs – AphalamukhGhat	25
3.5 Identification of Hotspots	29
3.6 Conclusion	31
Chapter 4 : Stakeholder's Consultation, Other Developmental Projects and Finalization of VECs 32	
4.1 Introduction	32
4.2 Basis and Strategy of Stakeholder's Selection	32
4.3 Stakeholder Consultation Stages	32
4.4 Identification of Stakeholders	33
4.4.1 Public Consultation Report	33
4.4.2 Institutional Stakeholder Consultation for Screening and Scoping Report	34
4.4.3 Public Consultation in EMFStage	37
4.5 Identification of Hotspots / Pressure Points Based on Stakeholder Consultations	39

4.6 Conclusions......41 Chapter 5 : Cumulative Impact Assessment, Mitigation Measures, Management Plan and Environmental Monitoring Programe for the upcoming / proposed development projects.......42 5.1 Introduction......42 5.2 Finalization of Hotspots for Cumulative Impact Assessmen ......42 5.3 Impact Identification on Dolphins as Hotspot......43 5.3.1 Background and Trends......44 5.3.2 5.3.3 Impacts on Dolphins......45 5.3.4 

5.3.	5	Change in trench and Scour	46
5.3.	6	Change in water Velocity	46
5.3.	7	Other external factors	46
5.3.	8	Cumulative Effects	47
5.3.	9	Mitigation Measures	47
5.4	Imp	act Identification Due to Proposed and Anticipated Developments on VECs	48
5.5	Miti	gation Measures	55
5.6	Envi	ironment Monitoring Plan	61
5.7	Con	clusions	64

# List of Tables

Table 1-1: Geo-Coordinates of the proposed 3 Ghats in Phase-I of the Project	1
Table 2-1: Summary of the Infrastructure Components at identified Priority North G	Guwahati Ghat / Landing point 5
Table 2-2: Summary of the Infrastructure Components at identified Priority GGG / I	_anding point7
Table 2-3: Summary of the Infrastructure Components at identified Priority Aphalan	mukh Ghat / Landing point10
Table 2-4: 1st Phase Project Salient Features Er	ror! Bookmark not defined.
Table 3-1: Indicators of VECs	15
Table 3-2: Indicators of VECs – North Guwahati Ghat	17
Table 3-3: Indicators of VECs – Guwahati Gateway Ghat	22
Table 3-4: Indicators of VECs – Aphalamukh Ghat	26
Table 3-5: Identified Major Hotspots	29
Table 4-1: Consultation Framework	32
Table 4-2: Summary of consultation meetings	
Table 4-3: Summary of Stakeholder Consultation and its compliance from AIWTDS	35
Table 4-4: Summary of Stakeholder Consultation (EMF Stage), Guwhati	
Table 4-5: Summary of Stakeholder Consultation (EMF Stage), Dibrugargh	
Table 4-6: Hotspots Identified as Per Consultation	
Table 5-1: Finalized VECs and Hotspots Selected for CIA Study	42
Table 5-1: Dolphins Status Around Project Sites	44
Table 5-2: Secondary Data on Dolphin presence around project sites	44
Table 5-4: Impacts on VECs Due to Proposed, Planned and Anticipated Developmen	its in Study Area49
Table 5-5: Interaction Matrix of Developments and Identified VECs and Cumulative	Impacts on VECs51
Table 5-6: Broad Mitigation Measures on the basis of Interaction Matrix of Develop	ments and Cumulative Impacts 55
Table 5-7: Specific Mitigation Measures Interaction Matrix of Developments an	nd Identified VECs and Cumulative
Impacts on VECs	57
Table 5-8: Monitoring Plan	61
Table 5-9: Structure of PGC	

# List of Figures

Figure 1-1: Location Map of Pre-Identified 11 Terminals / Ghats / Landing Points for development of ferry services in

Assam	2
Figure 2-1: Study Area- North Guwahati (500mt Radius from Project Site)	5
Figure 2-2: Study Area– Gateway Guwahati Ghat (GGG) (500mt Radius from Project Site)	7
Figure 2-3: Study Area- Aphalamukh Ghat (500mt Radius from Project Site)	10
Figure 3-2: VECs in 100 mt radius study area of North Guwahati Ghat	16
Figure 3-3: VECs in 300 mtradius study area of North Guwahati Ghat	16
Figure 3-4: VECs in 10 km radius study area of North Guwahati Ghat	17
Figure 3-5: VECs in 100 mt radius study area of Guwahati Gateway Ghat	21
Figure 3-6: VECs in 300 mt radius study area of Guwahati Gateway Ghat	21
Figure 3-7: VECs in 10 km radius study area of Guwahati Gateway Ghat	22
Figure 3-8: VECs in 100 mt radius study area of Aphalamukh Ghat	25
Figure 3-9: VECs in 300 mt radius study area of Aphalamukh Ghat	25
Figure 3-10: VECs in 10 km radius study area of Aphalamukh Ghat	26

# Abbreviation

AIPCL	Assam Inland Ports Corporation Ltd
AIWTCL	Assam Inland Water Transport Corporation Limited
AIWTDS	Assam Inland Water Transport Development Society
AIWTP	Assam Inland Water Transport Project
Aol	Area of Influence
СВО	Community Based Organizations
CE	Chief Engineer
CIA	Cumulative Impact Assessment
CIFRI	Central Inland Fisheries Research Institute
СРСВ	Central Pollution Control Board
CV	Curriculum Vitae
CWC	Central Water Commission
DBFOT	Design Build Finance Operate and Transfer
DIWTA	Directorate of Inland Waterway Transport Assam
DLI	Disbursement Linked Indicator
DPR	Detailed Project Report
EA	Environmental Assessment
ECoP	Environmental Codes of Practice
EDC	Eco-Development Committee
EHS	Environmental, Health and Safety
EIA	Environmental Impact Assessment
EIC	Engineer-In-Chief
EMF	Environmental Management Framework
EMIS	Environmental Management Information System
EMP	Environmental Management Plan
EMMP	Environmental Management & Monitoring Program
EOT	Extension of Time
ESE	Environmental, Social and Economic
ESHS	Environmental, Social, Health and Safety
FA	Financial Analyst
FBS	Fixed Budget Selection
FD	Finance Department
FRI	Forest Research Institute
FTP	Full Technical Proposal
GB	Governing Body
GCC	General Conditions of Contract
GIS	Geographic Information System
GoA	Government of Assam
JFMC	Joint Forest Management Committee
ID	Institutional Development
IR	Inception Report
IRS	Indian Register of Shipping
ITC	Instructions to Consultants
IUCN	International Union for Conservation of Nature
IWAI	Inland Waterways Authority of India
IWT	Inland Waterways Transport

IBRD	International Bank for Reconstruction and Development
IDA	International Development Association
IPP	Indigenous Peoples Plan
RAP	Resettlement Action Plan
VL	Joint Venture
LAD	Least Available Depth
LCS	Least Cost Selection
LU	Land Use
MIS	Management Information System
MoEF& CC	Ministry of Environment, Forests and Climate Change
MPR	Monthly Progress Report
NGO	Non-Governmental Organization
NPV	Net Present Value
NW	National Waterway
0&M	Operation and Maintenance
PIA	Project Influence Area
PIANC	Permanent International Association of Navigation Congress
PDO	Project Development Objectives
PGC	Project Guidance Council
PMU	Project Management Unit
РРР	Public Private Partnership
PWD	Public Works Department
QAP	Quality Assurance Procedure
QBS	Quality Based Selection
QC	Quality Control
QCBS	Quality Cum Cost Based Selection
QPR	Quarterly Progress Report
RE	Resident Engineer
RFCTLAR&R	Right or Fare Compensation and Transparent Land Acquisition and
	Rehabilitation and Resettlement
RFP	Request for Proposals
RH	Risk Assessment & Hazard
SA	Social Assessment
SCC	Special Conditions of Contract
SEESA	Strategic Environmental, Economic and Social Assessment
SIA	Social Impact Assessment
SMF	Social Management Framework
SMP	Social Management Plan
SPMG	State Project Management Group
STP	Simplified Technical Proposal
TL	Team Leader
TNA	Training Needs Analysis/Assessment
TQM	Total Quality Management
TORs	Terms of Reference
VR	Village Road
WB	World Bank

## Chapter 1 : Introduction

## 1.1 Preamble

The Government of Assam (GoA) has taken up a Project titled 'Assam Inland Water Transport Project (AIWTP)' to transform the quality of inland water transport services and integrate high quality passenger and vehicle ferry services into Assam's wider transport network. A society in the name and style of 'Assam Inland Water Transport Development Society (AIWTDS)' has been formed by the GoA under Transport Department to implement the Project in 2016. The Project will not only help in promoting the use of Inland Water Transport as eco-friendly, economic and convenient mode of transport but will also result in regional & economic development of Assam and nearby states as well as in providing better connectivity and access to the hinterland where the 'infrastructure' is quite rudimentary. AIWT is operating 102 nos. ferry services on the river Brahmaputra, Barak and in its tributaries for the purpose of public utility out of which 79 nos. ferry services are in the Brahmaputra Valley and 23 nos. ferry services are in the Barak valley.

The Environmental Impact Assessment (EIA) studies for the proposed AIWTProject for Phase I Ghats i.e. 3 terminal locations which areSouth Guwahati (In between GGG& GN Ghat), North Guwahati Ghat (in existing terminal sites) and AphalamukhGhat (Existing sites<sup>1</sup>)arecarried out in accordance with applicable WB, National and Assam state Government requirements on environmental, health and safety management.

In this context, AIWTDS intends to carry out Cumulative Impact Assessment (CIA) a per TOR and WB requirementfollowing the EIA findings of proposed AIWT for:

- a. Analysing the potential impacts and risks of proposed developments in the context of the potential effects of other human activities and natural environmental drivers on the chosen Valued Environmental Components (VECs) over time, and
- b. Proposing concrete measures to avoid, reduce, or mitigate such CIA and risk to the extent possible.

## 1.2 **Objectives of CIA**

- Assess the potential impacts and risks of a proposed and other developments over time on a chosen VEC;
- Verify that the proposed development's CIA and risks will not exceed a threshold that could compromise the sustainability or viability of selected VECs;

## 1.3 Study Area

The Phase I locations of development of Terminals / Ghats / Landing Points for ferry services in proposed project is shown in **Figure 1.1 and** Table 1.1. The CIA report is prepared covering the phase I activities. The EIA report of phase II is under finalization and final CIA report will be submitted covering phase I & II.

Ghats	North Bank		Ghats	Sout	h Bank		
	Latitude	Longitude		Latitude	Longitude		
AIWTDS Division, Guwahati District							
North Guwahati 26.1869 91.72157 Guwahati gateway Ghat		26.17993	91.734282				
AIWTDS Division, Dibrugarh District							
Aphalamukh	26.91587	94.299388					

#### Table 1-1: Geo-Coordinates of the proposed 3 Ghats in Phase-I of the Project

<sup>&</sup>lt;sup>1</sup> Existing as on January 2019



Figure 1-1: Location Map of Pre-Identified 11 Terminals / Ghats / Landing Points for development of ferry services in Assam

## 1.4 Approach and Methodology

Stepwise approach & methodology is given below.

- Identify VECs, and determine spatial and temporal Boundaries for CIA
- Identify other activities and developments affecting VECs
- Identify and finalize the Hotspots / Pressure Points based on desktop, field surveys and EIA.
- Identify and finalize the Hotspots / Pressure Points based on Consultations.
- Assess cumulative impacts on VECs
- Identify, when necessary, additional project mitigation (beyond that identified in the project ESIA) to reduce an estimated unacceptable cumulative impact on a VEC to an acceptable level.
- Management Plan
- Monitoring Plan

## **1.5 Structure of CIAReport**

CIA Report has been compiled in seven chapters as given below.

- 1. Chapter 1 Introduction and Background: This chapter describes Introduction of AIWT Project; Objective of the Study as per ToR; Study Area; Approach and Methodology.
- 2. Chapter 2 Project Description: This chapter describes components of AIWT project in an integrated manner
- 3. Chapter 3 CIA Boundaries and VECs: This chapter describes about CIA areas, VECs identified and Hotspots for CIA Study.
- 4. Chapter 4 Stakeholder Consultation, Other Development Proposals: This chapter describes development proposals, stakeholders, and consultation carried out so far.
- 5. Chapter 5 Cumulative Environmental Impact Assessment: This chapter describes Cumulative impact assessment, Mitigation Measures, Monitoring Plan

## Chapter 2 : Project Description

The project is focused on improving ferrying of cross-river passengers on the Brahmaputra and Barak and seeks to use the opportunity to establish a tenable foundation for development of a modern IWT sector in Assam. The long absence of adequate policy response and piecemeal investments in IWT in the State (as also nationally) have resulted in somewhat unorganised and weak condition for the sector, which is not predisposed to a linear scale-up. Despite the odds however, Assam manages to provide ferry services to about 5 million people annually, usually along with their vehicles/livestock/goods. In order to support the functioning but ill-equipped IWT sector therefore requires a more granular approach encompassing a range of supply and demand side factors. As such, the project is guided by a binding philosophy that admits wider, and even incremental interventions as long as they contribute to strengthening institutions and planning; operational efficiency and safety; and importantly sustainability. The project activities are organized under the four components collectively intended to tackle the regulatory, operational, and infrastructure challenges of the sector..

## 2.1 **Project Locations**

As discussed in Chapter -1, in Phase I 3 terminal locations are considered i.e. **South Guwahati (In between GGG& GN Ghat), North Guwahati Ghat (in existing terminal sites) and AphalamukhGhat (Existing sites<sup>2</sup>).** The project locations are discussed below.

Developm ent Site Location	Site Specific Findings	Advantages	Disadvantages	Remarks
North Guwahati (On North Bank of Brahmaput ra)	<ul> <li>Ghat is muddy flat land.</li> <li>As per record average 1000 Passenger/day travel from Ghat.</li> <li>Water quality analysis reflects high turbidity</li> <li>Basic Infra is lacking for passengers like ramp, approach paved roads, ticket house, security, toilet facilities, waiting area, special provision for ladies and elderly people, parking area etc.</li> <li>Temporary ramp and access roads are risky especially during rainy season.</li> <li>Ghat is highly eroded due to flood with silt deposits.</li> <li>Lack of solid waste management system</li> <li>Water-pollution due to improper management of waste and sewage</li> </ul>	<ul> <li>Environment Considerations:</li> <li>No tree cutting is associated.</li> <li>The proposed land required for the project is government land and under possession of IWT.</li> <li>Site is open sandy with no settlement except some encroachment.</li> <li>Site is accessible through existing PWD road</li> <li>Settlements located are at app. 300m from proposed terminal activities. Thus, minimal impact due to project activities.</li> <li>Locally available raw material (sand) for construction</li> <li>Site is not part of or close to any eco-</li> </ul>	Environment Considerations: Gangetic Dolphins which is Schedule-I species as per Wildlife Act, 1972 are existing in this stretch of river 2.5 km upstream of the site in North east direction near UmanandaGhat and 3 km near KacheriGhat Approach from city roads to the Ferry Ghat is not developed. In rainy season the passengers face problem. Site not directly connected to any public paved road at present. River banks and	<ul> <li>Site is selected on the basis of existing facilities and socio- economic and environment considerations</li> <li>No major environment, social or design issue associated</li> <li>All the negative impacts listed are manageable with proposed environment &amp; social management plans.</li> </ul>

#### 2.1.1 North Guwahati

<sup>2</sup> Existing as on January, 2019

Where the

Developm ent Site Location	Site Specific Findings	Advantages	Disadvantages	Remarks
	<ul> <li>Encroachment near the proposed access road and existing PWD road.</li> </ul>	<ul> <li>sensitive location</li> <li>Availability of land required for supportive infrastructure.Availabili ty of enough depth for berthing &amp; movement of ships and thus minimum dredging is required</li> </ul>	bed are required to be protected from erosion & scouring.	
/it enert fit cuusass	Antary Pitra Antary Pitra Antary Pitra			

Figure 2-1: Study Area- North Guwahati (500mt Radius from Project Site)



Table 2-1: Summary of the Infrastructure Components at identified Priority North Guwahati Ghat / Landing point

Sr. No Ghat name			Area	No. of Passenger		
		Proposed Components	Required [m <sup>2</sup> ]	hour /peaks	average	Considered for Planning
1.	North Guwahati	Ticket Counter	12/12	510	285	255
Ghat		Administration & Security	39/39			
		Passenger Waiting Area	253/253			
		Parking Area(two-wheeler)	143/143			

Sr.	Sr.		Area		No. of Passenger			
No	Ghat name	Proposed Components	Required [m <sup>2</sup> ]	hour /peaks	average	Considered for Planning		
		Toilet Facilities	67/67					
		Total at Berth	514					
		Landside	35/35					
		Delivery Parking						
		Total	35					
		Structural Dimension	(m)					
		Design Depth	1.7(39.33)					
		Maximum Height Difference	8.75					
		Access Bridge Width	6					
		Berthing Length (Phase 1)	85					

# 2.1.2 Gateway Guwahati Ghat

Developm	Site Specific Findings	Advantages	Disadvantages	Remarks
ent Site Location				
Gateway Guwahati Ghat (GGG) (On South Bank of Brahmaput ra)	<ul> <li>Ghat is muddy flat land.</li> <li>As per record daily average 800 Passenger travel from Ghat.</li> <li>Infrastructure facilities like passenger waiting area, toilets, parking area are provided.</li> <li>Toilet waste not treated and directly release into river</li> <li>Laboratory testing of the water quality confirmed the turbidity and contaminated nature of the water.</li> <li>Lackof ramp, approach paved roads etc.</li> <li>Temporary bamboo ramps / structures which are big problem during rainy season.</li> <li>Solid waste is dumped and scattered on site.</li> </ul>	<ul> <li>Environment Considerations:</li> <li>No tree cutting is associated since land requirement is limited to access road to the terminal development at riverbank.</li> <li>Site is open sandy with no development in nearby areas.</li> <li>Small encroachments are observed</li> <li>High siltation is recorded</li> <li>Site is with IWT Assam.</li> <li>Site is accessible by MG Road and city roads which are already developed.</li> <li>Settlements located at an app. Distance of 400 m from site thus minimal impact due to project activities.</li> <li>Locally available raw material (sand)</li> <li>Site is not part of or close to any eco- sensitive location</li> <li>Availability of land required for berthing and supportive infrastructure.</li> </ul>	Environment Considerations: • Gangetic Dolphins which is Schedule 1 species as per Wildlife Act, 1972 are existing in this stretch of river 1.5 km upstream of the site in North east direction near UmanandaGhat and 2 km near KacheriGhat • Approach from city roads to the Ferry Ghat is not developed. In rainy season the passengers face problem. • Site not directly connected to any public paved road to MG road	<ul> <li>No alternatives assessed as site already selected and land already with IWT Assam. Anticipated impact on Dolphin and Aquatic ecology due to vessel movement is analysed to be low as boat movement will be regulated at speed of 5kmph.</li> <li>No major environment, social or design issue associated</li> <li>All the negative impacts listed are manageable with proposed environment &amp; social management plans thus no major drawbacks associated with the site</li> </ul>



Figure 2-2: Study Area- Gateway Guwahati Ghat (GGG) (500mt Radius from Project Site)



Table 2-2: Summary of the Infrastructure Components at identified Priority GGG / Landing point

Sr.			Area Required		No. of Passenger		
No	Ghat name	Proposed Components	[m²]/	hour /peaks	average	Considered for Planning	
1.	Guwahati	At Berth		2300	1235	1150	
	Gateway Ghat	Ticket Counter	24/12				
		Administration & Security	67/67				

Sr.			Area Required		No. of Pas	senger
No	Ghat name	Proposed Components	[m²]/	hour /peaks	average	Considered for Planning
		Passenger Waiting Area	1143/439			
		Parking Area	644/247			
		Toilet Facilities	134/67			
		Total	2012/832			
		Landside	35/35			
		Delivery Parking				
		Total	35/35			
		Structural Dimension	(m)			
		Design Depth	1.9(39.53)			
		Maximum Height Difference	8.75	1		
		Access Bridge Width	8			
		Berthing Length (Phase 1)	170			
		Add. Berthing Length (Phase 2)	180			

## 2.1.3 AphalamukhGhat

ent Site Location	
Location	
Aphalamu kh Ghat (On North 	Iready and Iready WRD. d on and cology vessel isted gative listed geable posed nt ent is no is is control are

Developm ent Site	Site Specific Findings	Advantages	Disadvantages	Remarks
Location	<ul> <li>Ghat is connected through unpaved road. There are temporary shops around the approach road. Existing Ghat has land available for future development.</li> <li>Passengers have to go on pontoons by temporary bamboo ramps / structures which are big problem during rainy season.</li> <li>Solid waste is dumped and scattered on site.</li> </ul>			
		Aphalamukh Ghat		



Figure 2-3: Study Area- Aphalamukh Ghat (500mt Radius from Project Site)

Table 2-3: Summary of the Infrastructure Components at identified Priority Aphalamukh Ghat / Landing

-		٣				
Sr.	Ghat name	Proposed Components	Area		No. of Pa	ssenger
No			Required	hour	average	Considered for
			[m²]	/peaks	U U	Planning
1.	AphalamukhGhat	At Berth		•	1	
		Ticket Counter	12	505	340	250
		Administration & Security	39			
		Passenger Waiting Area	248			
		Parking Area(two-wheeler)	140			
		Toilet Facilities	67			
		Parking Area (light vehicles)	187.5			
		Total	693.5	]		
		Landside				
		Delivery Parking	35			
		Parking Area (light vehicles	375	]		
		Total	410			
		Structural Dimension	(m)			
		Design Depth	1.7 (39.73)	]		
		Maximum Height Difference	11.89			
		Access Bridge Width	6			
		Berthing Length	130	]		
		Total	1103.5			

## 2.2 Project Development Objectives

The Project Development Objectives (PDOs) are to (a) improve passenger ferry infrastructure and services in Assam and (b) improve the institutional capacity and framework for inland water transport in Assam.

The PDO will be measured by seven PDO indicators given below.

Passenger Ferry Infrastructure and Services

- Ferry service hours available in a day on project supported ferry routes
- Percent women users of ferries during peak hours
- User satisfaction (on access, safety, quality of services, facilities etc.) disaggregated by gender on project supported ferry routes

Institutional Capacity and Framework

- Regulation of IWT operations in Assam strengthened
- Unbundling public sector operations from industry regulations
- Enhanced IWT sector capacity on safety and modern technologies
- Establishing an emergency response system including a search and rescue unit

## 2.3 **Project Component**

The project is supported by an Investment Project Financing (IPF) of US\$88 million, which includes a financing of US\$53 million based on achievement of DLIs.The project will support ferry infrastructure and services (terminals and vessels), institutional reforms, consultancies/analytical studies, training and capacity building, goods including information and communication technology equipment, and development of software applications for safe and efficient management of the sector.

The project activities are organized under the following four components collectively intended to tackle the regulatory, operational, and infrastructure challenges of the sector.

#### **Component 1: Institutional, regulatory and safety strengthening (estimated cost US\$21 million)** This component will include the following:

a. Technical Assistance: (i) Carrying out technical assessments/studies to prepare anintegrated state-wide inland water transport (IWT) strategy and investment plan, to mainstream inland water transport and promote multi-modal integration and last mile connectivity; (ii) carrying out environmental and social impact assessments in relation to inland water transport investments financed under the Project; (iii) carrying out studies on weaknesses, institutional requirements and business plans for the IWT sector, to prepare institutional reforms including basic legislation for the strengthening of Assam Inland Water Transport Regulatory Authority ("AIWTRA") to develop and enforce safety, environmental and economic regulations for the IWT sector; (iv) unbundling shipping/ferry and terminal operations in Assam by establishing and operationalizing the Assam Shipping Company ("ASC") and Assam Ports Company ("APC"), developing business plans therefor, and providing technical assistance/guidance during the initial years of operations; and (v) undertaking assessment on, and eventually strengthening, the institutional capacity of the Directorate of Inland Water Transport Assam ("DIWTA") including establishing a new hydrography unit, carrying out job-mapping exercises and developing sector competencies (training and re-skilling)(US\$11 million).

b. Safety Management: (i) Assessing, procuring and deploying navigations aids in the Brahmaputra and Barak rivers to allow 24-hours/night navigation services in the most trafficked routes/crossing points; and (ii) establishing a search and rescue organization, piloting an emergency response system (including developing policies and procedures, procuring equipment and setting up/supporting management and operation teams), and improving existing systems for emergency preparedness for natural disasters and climate change(US\$10 million).

#### Component 2: Fleet safety improvements and modernization (estimated cost US\$25 million)

This component will include the following:

- a. "Jibondinga" incentive scheme: Implementing the "Jibondinga" incentive scheme retrofitting of existing vessels and/or new vessel acquisition by private boat/ferry operators through the provision of Matching Grants(US\$10 million).
- b. Procurement of New Vessels and Retrofitting of Existing Public Vessels: (i) Procuring approximately twenty (20) passenger ferries for ASC, with capability for carrying motorcycles and cargo, as well as providing longer haul services; (ii) retrofitting existing vessels operated by DWITA and/or ASC; and (iii) repurposing old pubic vessels for the provision of alternative (non-transport) critical public services (e.g. mobile clinics, schools, libraries, etc.)(US\$15 million).

**Component 3: Improvement in terminal infrastructure (estimated cost US\$55 million)** This component will support the following:

- a. Provision of Priority Terminals and Repair Facilities: Designing and constructing approximately three (3) priority mid- to large-size terminals and repair facilities in congested river crossings, as per standard modular designs for scalable infrastructure adaptable to rural and urban areas and following the "working with nature" approach (US\$40 million).
- b. Provision of Smaller Terminals: Designing and constructing at least four (4) small and mainly rural terminals, as per standard designs for modular and scalable infrastructure adaptable to rural and urban areas (US\$15 million).

Component 3 will provide standard designs for modular and scalable infrastructure that can be adapted for other urban and rural ferry terminals. It also includes ancillary infrastructure such as road access, terminal buildings, and other amenities for the differently abled, women, children, old, and infirm.

#### Component 4: Project management support (estimated cost US\$9 million)

This component will support implementation of the above three components and provide for costs on project preparation, implementation, coordination, and monitoring and evaluation (M&E). An important element of the component would support capacity augmentation and policy support on climate mitigation and adaptation through consultancies, knowledge events, staff training, and so on.

The activities supported under the component specifically include- Providing support for Project implementation, coordination, monitoring and evaluation, through: (i) establishing and ensuring the operability of AIWTDS, including the provision of training, staffing, office modernization and equipment; (ii) ensuring the operability of the AIWTRA, including the provision of training, staffing, office and equipment; (iii) providing technical assistance and management support, including hiring the services of the General Consultant and the Independent Verification Agency; (iv) carrying out Project audits; and (v) setting up monitoring and evaluation systems(US\$9 million).

#### 2.4 Conclusion

The report focuses on already identifiedinvestment locations. Total 3 terminal sites i.e. South Guwahati, North Guwahati and AphalamukhGhat and two maintenance locations i.e. Pandu Port and NeamatiGhat are finalized in Phase I. The project locations in Phase Iare proposed as per the demand analysis. Project is not affecting any of the environmental sensitive area. Project development requires raw material like earth, ballast, steel, sleepers etc. Obtaining all these raw materials have certain impact on the environment e.g. earth may be obtained borrow area, ballast requires stone quarrying & crushing which have significant impact on geology, Air quality, Noise, land form of the area. Similarly, the project development is ought to have various associated environmental impacts. But the project in operational stage will have minimum impacts as the project does not involve any huge discharges/emissions. However, apart from all above the project is highly beneficial in terms of passenger transport improvement in the area and reduction in GHG emissions. These impacts are described in later chapter of the reports. Also detailed baseline has been collected for the project area which has helped to identify the current status of VECs condition in the area and the significance of the anticipated impacts in that area.

# Chapter 3 : CIA Boundary and VECs

## 3.1 Introduction

Proposed project is expected to enhance the existing inland passenger transport system in the area and will improve the accessibility to the areas where the demand will lead to development and growth. This necessitates that study area size should be based on the extent of the area where accessibility improvements could occur and may require some judgments about the extent of the influence of the project. Therefore, CIA requires fixation of spatial and temporal boundaries in order to assess the impacts of direct, indirect and induced activities due to proposed project. Process of delineation of boundary largely depends upon the type of development & its potential to exhibit direct & indirect impacts on the surrounding environment. The following sections describe the CIA boundary, the rationale & basis of its delineation, VECs within the delineated boundaries, and hot spots identified.

## 3.2 Delineation of the CIA Boundary

The study boundary of for CIA has been considered based on the influence area of proposedIWTon islands, chars, riverbed, banks, the river basins/catchments upstream and downstream of the IWT area, floodplain, drainage areas and patterns, areas of potential influence of existing and planned river ports, landings, terminals, vessel shelters, ferry crossings, possible dredge spoil dumping locations, areas of ecological importance, upcoming infra projects etc. Brief summary of these developments along the tentative locations are presented below.

To conduct the detailed study of the project, three buffer boundaries have been considered; i.e. 100 mtrs, 300 mtrs and 10 kms.

- 100 mtrs buffer This area includes proposed terminal locations, allied proposed developments and the 100 m area from centre of proposed terminal. This boundary has been taken according to the EIA study conducted for the entire area. Under this buffer map roads, nallas / ponds, trees, wells / tube wells / hand pumps, temples / schools / hospitals / structures, high tension lines, stations / chainage and forests if any. This area will be the direct influence zone, as this will experience the maximum stress in terms of physiographic, biologic al & social change.
- 300 mtrs buffer –According to IFC codes and applicable Indian regulations, for archaeological and cultural sites a maximum distance of 300 mtrs is considered to study the impact of any upcoming developmental project. Therefore, using this boundary all the cultural and archaeological sites has been located to study the influenced locations on the site.
- 10 kms buffer It is being considered that the extent of area of influence of the project may not go up to 10 kms as per the expert and stakeholder's consultations. Therefore, the farthest distance covered in the CIA boundary is 10 kms. List of the existing & upcoming projects identified in the study area through stakeholder consultation is given in chapter stakeholder consultation.

Hence the spatial boundary has been demarcated considering all the above given features and buffer areas within the range of 10 kms. Areas beyond 10 kms areas are also considered for purpose of CIA study if they involve and have potential to undergo significant change/development due to proposed project or vice versa. This delineation of study area not only covers project where only localized effects are expected but also effects, which are regional in scale.

## 3.3 Valuable Environmental and Social Components

VECs are environmental and social attributes that are considered important in assessing risks. While VECs may be directly or indirectly affected by a specific development, they often are also affected by the cumulative effects of several developments. VECs are the ultimate recipient of impacts because they tend to be at the ends of ecological pathways. VECs in general refer to sensitive or valued receptors of impact whose desired future condition determines the assessment ends to be used in the CIA process.

The selection of biophysical and socio-economic VECs is a process that reflects a balanced and knowledgeable synthesis of a wide range of information regarding the Project, the environmental setting where the Project is located and an understanding of concerns and issues associated with the responsible development of the Project. The identification of VECs is important because the detailed environmental effects analysis, as laid out in the environmental assessment methodology, is conducted only on those VECs.

It has generally been recognized since the early 1980s (Beanlands and Duinker, 1983) that there is a need to somehow focus the environmental effects analysis and the statement of significance for residual adverse environmental effects on those components of the environment that have the most relevance to the decision-making process. It simply is not practical or achievable to conduct a detailed environmental effects analysis on every aspect of an ecosystem. However, the exclusion of some environmental components from being elevated to the status of VECs is not intended to exclude their consideration in the environmental effects analysis.

#### 3.3.1 Approaches for Identification of VECs

To identify the VECs for CIA study, it is possible to largely obtain cumulative opinions ofvarious stakeholders, which are directly & indirectly impacted due to proposed development, and extensive review of the existing ElAstudies of the proposed project.

Consultation with all the major stakeholders related to development activities in the vicinity of the project area has been done and already submitted in project wise EIA reports.

#### 3.3.2 Classification of VECs

Further, overlay mapping and GIS have been used for identifying the spatial distribution of VECs.Based on the above approach, mapping method and as per IFC guidelines forCIA and Management, VECs have been classified as givenbelow.

#### Physical features

- Urban Agglomerations / Centres
- Land Resources
- Proposed / Upcoming Infrastructure projects

#### Ecological Profile

- Bio Diversity (Forests / Wildlife Sanctuaries/ National Parks/Tiger Reserves/Bird Areas)
- o Wetlands
- $\circ$  Dolphins
- Migratory Birds
- Turtles

## Physical Environmental Profile

- o Air
- o Noise
- o Water
- Climate change

#### Cultural aspects

• Archaeological / Heritage Sites

#### 3.3.3 Identification of Indicators to Assess Conditions of VECs

To analyse the conditions and affect identified VECs various indicators have been identified &analysed. These indicators will help to identify the extent of impact on the identified VECs and assist in defining "Cause & Effect" relationship.

#### 3.4 Assessment of Status of Identified VECs

An extensive study including the site visits, study of the project areathroughtopo maps & Google maps, review of existing studies and literature was carried out to assess the status of identified VECs within the CIA boundary.

Sr. No.	Valuable En	vironmental Components	Indicators	
1.	Physical Features /	Urban Centres /	Population	
2.	Habitats	Agglomerations	Literacy	
3.			WFPR	
4.			GDP	
5.			Standard of living	
6.			Pressure on existing resources	
7.		Land Resources	Soil Erosion	
8.			Land Use Change	
9.		Proposed / Upcoming	Roads / Bridges	
10.		Infrastructure projects	Traffic Congestion (IWT Routes)	
11.			Traffic Congestion (Feeder Routes)	
12.			Rails	
13.			Air Connectivity	
14.			Health Facilities(Number)	
15.			Education Facilities(Number)	
16.			Number of Industries	
17.	Ecological Profile	Bio Diversity (Forests / Wildlife		
		Sanctuaries/ National Parks /	Impact on flora & fauna	
	-	Tiger Reserves / Bird Areas)		
18.	-	Wetlands	Impact on Wetlands	
19.	-	Dolphins	Impact on Dolphins	
20.	-	Migratory Birds	Impact on migratory bird	
21.		Turtles	Impact on Turtles and its breeding Locations	
22.	PhysicalEnviron	Air	Air Quality Index	
23.	mentalProfile	Water	Ground Water Resources	
24.	-		Water quality	
25.	-	Noise	Noise Levels	
26.		Sediment	Sediment Quality and impacts of sediment on	
	-		water quality	
27.	-	Climate Change	GHG	
28.	-		Erratic Rainfall	
29.			Flooding	
30.	Social	Infrastructure	Education, Health, Connectivity	
31.	Infrastructure	Industrial Corridor	Proposed / Planned)	
32.		Power Plants	Existing & Proposed)	
33.	Cultural Aspects	Archaeological /Heritage Sites	Impact on Archaeological Monuments	

#### Table 3-1: Indicators of VECs

#### 3.4.1 Identification of Indicators to Assess Conditions of VECs - North Guwahati Ghat



#### Figure 3-1: VECs in 100 mt radius study area of North Guwahati Ghat

Figure 3-2: VECs in 300 mtradius study area of North Guwahati Ghat







#### Table 3-2: Indicators of VECs – North Guwahati Ghat

Sr. No.	Valuable Environmental Components		0 to 100 mt buffer	100 to 300 mt buffer	300 mt to 10 km buffer	Remarks
1.	Physical Features	Urban Centres	None	None	Pan Bazaar Fancy Bazaar	
2.	Habitats	Agglomerati ons	Loss of structures(2 residential cum commercial establishments)	North Guwahati Bridge is the major upcoming project within 300 m w.r.t project site connecting Guwahati City to NorthGuwah ati.		The six lane bridge having 1.6 km length over the Brahmaputra river is proposed to be constructed which enhance the extension of the city towards the North bank and will reduce the congestion in the existing city areas. The project cost is 1890 crores and nodal agency is Urban Development Department, Government of Assam. The proposed bridge will reduce travel time to North Guwahati via Sarighat bridge.
3.			Loss of	1		

Sr. No.	Va Envir	luable onmental	0 to 100 mt buffer	100 to 300 mt buffer	300 mt to 10 km buffer	Remarks
	Com	ponents	liveliheed/0			
4.			livelihood(2 kiosks) Loss of			
			employees in shops/ agricultural labours/			
5.		Land	Habitation	Habitation	Habitation	
6.		Resources	Encroachment	Encroachme nt	Encroachment	
7.			Commercial	Commercial	Commercial	
8.			Parking		IIT Guwahati	
9.			Soil Erosion		North Guwahati College	
10.					Noonmati Refinery	
11.					Indian Oil Gas Bottling Plant	
12.					Saraighat Bridge	
13.		Proposed / Upcoming	None	None	Guwahati Smart City Metropolitan region	
14.		Infrastructur e projects			Pandu Port Proposed upgradation (4.3km)	
15.					Proposed Ropeway connecting south Guwahati to North Guwahati via Urvashi Temple and Umananda Temple (2.2km)	
16.	Ecologic al Profile	Bio Diversity (Forests / Wildlife Sanctuaries / National Parks / Tiger Reserves / Bird Areas)	Aquatic biota may get impacted due to construction activities (Low to Medium)	Low	1) Rani Reserve Forest (8.5km) 2) Digheshwar Reserve Forest (6km) 3) Sila Reserve Forest (4.2km) 4) Phatasil Reserve Forest (3km)	
17.		Wetlands	None	None	DeeporBeel Wetland Area (9.7km)	
18.		Dolphins	None	None	Near KacheriGhat (1km from North Guwahati Ghat)	
19.		Migratory Birds	None	None	DeeporBeel Bird Sanctuary (9.7km)	
20.		Turtles	None	None	Kamakhya Temple Region (3km)	
21.	Physical Environ mental	Air	Low to Moderate Impact (vessel movement and	Low Impact (vessel movement and	Industrial Area at Amingaon&Bamuni maidam and	These industrial areas are at a minimum distance of 4.0 km from
	Profile		DG sets on the	DG sets on the	111d1Ud111 dí1Ú	the project site. The

Sr. No.	Valuable Environmental		0 to 100 mt buffer	100 to 300 mt buffer	300 mt to 10 km buffer	Remarks
		<u>P010110</u>	terminal)	terminal)	Noonmati Refinery are at 6.0 km, 4.0km & 5.5 km respectively.	predominant wind direction at site is north east to south west as per climatology tables of India, therefore no significant impacts on air quality due to Noonmati Refinery which is located eastern side of project site.
22.		Water	Low to moderate impact (pollution due to oil spills or improper waste disposal)	Low to moderate impact (pollution due to oil spills or improper waste disposal)	Nil	
23.		Terrestrial Noise	Low to Moderate Impact (vessel movement)	Low Impact (vessel movement)	None	Terrestrial noise impact shall be moreclose to the ghat area as compared to areas within water
24.		Underwater Noise	Low to Moderate Impact (vessel movement)	Moderate Impact (vessel movement)	Moderate to high Impact (vessel movement)	The vessel movement would lead to underwater noise impact more in areas where there is a higher probability of spotting the dolphins
25.		Sediment	Moderate to high impact(dredging for maintaining LAD)	Moderate impact(dredgin g for maintaining LAD)	None	
26.		Climate Change	High (Flash flooding a major impact during rainfall)	High (Flash flooding a major impact during rainfall)	None	
27.	Social Infrastru	Infrastructure	Improved social and physical infrastructure	Improved social and physical infrastructure	Improved social and physical infrastructure	
28.	cture	Industrial Corridor	None	None	None	
29.		Power Plants	None	None	None	
30.	Cultural Aspects	Archaeologi cal / Heritage Sites	None	Aswaklanta Temple and DoulGovinda temple (cultural importance)	1) Umanadaghat, (Cultural/ archaeology importance) 2.4km) 2) Urvashi Island (archaeology importance) (2.3km)	
					3) Kamakhya temple region (archaeological importance) (1.7km)	The Kamakhya temple region is declared as the region of Archaeological importance by ASI

Sr. No.	Valuable Environmental Components	0 to 100 mt buffer	100 to 300 mt buffer	300 mt to 10 km buffer	Remarks
				(3a) Figures of Ganesa-2	
				(3b) Siva-Lingas – 12	
				(3c) Four-handed	
				(3d) Miniature	
				(3e) Figures of	
				(3f) Two-handed ' Bhairabi' – 1	
				(3g) Stone gateway	•
				(3h) Dancing Bhairaya (locally	
				known as Bala-	
				on rock – 1	
				(3i) Durgarilla Rock Inscription	
				4) Statue of LachitBorphukan	
				(cultural importance) (1.3km)	
				Rock Cut Structures	
				Temple (2km)	

## 3.4.2 Identification of Indicators to Assess Conditions of VECs – Guwahati Gateway Ghat



Figure 3-4: VECs in 100 mt radius study area of Guwahati Gateway Ghat

Figure 3-5: VECs in 300 mt radius study area of Guwahati Gateway Ghat





Figure 3-6: VECs in 10 km radius study area of Guwahati Gateway Ghat

#### Table 3-3: Indicators of VECs – Guwahati Gateway Ghat

Sr. No.	Valuable E Com	nvironmental conents	0 to 100 mt buffer	100 to 300 mt buffer	300 mt to 10 km buffer	Remarks
1.	Physical	Urban	Guwahati Smart	None	Pan Bazaar	
2.	Features	Centres	City		Fancy Bazaar	
3.	Habitats	Agglomerati ons	Loss of community assets (1 water kiosk and 1 ticket counter)	North Guwahati Bridge is the upcoming project within 300 m w.r.t project site connecting Pan bazar to North Guwahati.	Brahmaputra River Front Development Project by Guwahati Smart City Limited is under conceptual stage.	Details of bridge project have been described in section 3.4.1.
4.			Loss of other assets (2 trees and 1 boundary wall)	The elevated road from end point of bridge at Guwahati up toKacharighatpropo sed by PWD Assam. Project is under conceptual stage.		
5.		Land	Habitation	Habitation	Habitation	
6.		Resources	Commercial	Commercial	Commercial	
	Į		Highway		IIT Guwahati	
7.			Parking		North Guwahati College	

Sr.	Valuable E	nvironmental	0 to 100 mt	100 to 300 mt	300 mt to 10 km	Remarks
No.	Com	ponents	buffer	buffer	buffer	
8.			Soil Erosion		Noonmati Refinery	
9.					Indian Oil Gas	
10					Bottling Plant	
10.		Duan a sa d /	News	News	Saraighat Bridge	
11.		Proposed /	None	None	Proposed Ropeway	
		Infrastructur			Guwabati to North	
		e projects			Guwahati via Urvashi	
		o projecto			Temple and	
					Umananda Temple	
					(1.9km)	
12.					Guwahati Smart City	
					Metropolitan region	
13.					Pandu Port	
					Proposed	
14	Foologiaal		Aquatia hiata may	Aquatia biata may	1) Repi Record	
14.	Profile	Elo Diversity	aet impacted due	aet impacted due to	Forest (7.7km)	
	TONIC	Wildlife	to construction	construction	2) Digheshwar	
		Sanctuaries	activities	activities	Reserve	
		/ National			Forest(6.5km)	
		Parks / Tiger			<ol><li>Sila Reserve</li></ol>	
		Reserves /			Forest (5.7km)	
		Bird Areas)			4) Phatasil Reserve	
15		Matlanda			Forest (2.4km)	
15.		vveliands	None	None	Deeporbeer weiland	
16	1	Dolphins	None	None	Near KacheriGhat	
10.		Dolphino			(400m from Guwahati	
			None	None	Gateway Ghat)	
17.		Migratory			DeeporBeel Bird	
		Birds	None	None	Sanctuary (9.8km)	
18.		Turtles			Kamakhya Temple	
			None	None	Region (1.9km)	
19.		Intrastructure	improved social	improved social	improved social and	
	Social		nhysical	anu physical	infrastructure	
	Infrstructu		infrastructure	infrastructure	Innastructure	
20.	re	Industrial	None	None	None	
		Corridor				
21.		Power Plants	None	None	None	
22.	Physical	Air	Low to Moderate	Low Impact (vessel	Industrial Area at	These industrial
	Environm		Impact (vessel	movement and DG	Amingaon&Bamunima	areas are at a
	ental		movement and DG	sets on the terminal)	Idam and Noonmati	minimum
	Profile		sets on the		Refinery are at a	distance of 4.0
					4  0  km & 5 5  km	project site
					respectively	hence the impact
					. seperatory.	is negligible.
23.		Water	Low to moderate	Low to moderate	None	J. J. 21
			impact (pollution	impact (pollution		
			due to oil spills or	due to oil spills or		
			improper waste	improper waste		
			disposal)	disposal)		

Sr.	Valuable E	nvironmental	0 to 100 mt	100 to 300 mt	300 mt to 10 km	Remarks
No.	Com	ponents	buffer	buffer	buffer	
24.		Terrestrial Noise	Low to Moderate Impact (vessel movement)	Low Impact (vessel movement)	None	Terrestrial noise impact shall be closer to the ghat area as compared to areas within water
		Underwater Noise	Low to Moderate Impact (vessel movement)	Moderate Impact (vessel movement)	Moderate to high Impact (vessel movement)	The vessel movement would lead to underwater noise impact more in areas where there is a higher probability of spotting the dolphins
25.		Sediment	Moderate to high impact (dredging for maintaining LAD)	Moderate impact (dredging for maintaining LAD)	None	
26.		Climate Change	High (Flash flooding a major impact during rainfall)	High (Flash flooding a major impact during rainfall)	None	
27.	Cultural Aspects	Archaeologic al / Heritage Sites	Statue of LachitBorphukan (59mt)	None	1) Umanadaghat, (Cultural/ archaeology importance) (2km)	
28.					2) Urvashi Island (archaeology importance) (1.7km)	
29.					3) Kamakhya temple region archaeological importance) (2km)	The Kamakhya temple region is declared as the region of
30.					(3a) Figures of Ganesa-2	Archaeolgical importance by
31.					(3b) Siva-Lingas – 12	ASI
33.					Bhairabi – 1 (3d) Miniature	
34.					Sikhara Shrines – 4 (3e) Figures of	
35.					ʻNarakasur' – 1 (3f) Two-handed	
36.					'Bhairabi' – 1 (3g) Stone gateway	
37.					(3h) Dancing Bhairava (locally known as Bala- bhairava) engraved on rock – 1	

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Sr. No.	Valuable Environmental Components	0 to 100 mt buffer	100 to 300 mt buffer	300 mt to 10 km buffer	Remarks
38.				5) Rock Cut Structures Shukreshwar Temple (archaeological importance) (1.1km)	
39.				6) Aswaklanta Temple (cultural importance) (1.3km)	

## 3.4.3 Identification of Indicators to Assess Conditions of VECs – AphalamukhGhat



Figure 3-7: VECs in 100 mt radius study area of Aphalamukh Ghat

Figure 3-8: VECs in 300 mt radius study area of Aphalamukh Ghat



Figure 3-9: VECs in 10 km radius study area of Aphalamukh Ghat



Table 3-4: Indicators of VECs – Aphalamukh Ghat

Sr.	. Valuable Environmental		0 to 100 mt buffer	100 to 300 mt	300 mt to 10 km	Remarks
1	Physical	Urban Centres	No major urban	None	Maiuli Habitation	
1.	Features	orban ochirco	centres			
2.	Habitats	Agglomerations	Loss of structures (9 residential cum commercial establishments)			
3.			Loss of livelihood (9 employees in shops/ agricultural labours/ sharecroppers)			
4.		Land	Commercial	None	Road	
5.		Resources	Parking		Habitation	
6.			Soil Erosion		Commercial	
7.					Tourists Resorts	
8.		River protection work	None	None	Majuli Island (Majuli Cluster of Tourism Properties by Assam Tourism Development)	The details will be collected and will be submitted in the final CIA report.
9.					Nemati Port development by IWAI along with navigation channel from Nemati to Pandu Port (7.9km)	
10.	Ecologic al Profile	Bio Diversity (Forests / Wildlife Sanctuaries / National Parks / Tiger Reserves / Bird Areas)	Aquatic biota may get impacted due to construction activities Majuli Island	Aquatic biota may get impacted due to construction activities Majuli Island	Majuli Island	
11.		Wetlands	None	None	None	
12.		Dolphins			Janjimukh(5km), Salmara(3.3km) and	
13		Migratory Birds	Yes Majuli Island	Yes Maiuli Island	Nimati(9.5km) Majuli Island	
10.		Turtles	Najuli Island	Najuli Islanu	None	
15		Infrastructure	Poor	Poor	Moderate	
	Social		physical infrastructure	physical infrastructure	physical infrastructure	
16.	Infrastru cture	Industrial Corridor	None	None	None	
17.		Power Plants	None	None	None	
18.	Physical Environ mental Profile	Air	Low to Moderate Impact (vessel movement and DG sets on the terminal)	Low Impact (vessel movement and DG sets on the terminal)	None	

Sr. No	Valuable	Environmental	0 to 100 mt buffer	100 to 300 mt	300 mt to 10 km	Remarks
19.		Water	Low to moderate impact (pollution due to oil spills or improper waste disposal)	Low to moderate impact (pollution due to oil spills or improper waste disposal)	None	
20.		Terrestrial Noise	Low to Moderate Impact (vessel movement)	Low Impact (vessel movement)	None	Terrestrial noise impact shall be closer to the ghat area as compared to areas within water
21.		Underwater Noise	Low to Moderate Impact (vessel movement)	Moderate Impact (vessel movement)	Moderate to high Impact (vessel movement)	The vessel movement would lead to underwater noise impact more in areas where there is a higher probability of spotting the dolphins
22.		Sediment	Moderate to high impact (dredging for maintaining LAD)	Moderate impact (dredging for maintaining LAD)	None	
23.		Climate Change	High (Flash flooding a major impact during rainfall)	High (Flash flooding a major impact during rainfall)	None	
24.	Cultural Aspects	Archaeological / Heritage Sites/ areas of cultural importance	Majuli Island (under consideration stage only by UNESCO world heritage site)	Majuli Island (under consideration stage only by UNESCO world heritage site)	Majuli Island (declared UNESCO world heritage site) Satras (cultural importance) 1) GarmurSatra (1.6km) 2) BhogpurSatra (1.3km) 3) KamalabariSatra (1.3km) 4) DakhinpatSatra (3km) 5) AuniatSatra (17km) 6) BengenaAtiPuron iSatra (25km) 7) Sri SriElengiLetugra mBorSatra (13km) 8) ModerguriSatra	

AIWTP - Cumulative Impact Assessment Report (Phase-I) 2019

Sr. No.	Valuable Environmental Components	0 to 100 mt buffer	100 to 300 mt buffer	300 mt to 10 km buffer	Remarks
No.	Components		buffer	buffer (13km) 9) Mokha&Samaguri Satra (6km)	

#### 3.5 Identification of Hotspots

On the basis of the identified VECs, spatial analysis, Baseline conditions, literature review and study of the EIA& SIA Reports of the Ghat Areas, hotspots are identified. Hotspots are defined as the zones which have potential for expansion and can accommodate the developmental pressure. These hotspots are identified based on primary study. These will be further enhanced after addition of input from stakeholder consultation and baseline study of theVECs. From the primary desktop study, it is obvious that these areas are significantly going to be impacted and this has helped focusing on these areas while carrying out stakeholder consultation. Hotspots identified are given in **Table 3.5** below.

#### Table 3-5: Identified Major Hotspots

Sr. No.	Project Ghat	VECs identified to be impacted majorly	Hotspots based on VECs	Reason for declaring hotspots
1.	Guwahati Gateway Ghatand North Guwahati	Air Quality	<ol> <li>Guwahati Metropolitan city</li> <li>Pandu Port (maintenance of vessels shall lead to water and noise pollution)</li> <li>Upcoming Ropeway (reduction in distribution of passengers)</li> <li>Access Road Development</li> <li>Guwahati- North Guwahati Bridge is the major upcoming project within 300 m w.r.t project site connecting Pan bazar to North Guwahati by PWD</li> <li>Proposed elevated road along the River from End point of Guwahati- North Guwahati Bridge to Kachari Ghat over the River Brahmaputra by PWD</li> <li>Brahmaputra River Front</li> </ol>	Increment of traffic movement due to terminal development may lead to incremental air pollution levels The construction activities at proposed site may lead to incremental air pollution.

Sr. No.	Project Ghat	VECs identified to be impacted majorly	Hotspots based on VECs	Reason for declaring hotspots
			Development Project by Guwahati Smart City Limited	
2.		Water Resources & Water Quality	<ol> <li>Guwahati Metropolitan city</li> <li>Pandu Port (maintenance of vessels shall lead to water and noise pollution)</li> <li>Upcoming Ropeway (reduction in distribution of passengers)</li> <li>Proposed Navigation development from Neamati Port to Pandu Port by IWAI</li> </ol>	<ol> <li>Population ingress due to improvement in inland transportation and improper handling of waste at terminal and on board may lead to water pollution.</li> <li>Oil spill may be considered as a source of water contamination.</li> </ol>
3.		Under Water Noise levels	Dolphin locations Dredging Locations	<ol> <li>Maintenance dredging will cause impacts on environment</li> <li>Ferry movement in water channels may lead to underwater noise pollution</li> </ol>
4.		Ecology	Dolphin locations Dredging Locations	1) Vessel movement may lead to accidents related to dolphins
5.		Social	Employment opportunity	1) Increment in employment due to infrastructure and terminal development
6.		Tourism	1)UmanandaTemple2)UrvashiIsland3) Majuli Island	Improvement in tourism due to development in transportation facilities
7.		Land use	Guwahati Metro City	Guwahati has scope for future development as smart city and could also be impacted, though located within distance from 300 mt to 10 kms boundary of Guwahati Gateway Ghat
			Proposed Ropeway	Development proposals in the region.
8.			Pandu Port	Potential for expansion and development of port for maintenance facilities
1.	AphalamukhGhat	Air Quality	<ol> <li>Satras</li> <li>Nemati port development by IWAI (proposed)</li> <li>Access Road Development</li> </ol>	Increment of traffic movement due to terminal development may lead to incremental air pollution levels
2.		Water Resources & Water Quality	1)Satras 2) Nemati port development by IWAI (proposed)	water pollution due to improper handling of waste generated on board and oil spill

Sr. No.	Project Ghat	VECs identified to be impacted majorly	Hotspots based on VECs	Reason for declaring hotspots
3.		Under Water Noise levels	Dolphin locations Dredging Locations	<ol> <li>Maintenance dredging will cause impacts on environment</li> <li>Ferry movement in water channels may lead to underwater noise pollution</li> </ol>
4.		Ecology	Dolphin locations Dredging Locations	1) Vessel movement may lead to accidents related to dolphins
5.		Social	Employment opportunity	1) Increment in employment due to infrastructure and terminal development
6.		Tourism	Majuli Island	Majuli Island (Majuli Cluster of Tourism Properties by Assam Tourism Development)

## 3.6 Conclusion

Delineation of CIA boundaries has been carried out along with identification of VECs, their current status and hotspots in the proposed Ghat study area. These VECs are the ultimate recipient of impacts because they tend to be at the ends of ecological pathways. Therefore, these VECs may be directly or indirectly affected by a specific development or by the cumulative effects of several developments. Therefore, it is essential to carry out the stakeholder's consultations (a kind of collaborative judgement) considering other proposed developmental work within the CIA boundary. This will give insight into type and extent of impacts and after finalization of hotspots, further baseline assessments of the VECs can be done.

## Chapter 4 : Stakeholder's Consultation, Other DevelopmentalProjects and Finalization of VECs

## 4.1 Introduction

Collaborative judgement methods build on individual planning judgement by incorporating input from other people knowledgeable of the study area to inform conclusions about future land use and developments in the study area. Literature cites that this approach offers a robust way of incorporating multiple viewpoints into the impact assessment process. Further, this approach can beused in combination with other methods. The current study has used the outcome of GIS based mapping to confirm, validate and identify additional hotspots and VEC in the study area through collaborative judgement. We also considered the feedback received during the consultation process to address issues raised through changes to project design, proposed mitigation measures, or development benefits and opportunities. The basis, strategyand the steps used for consultations have been described below.

## 4.2 Basis and Strategy of Stakeholder's Selection

Stakeholders are defined as any individual, agency or organization that may directly or indirectly be impacted by the project. Stakeholder consultations can add valuable input to the study by providing the actual information of the site. Idea behind the stakeholder consultation for this project is to identify the major existing, proposed, planned and anticipated developments in the study area, whichin future will interact and will result into cumulative impacts.

Stakeholders are selected with the help of expert's advice and discussion with AIWTDS which are well covered in EIA report. As per discussion with AIWTDS& experts, stakeholders which will be directly & indirectly impacted due to the proposed development are identified.

## 4.3 Stakeholder Consultation Stages

As per the World Bank Mandate, the stakeholder's consultation is to be conducted at various stages of the project viz., at screening, scoping stage, EMF stage, Draft EIA stage. Consultations with the key stakeholders will be carried out throughout the Project life. These include consultations and liaison with communities and other stakeholders during the construction phase and extensive consultations with the grass-root as well as institutional stakeholders durina the EIA studies. The consultation framework for the project is presented in Table 4-1.

Stakeholder	Objective/Purpose	Responsibility	Timing
Communities and	Information dissemination;	E&S Cell of	Pre - Construction
other stakeholders	Public relation; confidence building;	AIWTDS & EIA	phase
	awareness about risks and impacts;	Team	
	minimizing conflicts and frictions.		
	Sharing EIA TOR	E&S Cell of	During scoping stage of
Communities and		AIWTDS and	EIA
other stakeholders		EIA team	
	Sharing of EMF	E&S Cell of	During EMF Stage
		AIWTDS and	
		EIA team	
	Dissemination of	E&S Cell of	During EIA study
	information on project and its key	AIWTDS and	(once draft EIA is
	impacts and proposed mitigation	EIA team	available)
	measures; soliciting views, comments,		
	concerns, and recommendations of		

#### Table 4-1: Consultation Framework

Stakeholder	Objective/Purpose	Responsibility	Timing
	stakeholders		
Communities and	Awareness about risks and impacts;	E&S Cell,	Construction
other stakeholders	minimizing conflicts.	AIWTDS;	phase
		Contractors	
Consultations with	Liaison with communities and project	E&S Cell of	Operational phase
communities	beneficiaries	AIWTDS	

## 4.4 Identification of Stakeholders

Stakeholder consultations encompass all major activities concerning the project vis-à-vis environmental issues. At initial stage, the stakeholders are identified for consultation. Inland waterway commuters, residents of living on the bank of the Brahmaputra river and around the jetty location, are the prime stakeholders. They are actively or passively influenced by the jetty vis-à-vis IWT. Ferry operators, Fishermen, local amenity service providers, commercial establishmentsarealso important stakeholders. Non-Government Organisations working in the field of Social and Environmental management contribute significantly in the consultation process. State WRD, Assam is a major stakeholder since all the Ghats are exposed to floods and erosion. Other concerned Govt. Departments play important role in providing secondary data/information.

Community Consultations were done to assess stakeholders' interest and support for the project; and to ensure their ideas and opinion are considered during the project preparation. Such consultations during the project preparation will help to minimize the risks and improve effective and inclusive engagement with the project affected parties throughout the project life cycle. Such consultations will ensure that appropriate project information is disclosed to stakeholders in a timely, understandable, accessible and appropriate manner.

The public directly affected from the commencement of the project have also been consulted. The public consultations have been done with the individuals belonging to PAPs and PAFs.

#### 4.4.1 Public Consultation Report

All the stakeholders and community correspondents appreciated the project. The concerns of the consultation participants were mainly focused on improvement and extension of terminals, safety and security of passengers, impact on livelihood, dredging and environmental issues including management of dredged materials. The summary of points discussed in these consultation meetings.

Stakeholders Type	Concerned raised	Responses and mitigation measures
Shopkeepers	<ul> <li>Shopkeepers opined in favour of the project, but they want that the launch Ghat are improved with more facilities such as toilets, sufficient space for shops, parking, sitting area</li> <li>They expressed that the project will increase their business opportunities and new venture of business will be opening after completion of the project.</li> </ul>	<ul> <li>Toilets and drinking water facilities are included in the design of terminals.</li> <li>The designs of terminals will also include shops/kiosks and while leasing out these shops, priority will be given to the affected communities.</li> </ul>
Physically Challenged People	<ul> <li>There is no special facility for the disabled people in the ferry terminals and vessels.</li> <li>Wheel chair and bed facilities are available only for patients and for emergency situation.</li> <li>There are no doctors permanently on duty. Physically Challenged People persons want</li> </ul>	• The designing of terminals will be addressing the issue.

Table 4-2: Summary of consultation meetings

Stakeholders	Concerned raised	Responses and mitigation measures
Fishermen	<ul> <li>proper safety and security in terminal and ferry. Disabled persons do not know the facilities about river transports.</li> <li>Most of the people think that road transport is easier than river transport especially for the physically challenged persons as they cannot swim. They want separate space/seat for them in the ferry and easy boarding facility such as smooth way, wheel chairs, etc.</li> <li>If such facilities are provided for the physically challenged people, then they may comfortably use the river transport.</li> <li>They want modern signalling system and safety and security during fishing. Some time, they are to face trouble from pirates or some politically influenced persons who force them to pay money for fishing. They welcomed the project but requested to keep in mind about fish moving routes and fishing areas during dredging so that their livelihoods will not be affected.</li> </ul>	<ul> <li>Navigational signals will be provided along the channels.</li> <li>Spawning areas of fish, migratory routes and commercial areas for fishing will be avoided for dredging and dredged material disposal</li> </ul>
Launch and Ferry Workers	<ul> <li>Launch and ferry workers expressed their appreciation of the project.</li> <li>They are concern about dredging and signalling system in the river routes as there were some incidents of collision of vessels. Improved signalling system may prevent such accidents.</li> <li>They want sufficient Personal Protective Equipment (PPE) for their safety in the launch and other water vessels. PPE can also be available for the passengers</li> </ul>	<ul> <li>Safety signal system are included in the project planning. Navigation routes will be scientifically decided and monitored</li> <li>PPEs will be provided</li> <li>Ferry operators mainly focused on the limitations of the existing facilities and the need for providing better facilities and services. Private ferry operators were apprehensive about losing their job when the project is operational.</li> <li>Labourers were hopeful of getting better employment opportunities and better wages. Labour unions are either absent or not very active to protect their welfare.</li> </ul>
Ferry Users	•	<ul> <li>All stakeholders welcome the project as it will bring better infrastructure and hence better facilities which in turn will contribute to their various requirements related to water transport.</li> <li>Women travellers demanded for enhanced care and security supports to them while travelling.</li> <li>Regular travellers demanded more about approach roads and last mile connectivity issues. Shifting of the Ghats during rainy seasons and lack of facilities are troubling them lot.</li> </ul>

## 4.4.2 Institutional Stakeholder Consultation for Screening and Scoping Report

Institutional stakeholder consultation is conducted on 8<sup>th</sup> October 2018 as per world bank requirement at screening and scoping stage. The major Comments/Suggestions and its reply is tabulated below in **Table No. 4.3**. The summary of Stakeholder Consultation is given below;

Commonts/Suggestions	Pomarks / Ponly
<ul> <li>The presentation is more generalized rather than that of to the point and specific</li> <li>More points should be included in the parameters for screening part because location wise they are vast diversity which had full attention.</li> </ul>	The presentation is prepared for the screening and scoping. The main objective was to receive the comments from participants which can be taken into consideration for EIA studies. During EIA presentation in Public domain all the points will be presented in detail as per qualitative and quantitative analysis as studied.
<ul> <li>When the project implemented the following points are to be addressed</li> <li>Green engineer is to be filled (like solar engine, water jet engine also be a filled with vessels.</li> <li>Bio toilet for pollution free option</li> <li>All ferry services are to be declared as pollution free zone.</li> <li>Community participation.</li> <li>River water protection to be minimized by using Bio disaster safety tank for Human social waste.</li> </ul>	<ul> <li>All the sustainable solutions like green engine, solar light panel installation on the top of the pontoons and static structures at Ghats, STP with zero discharge system, closed fuelling system will be implemented for the pollution free operations at Ghat locations. These are already taken into considerations.</li> <li>Proper solid waste management at Ghat locations will be implemented with community participations.</li> <li>Policy and protocols will be displayed at public domain to follow the conditions during travelling and operations at Ghat Location.</li> </ul>
Safety of water animals	Ecology and biodiversity will be studied in detailed during EIA and locations where most frequently the aquatic fauna like Gangatic Dolphins and tortoise are found will be mapped. Accordingly, the management plan will be prepared which will be strictly followed and implemented during construction and operation phase.
The river banks are prone to erosion in summer. Situation in winter. The river terminal/ Ghats should be designed considering these two aspects. Otherwise people have to suffer, and business will be hampered.	The jetty / pontoons are proposed as floating structures which are as per the seasonal variation and water level fluctuations during dry, wet and winter season of the region. It will mitigate the seasonal relocation of the jetty operation system and throughout the year passengers can take advantage of the ferry.
<ul> <li>Sustainable garbage management.</li> <li>Protect erosion by permanent structure with proper plantation.</li> <li>Pollution management/ control by proper way</li> <li>Protection of river water animals.</li> <li>Protection of both bank erosions with plantation</li> <li>Pollution control of river water.</li> <li>Attention for oil spillage, garbage disposal etc.</li> </ul>	<ul> <li>Eco-friendly Erosion Control measures will be suggested in EIA like Geo-tube embankment, piling up the geo- bags, Geo-textile Embankments etc after feasibility.</li> <li>All the sustainable solutions like green engine, STP with zero discharge system, closed fuelling system will be implemented for the pollution free operations at Ghat locations. These are already taken into considerations.</li> <li>Ecology and biodiversity will be studied in detailed during EIA and locations where most frequently the aquatic fauna like Gangetic Dolphins and tortoise are found will be mapped. Accordingly, the management plan will be prepared which will be strictly followed and implemented during construction and operation phase.</li> <li>Proper solid waste management at Ghat locations will be implemented with community participations.</li> <li>Policy and protocols will be displayed at public domain to follow the conditions during travelling and operations at Ghat Location.</li> <li>Safety aspects will be covered as per the MORPOL, IWAI, EHS Ports protocols.</li> <li>EMP will be prepared</li> </ul>
<ul> <li>What happens to the flora being displaced?</li> <li>0 KM barrier- how will it keep fauna like Dolphin &amp; fish away?</li> <li>In case of an oil spill how prepared is</li> </ul>	<ul> <li>Appropriate protocols and procedures will be prepared for sighting of dolphins and other endangered wildlife species within the vicinity of the dredging site. The objective of the protocols and procedures will be aimed</li> </ul>

Table 4-3: Summary	of Stakeholder	Consultation and its	compliance from	AIWTDS
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Comments/Suggestions	Remarks / Reply
<ul> <li>everyone?</li> <li>Suggestions: An integrated understanding of the endemic species found at the location.</li> </ul>	<ul> <li>at having no or minimal impacts on the respective wildlife species.</li> <li>As per convention, Ships are required to carry a shipboard oil pollution emergency plan. Operators of offshore units under the jurisdiction of Parties are also required to have oil pollution emergency plans or similar arrangements which must be coordinated with national systems for responding promptly and effectively to oil pollution incidents. Ships are required to report incidents of pollution to authorities and the convention details the actions that are then to be taken. The Convention calls for the establishment of stockpiles of oil spill combating equipment, the holding of oil spill combating exercises and the development of detailed plans for dealing with pollution incidents.</li> <li>Parties to the convention are required to provide assistance to others in the event of a pollution emergency and provision is made for the reimbursement of any assistance provided. MARPOL implementation plan will be prepared.</li> </ul>
Methodology of assessment of import on "Aquatic Biodiversity" needs to be properly explained.	<ul> <li>Appropriate protocols and procedures will be prepared for sighting of dolphins and other endangered wildlife species within the vicinity of the dredging site. The objective of the protocols and procedures will be aimed at having no or minimal impacts on the respective wildlife species</li> </ul>
Implantation of MARPOL Annexure I to VI	MARPOL implementation plan will be prepared and will be incorporated in safety aspect of FIA report
<ul> <li>The Baseline survey regarding the environment may kindly be provided.</li> <li>The EIA must come up with clear comments on how to go for preparation of EMP</li> <li>Water quality issues were the terminal.</li> <li>Sourcing of construction materials from nearby areas (of Ghats) are of concern. Thus, alternative arrangements must be suggested.</li> </ul>	<ul> <li>is covered in EIA in Baseline Environmental assessment for one season.</li> <li>Full EMP with implementation plan and responsibility matrix with costing is prepared and incorporated in EIA report.</li> <li>Water quality issues at the terminal will be addressed and mitigation plan will be prepared.</li> <li>Noted. Construction material management plan will be prepared and added in Alternative assessment chapter under construction technology.</li> </ul>
<ul> <li>What are the parameters you have studied in water quality analysis?</li> <li>How you address the problem</li> <li>What are the parameters you have studied in air quality parameter?</li> <li>Do you study the flood?</li> <li>How many samples you have studied for each location</li> </ul>	<ul> <li>Parameters for air and water quality studied are as per TOR given by World Bank.</li> <li>We will carry out qualitative and quantitative baseline and impact assessment for all parameters and accordingly suggest mitigation measures.</li> <li>Environmental modelling will be carried to assess the incremental pollution load in air and noise levels.</li> <li>Flood management is already covered in the EIA scope.</li> </ul>
<ul> <li>Is the analysis of alternative was done during environmental screening exercise?</li> <li>Then what is the criteria matrix.</li> <li>How will be river ecosystem affect if the ferry.</li> </ul>	River ecosystem will be studied during EIA and
<ul> <li>How will be river ecosystem affect in the ferry will start?</li> <li>How new ferries will lead to sustainable development?</li> <li>This project might affect upon river ecosystem will be disrupted by this project what will be the measures regarding this?</li> </ul>	<ul> <li>addressed in the impact assessment chapter.</li> <li>Environmental modelling will be carried to assess the incremental pollution load in air and noise levels.</li> <li>MARPOL implementation plan will be prepared and will be incorporated in safety aspect of EIA report.</li> </ul>

O anno an ta lOs anno ati an a	Dementer / Demte	
Comments/Suggestions	Remarks / Reply	
<ul> <li>If the number of ferry Ghats increase. So, river water bodies will be polluted by the oil spillage. How are you looking after this? What will be the measures?</li> <li>Ferries can be the cause of Shoreline erosion.</li> <li>How is the increased no. of ferries going to affect the river ecosystem, as well as the surrounding areas (near the Ghats)</li> <li>Environment becomes the home of Biotic and Abiotic species. So, my comment is that if inland water transports will cheapest sources of transportation but if we see in other side. It will be the sources of pollution to the water which is the basic sources of living for both. So, my comment is that how we can control the polluting of the water.</li> </ul>	<ul> <li>As per convention, sings are required to carry a shipboard oil pollution emergency plan. Operators of offshore units under the jurisdiction of Parties are also required to have oil pollution emergency plans or similar arrangements which must be coordinated with national systems for responding promptly and effectively to oil pollution incidents. Ships are required to report incidents of pollution to authorities and the convention details the actions that are then to be taken. The Convention calls for the establishment of stockpiles of oil spill combating equipment, the holding of oil spill combating exercises and the development of detailed plans for dealing with pollution incidents</li> <li>Erosion control plans will be prepared and implemented after technical feasibility</li> </ul>	
<ul> <li>IWTD may operate hybrid vessels to minimize water pollution</li> </ul>	This will be definitely taken into consideration while vessel design proposals	
• Hybrid- Electric + Solar Diesel + Electric		
• They may seek for Govt. assistance (found central+ state as these version scheme and		
Govt.) to provide fund to control pollution.		

It can be noted from the above discussion and recommendations that the stakeholders shown their concern for aquatic biology especially towards Dolphin conservation which is IUCN recognized endangered species. Also, the water quality disturbance due to oil spillage is a sensitive issue. All the issues are taken into consideration during detailed EIA study and complied with best mitigation measures.

#### 4.4.3 Public Consultation in EMFStage

Stakeholder consultations were conducted on 4<sup>th</sup>February 2019 in Guwahati Circuit house and at Aphalamukh Gram Panchayat Office on 7th, February 2019. Findings from EMF study and TOR were discussed in the forum. Important Comments/Suggestions made during Public consultation at Guwahati and Dibrugarh are presented in **Table 4.4** and **Table 4.5**respectively

Table 4-4: Summary of Stakeholder Consultation (EMF Stage), Guwhati

Comments/Suggestions	Remarks / Reply
<ul> <li>Energy saving practices should be implemented</li> <li>Detailed EMP and costing should be prepared</li> <li>EMP should be implemented and monitored during construction and operation stage</li> <li>STP should be installed and monitored on Terminals for its operations</li> <li>Solar energy should be thought of at terminals</li> <li>Night navigation should be improved</li> <li>All the environmental concerns should be considered in design of terminals by DPR consultants</li> <li>Training requirements should be considered in EMF</li> </ul>	<ul> <li>All the sustainable solutions like green engine, solar light panel shall be installed</li> <li>Proper solid waste management at Ghat locations will be implemented with community participations.</li> <li>Mechanism for review and monitoring of implementation of EMP will be established</li> <li>Night navigation improvement is already considered by PP in the project</li> <li>Training requirements are already considered at different stages of the project.</li> <li>All the identified environmental issues will be considered during design of terminals and vessels</li> </ul>

C	omments/Suggestions	Remarks / Reply
•	Day to day ferry service should be	<ul> <li>Noted and will taken care of</li> </ul>
	introduced	• Night navigation is already considered in the
٠	Night Navigation should be improved	proposed project
٠	People have to take Dead Body from Jorhat	• Noted. This should be implemented by the local
	to Majuli. But at present no such facility is	authority.
	available. People have to wait for ferry	• Zero waste disposal is already considered in the
	service to carry dead body. So it is	project terminals
	requested to have facility on ghat for dead	• Employment will be definitely improved in IWT
	bodies.	sector. Also training centres and facilities are
•	waste generation and its management	already considered in the project
	should be taken care of. Zero discharge	• Toilet facilities, bio-septic tanks, solar energy at
	facilities should be implemented.	terminals, etc. are considered in the project
•	Employment can be improved in the IVVI.	design
	suitable and required training should be	
	Toilot facilities along with his sentic tank	
•	which are not available at present should be	
	constructed	
•	Incremental facilities should be considered	
	during design as the passengers have	
	increased in the past few years. As the	
	Majuli is main attraction of tourists, all	
	necessary facilities should be made	
	available on Ghat.	
•	At present no facility like waiting room,	
	toilets, parking is available	

Table 4-5: Summary of Stakeholder Consultation (EMF Stage), Dibrugargh

## 4.5 Identification of Hotspots / Pressure Points Based on Stakeholder Consultations

In the earlier section of **Chapter3**, five major hotspots were identified on the basis of the desktop study and their background supporting accommodation of further developmental pressure. Further information gathered from Stakeholder consultation has added information about the hotspots which have potential to experience developments in future. List of hotspots on basis of the proposed development projects and stakeholder consultations is given in **Table 4.6**.

Sr. No.	Project Ghat	VECs identified to be impacted majorly	Hotspots based on VECs	Reason for declaring hotspots
1.	Guwahati Gateway Ghatand North Guwahati	Air Quality	<ol> <li>Guwahati Metropolitan city</li> <li>Pandu Port (maintenance of vessels shall lead to water and noise pollution)</li> <li>Upcoming Ropeway (reduction in distribution of passengers)</li> <li>Access Road Development</li> <li>North Guwahati Bridge is the upcoming project within 300 m w.r.t project site connecting Pan bazar to North Guwahati.</li> </ol>	Increment of traffic movement due to terminal development may lead to incremental air pollution levels The construction activities at proposed site may lead to incremental air pollution.
2.		Water	1) Guwahati Metropolitan city	1) Population ingress
		Resources &	2) Pandu Port (maintenance of vessels	due to improvement in
		vvaler Quality	shall lead to water and holse pollution)	iniand transportation and

#### Table 4-6: Hotspots Identified as Per Consultation

Sr. No.	Project Ghat	VECs identified to be impacted majorly	Hotspots based on VECs	Reason for declaring hotspots
			<ol> <li>Upcoming Ropeway (reduction in distribution of passengers)</li> <li>Proposed Navigation development from Neamati Port to Pandu Port by IWAI</li> </ol>	<ul> <li>improper handling of waste at terminal and on board may lead to water pollution.</li> <li>2) Oil spill may be considered as a source of water contamination.</li> </ul>
3.		Under Water Noise levels	Dolphin locations Dredging Locations	<ol> <li>Maintenance dredging will cause impacts on environment</li> <li>Ferry movement in water channels may lead to underwater noise pollution</li> </ol>
4.		Ecology	Dolphin locations Dredging Locations	<ol> <li>Vessel movement may lead to accidents related to dolphins</li> </ol>
5.		Social	Employment opportunity	1) Increment in employment due to infrastructure and terminal development
6.		Tourism	1)UmanandaTemple2)UrvashiIsland3) Majuli Island	Improvement in tourism due to development in transportation facilities
7.		Landuse	Guwahati Metro City	Guwahati has scope for future development as smart city and could also be considered to be impacted, though located within distance from 300 mt to 10 kms boundary of Guwahati Gateway Ghat has interaction of various proposed development activities like river front development and proposed Guwahati- North Guwahati Bridge
8.			Proposed Ropeway Pandu Port	in the region. Potential for expansion
				and development of port for maintenance facilities
7.	AphalamukhGhat	Air Quality	<ol> <li>Satras</li> <li>Neamati port development by IWAI (proposed)</li> <li>Access Road Development</li> </ol>	Increment of traffic movement due to terminal development may lead to incremental air pollution levels
8.		Water Resources & Water Quality	<ol> <li>Satras</li> <li>Neamati port development by IWAI (proposed)</li> </ol>	water pollution due to improper handling of waste generated on board and oil spill

Sr. No.	Project Ghat	VECs identified to be impacted majorly	Hotspots based on VECs	Reason for declaring hotspots
9.	9.	Under Water Noise levels	Dolphin locations Dredging Locations	<ol> <li>Maintenance dredging will cause impacts on environment</li> <li>Ferry movement in water channels may lead to underwater noise pollution</li> </ol>
10.		Ecology	Dolphin locations Dredging Locations	1) Vessel movement may lead to accidents related to dolphins
11.		Social	Employment opportunity	1) Increment in employment due to infrastructure and terminal development
12.		Tourism	Majuli Island	Majuli Island (Majuli Cluster of Tourism Properties by Assam Tourism Development)

## 4.6 Conclusions

The impacts were identified and verified with consultations among stakeholders like other Government Departments responsible for non-AIWTP activities, local pressure groups, and others. Additional mitigation measures identified are being now refined through feedback from other authorities with whom coordination is being undertaken through the project governing council, and informal meetings. Monitoring mechanism is being finalized based on the feedback from such meetings.

The outcome of stakeholder consultations not only confirmed the identified VECs but also indicated their anticipated change as well perception about cumulative social & environmental impacts. The hotspots identified in the Chapter -3 are further strengthened with the help of stakeholder's consultation at various districts along the alignment. In EIA, thebaseline of the identified VECs are discussed. On the basis, the impact assessment study is carried out in further chapters.

## Chapter 5 : Cumulative Impact Assessment, Mitigation Measures, Management Plan and Environmental Monitoring Programme for the upcoming / proposed development projects

## 5.1 Introduction

Cumulative impacts are those that result from the successive, incremental, and/or combined effects of an action, project, or activity (collectively referred to in this document as "developments") when added to other existing, planned, and/or reasonably anticipated future ones. For practical reasons, the identification and management of cumulative impacts are limited to those effects generally recognized as important on the basis of scientific concerns and/or concerns of affected communities. Multiple and successive environmental and social impacts from existing developments, combined with the potential incremental impacts resulting from proposed and/or anticipated future developments, may result in significant cumulative impacts that would not be expected in the case of stand-alone development.

In this case, cumulative impacts occur because a series of projects of the same type and correlated to each other are being developed; for example, when several development projects are planned or constructed surrounding the proposed Ghat locations or within the same area, when multiple projects and waterways projects are developed in close proximity, or when a number of Infra projects are planned within the same region.

## 5.2 Finalization of Hotspots for Cumulative Impact Assessment

CIA study for Proposed Project includes quantitative and qualitative assessment of the impacts which will be cumulatively caused by the existing development, Proposed Project development, other proposed / planned developments and anticipated developments. Zones for which cumulative assessment will be carried out are identified as hotspots on the basis of outputs of desktop study, baseline study and stakeholder consultation.

Sr. No.	Project Ghat	VECs identified to be impacted majorly	Hotspots based on VECs
1.	Guwahati Gateway Ghatand North Guwahati	Air Quality	<ul> <li>Project activity</li> <li>Brahmaputra River Front Development Project by Guwahati Smart City Limited within within 300m is another upcoming project</li> <li>Pandu Port (maintenance of vessels shall lead to water and noise pollution)</li> <li>Upcoming Ropeway (reduction in distribution of passengers)</li> <li>Proposed Navigation development from Neamati Port to Pandu Port by IWAI</li> <li>Access Road Development</li> <li>North Guwahati Bridge is the major upcoming project within 300 m w.r.t project site connecting Guwahati city to North Guwahati.</li> </ul>
2.		Water Resources & Water Quality	<ul> <li>Brahmaputra River Front Development Project by Guwahati Smart City</li> <li>Pandu Port (maintenance of vessels shall lead to water and noise pollution)</li> <li>Upcoming Ropeway (reduction in distribution of passengers)</li> </ul>
3.		Under Water Noise levels	<ul><li>Dolphin locations</li><li>Dredging Locations</li></ul>

#### Table 5-1: Finalized VECs and Hotspots Selected for CIA Study

Sr	Project Ghat	VFCs identified	Hotspots based on VECs		
No.		to be impacted			
		majorly			
4.		Ecology	Dolphin locations		
			Dredging Locations		
			Dumping of dredged material		
5.		Social	Loss of Structures on Ghat		
6.		Tourism	Umananda Temple		
			Ashwakalanta Temple		
7.		Landuse	Guwahati Smart City River Front Development Project		
8.			Proposed Ropeway		
			Pandu Port		
			Access Road Development		
1.	AphalamukhGhat	Air Quality	Project Activity		
			Satras		
			Neamati port development by IWAI (proposed)		
			Access Road Development		
2.		Water Resources	Satras		
		& Water Quality	Neamati port development by IWAI (proposed)		
3.		Under Water	Dolphin locations		
		Noise levels	Dredging Locations		
4.		Ecology	Dolphin locations		
			Dredging Locations		
			Dumping of dredged material		
5.		Social	Loss of Structures on Ghat		
6.		Tourism	Tourism Development Project of GoA in Majuli Island		
7.		Landuse	<ul> <li>Neamati port development by IWAI (proposed)</li> </ul>		
			<ul> <li>Access Road Development</li> </ul>		

## 5.3 Impact Identification on Dolphinsas Hotspot

The Ganges River Dolphin (Platanistagangeticagangetica) is found in most of the areas of the Brahmaputra river system in Assam. This species is categorized as Endangered by the International Union for Conservation of Nature (IUCN) Red List (2010) with the wild populations decreasing drastically within the range countries. These dolphins share the same ranks as the tigers and great apes that are listed as a species endangered by trade on Appendix I of Convention on International Trade of Endangered Species of Flora & Fauna (CITES).

Ganges River dolphins are generally concentrated in counter-current pools below channel convergences and sharp meanders (Kasuya and Haque 1972, Smith 1993, Smith et al. 1998)and above and below mid- channel Islands, bridge pilings, and other engineering structures that cause scouring. Dolphins could potentially be negatively affected by dumping in the scour holes because scour holes are used as a refuge by the dolphins and other aquatic animals during dry season when water levels are low in the rivers. Their fidelity to countercurrent pools is probably greatest in fast-flowing channels (Smith et al. 1998). Isolation in seasonal lakes sometimes occurs (especially in the Brahmaputra basin), asdoes "escapement" from the river channels into artificial water bodies such as canals and reservoirs.

Water abstraction upstream decrease river depth and the appearance of sand bars during winter season cause danger to the dolphins as the river is divided into small segments, causing a segregation of populations in deeper pools, narrowing of the gene pool, increase in the intensity of fishing, river traffic, pollution due to release of untreated effluents from industries, incidental and/or intentional capturing for oil extraction for use as fish attractant, liniment and aphrodisiac, etc., have become the major threats for its survival.

The significance of water depth as an important factor for determining the distribution pattern and habitat selection of marine dolphins is well documented (Ross et al. 1987, Hastie et al. 2005). It is perceived that the same applies for the Ganges River dolphin. Earlier studies in the Brahmaputra in India indicated certain depth range preferences of the Ganges River dolphin between 8 and 10 meters (Mohan et al. 1997); however in a recent study Wakid(2009) showed that the preferred water depth for the dolphins is between 4.1 - 6 meters for the same river. This variation may be due to the physical changes in sedimentation that mighthave happened over the years and other anthropogenic reasons for reduced water flowing the Brahmaputra River.

Seasonality, food availability and environmental conditions of the water are the main factors of the Ganges River dolphin for its habitat use/preference (Hussain et al. 2011). Optimum water depth preferred by the Ganges River dolphin throughout the year is mostly available in sections where scours in the river exist. Secondly, most river fishes occur or should have occurred in the scours of the rivers during the winter and summer months (Hussain 2010). The dolphins feed on fishes hence distribution, composition and abundance of their prey may also play an important role in the distribution and abundance of dolphins and consequently habitat utilization.

#### 5.3.1 Background and Trends

A detail dolphin study was conducted during the dry season 2019. The findings of the study are given in **Table 5.1**.

SI. No.	Route Name	Longitude	Latitude	Nos. of Dolphin Sighted
1	Neamati to KamalabariGhat	94.23043	26.86408	7
2	Neamati to AphalamukhGhat (Spotted near AphalamukhGhat)	94.29839	26.91219	4
3	Guwahati Gateway Ghatto UmanandaGhat (Spotted near UmanandaGhat)	91.74617	26.19768	4

Table 5-2: Dolphins Status Around Project Sites

It may be seen from the above table that the dolphinswerespotted in GGG and North Guwahati ghatfalls under the route Guwahati Gateway Ghatto Umanandaghat, where 04 numbers of dolphins were sighted near Umanandaghat. However, dolphins were not spotted near GGG and North Guwahati Ghat. The presence of dolphins in GGG and North Guwahati Ghat cannot be ruled out because of their constant movement. Similarly, 04 numbers of dolphins were spotted near Aphalamukhghat under Neamati-Aphalamukh route.

#### 5.3.2 Secondary Data on Dolphin presence around project sites:

Secondary data on presence of dolphin in Brahmaputra were collected from earlier study. Data with respect to project sites Guwahati and Aphalamukh are presented in **Table 5.2**.

Table 5-3: Secondary	/ Data	on	Dolp	hin	presence	around	project sites	

SI. No		Dolphin	Location of sighted		Dol	phin No	
	Ghats	Occurrence	area	Calf	Sub-adult	Adult	Total
1.	Guwahati	Yes	N26011/239//; E 91044/365	-	-	1	1
			N26010/981//; E 91044/175//	-	1	2	3
			N26010/610//; E 91042/587//	-	1	2	3
			N26010/699//; E 91041/066/	-	-	3	3
2.	Aphalamukh	No	-	-	-	-	
3.	Neamati	Yes	N26051/841//; E 94014/656//	-	1	2	3

Source: Conservation of Gangetic dolphin in Brahmaputra river system, India, Dr. Abdul Wakid, 2004

It may be seen from **Table 5.2** that dolphins have been sighted in the study area of Guwahati. No dolphin was sighted at Aphalamukh area. However, dolphins have been spotted during the recent survey conducted for this EIA study. It may be concluded that presence of dolphin in three project sites are confirmed. Dolphin sighting depends on many factors such as river condition, availability of food, water depth etc.

#### 5.3.3 Impacts on Dolphins

Based on the outcome of primary survey and secondary information, it has been established that dolphins are spotted at the project sites. As dolphins are present in whole of Brahmaputra river, their movement and surfacing behaviour for breathing are reported in specific areas. Dolphins are reported at the sites where fishes are maximum available at the confluence sites and where counter current exists, which make them easier to catch prey. Dolphins prefer to stay where water depth is more with counter current.

Accidental killing of dolphin in the form of by-catch in net fishing is one of the main threats for dolphins in the rivers. It was reported that accidental killing of dolphins in the project and surrounding areas through getting trapped or entangled in fishing nets were higher in the past but reported less during the survey period. Other threats for dolphins in the rivers included oil spill from boats and ships, river erosion, low water depth during winter, use of harmful fishing gears (especially current net) and making cross dam of bamboos across some sections of the rivers/tributaries/distributaries for fishing. As reported by local people, the practice of intentionally trapping and/or killing of dolphins in the rivers for commercial reasons is gradually gaining momentum for oil extraction. Remains of the dolphin body, particularly the head, are used in the brush pile fishery – certain sections of the river close to the banks is fenced using bamboos and piles of tree branches are used to provide a temporary refuge for the fish during the dry season when water level gets low. During dry season the fenced area is netted and fishes are caught. By putting the remains of the dolphin body and head together with the tree branches fishes are attracted by the smell as they decompose.

Very little is known about the effects of vessel traffic on river dolphins and porpoises. Ferry crossings, commercial ports, and primary fishing grounds in rivers are generally located downstream of convergent channels or sharp meanders, which are also the preferred habitat of river dolphins. River dolphins are often observed swimming in areas with high vessel traffic, that includes small boats, motorized ferries.

Dolphins may be more vulnerable to collisions during calving and nursing periods. The direct risks associated with the current project dolphin and dolphin habitat include: (a)generation of underwater noise levels from the dredging equipment; (b) impacts on dolphin habitat due to disposal of dredged material in scour holes and (c) Dolphin being an endangered species found exclusively in Brahmaputra region may be one of the tourism interests for sightseers and visitors, as such there could be accidents caused due to activities like feeding the fishes and non-maintenance of ferry speed at dolphin hotspots.

**With respect to (a):** For dolphins, sound serves three main functions: (i) it provides information about their environment, (ii) it is used for communication and (iii) it enables the remote detection of prey. The sounds generated by dolphins often extend beyond the range audible to the human ear. Vocalizations of Dolphins will be in range of 125-173 (dB at 1m) for whistles and 218-228 (dB at 1m) for clicks. Underwater noise levels generated by dredging activities are expected below 175 dB. The threshold peak impulse source pressure for direct physical trauma in aquatic mammals is generally considered to be more than 200dB and hence dolphins would not be expected to experience permanent hearing impairment from sound pressures generated by the dredging. However, effects on behavior are more likely. Behavioural studies conducted elsewhere on the impact of similar activities like piledriving on dolphin indicated a temporary displacement from the area where pile drivers are operating and they

returned close to normal once pile driving had ceased. Whilst for fish,adversebehavioural aspects occur at a noise level of 150 dB and physical injury may occur at206 dB. The indirect impacts on the dolphin from dredging activities would be impact on its prey, the fish.

With respect to (b), this impact can be effectively minimized by prohibiting deposition of dredged material in deep scour holes (greater than 5m depth), which are the preferred habitatfordolphins.Only shallower scour holes will be permitted for use by contractors for depositing dredged material in river.

With respect to (c), proper signage indicating the presence of dolphins along with information and instructions regarding the same should be mentioned at the hotspots. The Assam tourism department should also include these hotspots in their schedules so that the tourists and visitors could be educated about the enriched biodiversity of the area.

#### 5.3.4 Impacts at Dredging Sites

If the slope is upward, the tertiary consumer may easily reach the secondary and primary consumer which may bring about a reduction in their number as the zonation is not maintained properly. Habitat changing pattern due to this intervention may prove as a risk. Along with this, if the dredged sites are breeding ground for any unknown or unidentified species, the whole system can be collapsed as well. It will change the species composition of the water area and the fishermen depended on the fishes will not be able to catch them frequently and gradual effect on livelihood may be experienced.

Due to such potential impacts, which might be unavoidable in the locations of required dredging, the project will support a biodiversity conservation program which aims to contribute towards enhancing the management of dolphins and improve the aquatic ecosystem environment for key species. On the other hand, if a fish population is aware of the new way that has been created by dredging; they may use it in the consecutive years for both migration and feeding. Some dredging sites create artificial scour that can also be used as habitat and hiding place for fishes. Nutrient cycling is another key objective that can be taken under consideration as positive impact.

#### 5.3.5 Change in trench and Scour

Trench and scour are shallow or narrow depression or ditches that are used by many riverine and floodplain fishes for multidimensional purposes. Destruction of these specific sites may be proved as habitat alteration and unwanted movement of fishes. It possibly will change the food and feeding behavior of fishes due to unavailability of proper nutritional elements around the new living grounds. Fish catch prototype will change as well as the living of the local fish depended people will be hampered, which needs a very good insight.

#### 5.3.6 Change in water Velocity

Change in water velocity is another impact that can occur at the dredging spots leaving the biodiversity interrupted. High water velocity results in turbidity in the riverbed. Some fishes don't like too much velocity and some are very akin to the same. As the width of the river is not going to expand during this project implementation period (except natural river bank erosion), this possible impact is negligible.

#### 5.3.7 Other external factors

Navigational vibration is sometime horrifying to brood and juveniles of surface water. Oil spillage causes plankton destruction and bio-safety of natural riverine water. This very situation creates obstruction in food chain mainly in primary and secondary consumer level.

#### 5.3.8 Cumulative Effects

In Brahmaputra River the long term mean sediment transport is believed to increase through Assam from 250 million metric tons per year at the eastern end to 500 million metric tons per year at the western end. Out of which one third is deposited in river bed consequently decreased river depth over time. The shallow depth of river increased the frequency of the flooding on the banks of the rivers and decreased fish population. Number and type of fish species are also decreasing over time as few species require depth on the river to breed. The proposed maintenance dredging activity under Assam IWT project and other future projects will not restore the type of species significantly due to very less restoration of the original depth of the Brahmaputra river.

However, the proposed project will improve and maintain navigation channels and land reclamation that will have some impacts on the aquatic biodiversity. Dredging activities will disturb the Dolphins, benthic habitat and the bottom fish feeders that depend on the benthic habitat. The sediments generated from the dredging activity will affect the water quality and in turn the quality of the entire river habitat. The water quality of the river will also be affected due to risk of oil spills from the vessels and disposal of waste water in unscientific way from terminals / maintenance ghats. Incremental load of vessels from upgradation of project and also development of IWAI Neamati Port may increase the risk of collision of dolphins with the vessels and ships. Underwater noise generated due to the heavy ship movements from Neamati Port, Vessel navigation,maintenance dredging may impact the dolphins.

The cumulative impacts associated with various activities in the watershed include risk ofwater pollution from accidental spillage of fuels, hazardous material and bilge water from the various types of vessels used in the river for various purposes, and risk of collision of dolphins with vessels. Motor boats will be extensively used for transport of personnel, material and fuel. There is a risk of water pollution from these activities through accidental spillage of fuels, hazardous material and bilge water. Any such pollution events will seriously impact the downstream dolphin and fish habitat. Further, there is a risk collision between dolphins and motor boats.

#### 5.3.9 Mitigation Measures

The impacts on the dolphin from the project activities can be minimized the contractor by taking utmost care to prevent such risks and will prepare an emergency preparedness plan to address these risks. The contractor will make booms, absorbents and skimmers available onsite along with trained personnel to recover spilled oils from water surface. The contractor shall include training in the use of this equipment within his training plan and carryout regular drills in the deployment of this equipment. All waterborne plant shall be regularlyserviced per the manufaturer's guidelines and inspected daily prior to operation.

Dredging work will adopt soft start; using low energy start to the piling operations to give dolphins an opportunity to leave the area, gradually ramp up the sound levels to scare the dolphins and other cetaceans away before dredging commences. Contractor will also use Accousitc Harassment Device<sup>3</sup> to chase away dolphins from the construction areas. Given that monsoon period with in the dolphins main calving period, which is July to August, the impacts on dolphins during this critical period will naturally be minimized, since little dredging is expected to be required during monsoon months. In addition, Pingers, set at 145dB at 70kHz, may be used to drive away the dolphins, if necessary. During the dredging activities under the current component, the contractor shall be prohibited from bailing or pumping this water into the river, but instead shall be required to collect the bilge water, treat

<sup>&</sup>lt;sup>3</sup> Acoustic harassment and acoustic deterrents are technologies used to keep animals and in some cases humans away from an area. Applications of the technology are used to keep marine mammals away from aquaculture facilities and to keep birds away from certain areas

it by separation and dispose of the separated oil and fuel as hazardous waste. Refueling of dredgers and boats will be properly carried out to avoid any spills.

#### **Recommendations:**

- Proper Soil Management is a prerequisite to this project. The soil management plan is included recommendations/suggestions to ensure the proper use of the dredged soil in EIA.
- Dykes that disconnect river and floodplain should be avoided to protect the regular fish movements.
- The dredging and navigation should be done as less as possible limited to maintenance purpose. It will save the maximum gravid fish and juveniles as well.
- Using the concept of setback distance can be utilized. It will facilitate required amount of water flow through the corridors.

# 5.4 Impact Identification Due to Proposed and Anticipated Developments on VECs

It is identified that major proposed/planned/anticipated development includes the following:

- 1. Proposed Brahmaputra River Front Development Project by Guwahati Smart City Limited
- 2. Proposed Passenger Ropeway project connecting South and North Guwahati
- 3. Pandu Port
- 4. Proposed Navigation development from Neamati Port to Pandu Port by IWAI
- 5. Neamati port development by IWAI (proposed)
- 6. Access Road Development
- 7. Majuli Cluster of Tourism, Assam Tourism Development in Majuli Island
- 8. North Guwahati Bridge is the major upcoming project within 300 m w.r.t project site connecting Pan bazar to North Guwahati.
- 9. Proposed Elevated Road from the Guwahati-North Guwahati Bridge to Kachari Ghat over the River Brahmaputra

An attempt has been made to assess impacts of these developments independently on the VECs. It is seen that proposed planned development will further impact VECs which are already impacted either by improving or deteriorating the condition. It is however necessary to assess how these VECs and developments (existing, planned, proposed & anticipated) will interact with each other, resulting into cumulative impacts.

However, the anticipated negative impacts on identified VECs are localized, short term and transient in nature particularly in construction phase, which could be mitigated by implementation of environment and social management plans, applicable best practices of concerned sector(s), etc. Transport mode of IWTas compared to road / railway will improve air quality inoperational phase of the project. Overall, it is anticipated that positive impacts like development of new infrastructure, creation of new employment opportunities, livelihood improvement leading to improved quality of life, socioeconomic parameters, improved access to goods and services to be provided by the project will outweigh the anticipated negative impacts (which can be mitigated) and contribute to realisation of project objectives and intended benefits.

			P000	a, i iunne		interpu	Antic	ipatec	Impa	icts o	on VEC	s				
Areas	Proposed / Planned Development / Hotspots	Anticipated Impacts	Air Quality	Water Resources & Water Quality	Ambient Noise Levels	Under Water Noise levels	Ecology	Social	Tourism	Landuse	Drainage Pattern	Existing	Proposed Infrastructure	Quality of Life	Microclimate	Soil Erosion
Guwahati	Brahmaputra River	Increase in Commercial Area	-	-	-	Nil	-	+	+	+	+	+	+	+	-	+
Gateway	Front Development	Increase in Residential Area	-	-	-	Nil	-	+	Nil	+	+	+	+	+	-	+
Ghat and	Project	Increase in road Traffic	-	Nil	-	Nil	-	-	-	-	Nil	-	-	-	-	Nil
North Guwahati		Increase in Vessel Demand due to population Growth	-	Nil	-	-	-	-	+	Nil	Nil	-	-	-	-	Nil
Ghat		Road Connectivity	-	-	-	Nil	-	-	-	-	-	+	+	+	-	Nil
		Increase in Industrial Area	-	-	-	Nil	-	+	+	+	-	-	-	-	-	Nil
		Resource Utilization (Land, Water, Energy)	-	-	-	Nil	-	Nil	-	-	-	-	-	-	-	Nil
		Increase in floating population due to influx of tourists	-	-	Nil	Nil	-	+	+	Nil	-	-	-	+	-	Nil
	Proposed Passenger	Increase in Commercial Area	-	-	-	Nil	-	+	+	+	+	+	+	+	-	+
	Ropeway project	Increase in Residential Area	-	-	-	Nil	-	+	Nil	+	+	+	+	+	-	+
	connecting South and North Guwahati	Resource Utilization (Land, Water, Energy)	-	-	Nil	Nil	-	Nil	+	-	-	-	-	+	-	Nil
	Pandu Port	Increase in Commercial Area	-	-	-	Nil	-	+	Nil	+	+	+	+	+		Nil
		Increase in Inland Traffic	-	-	-	-	-	+	Nil	Nil	Nil	+	+	Nil	-	Nil
		Increase in Industrial Area	-	-	-	Nil	-	+	+	+	-	+	+	+	-	Nil
		Resource Utilization (Land, Water, Energy)	-	-	-	Nil	-	Nil	Nil	-	-	-	-	Nil	-	Nil
	Access Road	Increase in Commercial Area	-	Nil	-	Nil	-	+	+	+	+	+	+	+	-	Nil
	Development	Increase in Residential Area	-	Nil	-	Nil	-	+	+	+	+	+	+	+	-	Nil
		Increase in Road Traffic	-	Nil	-	Nil	-	-	-	-	Nil	-	-	-	-	Nil
		Resource Utilization (Land, Water, Energy)	-	-	-	Nil	-	Nil	Nil	-	-	-	-	-	-	Nil
	Proposed North Guwahati bridge	Increase in Commercial Area	-	Nil	-	Nil	-	+	+	+	+	+	+	+	-	Nil
		Increase in Residential Area	-	Nil	-	Nil	-	+	+	+	+	+	+	+	-	Nil
		Increase in Road Traffic	-	Nil	-	Nil	-	-	-	-	Nil	-	-	-	-	Nil

Table 5-4: Impacts on VECs Due to Proposed, Planned and Anticipated Developments in Study Area

							Antic	ipateo	l Impa	icts o	n VEC	s				
Areas	Proposed / Planned Development / Hotspots	Anticipated Impacts	Air Quality	Water Resources & Water Quality	Ambient Noise Levels	Under Water Noise levels	Ecology	Social	Tourism	Landuse	Drainage Pattern	Existing Infrastructure	Proposed Infrastructure	Quality of Life	Microclimate	Soil Erosion
		Resource Utilization (Land, Water, Energy)	-	-	-	Nil	-	Nil	Nil	-	-	-	-	-	-	Nil
Aphalam	Neamati port	Increase in Commercial Area	-	-	-	Nil	-	+	Nil	+	+	+	+	+	-	Nil
ukhGhat	development by IWAI (proposed) and	Increase in approach road Traffic	-	-	-	Nil	-	-	Nil	-	Nil	-	-	-	-	Nil
	Navigation	Increase in Inland Traffic	-	-	-	-	-	-	Nil	Nil	Nil	-	+	+	-	-
	Development from	Increase in Industrial Area	-	-	-	Nil	-	+	Nil	+	-	+			-	
	Neamati to Pandu Port	Resource Utilization (Land, Water, Energy)	-	-	-	Nil	-	Nil	Nil	-	-	-	-	-	-	Nil
	Access Road	Increase in Commercial Area	-	Nil	-	Nil	-	+	+	+	+	+	+	+	-	Nil
	Development	Increase in Residential Area	-	Nil	-	Nil	-	+	+	+	+	+	+	+	-	Nil
		Increase in road Traffic	-	Nil	-	Nil	Nil	-	-	-	Nil	-	-	-	-	Nil
		Resource Utilization (Land, Water, Energy)	-	-	-	Nil	-	Nil	Nil	-	-	-	-	+	-	Nil
	Majuli Cluster of	Increase in Commercial Area	-	-	-	Nil	-	+	+	-	-	+	+	+	-	Nil
	Tourism Properties	Increase in Residential Area	-	-	-	Nil	-	+	+	-	-	+	+	+	-	Nil
	by Assam Tourism	Increase in road Traffic	-	Nil	-	Nil	Nil	-	-	-	-	-	-	-	-	Nil
	Development in Majuli Island	Increase in tourist Vessel Demand	-	Nil	-	-	-	+	+	Nil	Nil	+	+	+	-	-
		Upgradation in Cultural activities	-	+	Nil	Nil	-	+	+	+	Nil	+	+	+	+	Nil
		Resource Utilization (Land, Water, Energy, supporting goods)	-	-	-	Nil	-	+	+	+	-	-	-	+	-	Nil
		Increase in floating population due to influx of tourists	-	-	Nil	Nil	-	+	+	Nil	-	-	-	+	-	Nil
		Employment and entrepreneurships	Nil	Nil	Nil	Nil	Nil	+	+	+	Nil	+	+	+	Nil	Nil

Dovolonmonte							
Developments			3116				Impacts
VECs	Existing situation at Project sites	Proposed Passenger Ropeway project connecting South and North Guwahat	Neamati port development by IWAI (proposed) and Navigation Development from Neamati to Pandu Port	Majuli Cluster of Tourism Properties by Assam Tourism Development in Majuli Island	Guwahati Metro City / Tourism development / Urbanization	Access Road Development	Cumulative Impact
Air Quality	Air Quality deteriorated high particulate matter however air quality will get improved with adequate measures	Air quality will improve	Air quality will improve	Air Quality will deteriorate significantly due to development projects but can be controlled with adequate Measures	Air Quality will deteriorate	Air quality will deteriorate during implementatio n however will improve significantly after completion	Air Quality will improve
Water Quality	Water quality will be deteriorated significantly but can be controlled by keeping provisionofad equateETPs/ STPs	Water quality will not be significantly impacted	Water quality will be deteriorated significantly but can be controlled by keeping provisionofadequateE TPs/STPs	Water quality will be deteriorated but can becontrolledbykeepin gprovisionofadequat e STPs	Water quality will be deteriorated but can be controlled with provision of CSTPs, and their regular monitoring	Water quality will not be significantly impacted	Water quality will be deteriorated significantly
Water Resources	Ground water level declining trend	No impact on water resources	No impact on water resources	More depletion of ground water resources but canbecontrolledusin gtechniqueswithmini mumwater consumption and least waterwastage	More depletion of ground water resources but can be controlled using water conservation measures	No impact on water resources	Water Resources will further be depleted
Noise Level	Noise levels high in commercial, areas. Noise level	Intermittent noise level will increase in areas	Noise level will increase	Noise level will increase but can be controlled using noise control technologies	Noise level will increase	Noise level will increase	Noise level will significantly increase

Tabla	5 F.	Interaction	Matrix		nmonte a	nd Idontified	VECs and	Cumulativo	Impacte	on VECs
lable	<b>J-J</b> .	Interaction	I WIALITA	OI Develo	pinients a	na laentinea	VECS and	Cumulative	impacts	OII VEUS

Developments			Sma	all Scale Impacts			Large Scale Impacts
VECs	Existing situation at Project sites	Proposed Passenger Ropeway project connecting South and North Guwahat	Neamati port development by IWAI (proposed) and Navigation Development from Neamati to Pandu Port	Majuli Cluster of Tourism Properties by Assam Tourism Development in Majuli Island	Guwahati Metro City / Tourism development / Urbanization	Access Road Development	Cumulative Impact
	insensitive locations is evenhigherd uring day at many locations						
Ecology / Bio- diversity	No cutting of vegetation No Eco- sensitive zone within study area High impact on aquatic flora &fauna including dolphins, turtles and fishes. May directly impact the primaryprodu ctivityofwater body	Less nos. of tree cutting No Eco sensitive zone within study area	High impact on aquatic flora & fauna including dolphins, turtles and fishes. May directly impact the primaryproductivityof water body	High Impact on terrestrial flora / aquatic fauna / May have impact on aquatic flora Green belt will be developed as per mandate may balance the negative impact	Will disturb both local flora & fauna	Less Impact on terrestrial flora. May have impact on aquatic flora Green belt can be developed as per mandate may balance the negative impact	Flora &Fauna both terrestrial & aquatic will be significantly impacted
Soil Erosion	Soil erosion noticed along bank of rivers	Excavation of soil from borrow area will lead to significant soil erosion	Construction of structures may further lead to soil erosion in upstream and downstream of river	Soil quality may be polluted but can be taken care by taking adequate waste management techniques and mulching	Soil erosion will be decreased due to proper landscape development	Excavation of soil from borrow area will lead to significant soil erosion	Enhanced soil erosion
Land Use	No land use diversion is envisaged	Land use diversion is envisaged	No land use diversion is envisaged	Land use may change significantly	Developed as permaster plan butmay also be developed bydiverting the landuse	Land use diversion for road construction	Major Impacts are envisaged

Developments			Sm	all Scale Impacts			Large Scale Impacts
VECs	Existing situation at Project sites	Proposed Passenger Ropeway project connecting South and North Guwahat	Neamati port development by IWAI (proposed) and Navigation Development from Neamati to Pandu Port	Majuli Cluster of Tourism Properties by Assam Tourism Development in Majuli Island	Guwahati Metro City / Tourism development / Urbanization	Access Road Development	Cumulative Impact
						significant for green field projects	
Quality of Life	High level of unemploym ent &high poverty. However proposed project will Increase employment opportunitie sthuswillimp rove quality of life	Increase employment opportunities thus will improve quality of life	Increase employment opportunities thus will improve quality of life	Increase employment opportunities thus will improve quality of life	Increase employment opportunities thus will improve quality of life	Increase employment opportunities thus will improvequalit y of life	Significant improvement in quality of life
Pressure on Existing Resources	High population and limited resources & infrastructur e	Will reduce pressure road / bridges infra but may pressurize the feeder routes and nearby settlements / towns due to induced growth options	Will reduce pressure roads and NH but may pressurize the feeder routes and nearby settlements/towns due toinducedgrowthoptio ns	Will furtherincreasepress ureon all theresourcessignific antly	Will further increase pressure on all the resources	Transport Infrastructure will be improved due to availability of easy connectivity	Pressure on existing resources will increase significantly, ifnewsources notprovidedto cater topressurefro mupcoming development s
Infrastructure	Insufficient in terms of railways, roads, electricity, power land etc	Will improve infrastructure significantly	Will improve infrastructure significantly	Will improve infrastructure significantly	Will improve infrastructure significantly	Will improve infrastructure significantly	Will improve infrastructure significantly

Developments			Sma	all Scale Impacts			Large Scale Impacts
VECs	Existing situation at Project sites	Proposed Passenger Ropeway project connecting South and North Guwahat	Neamati port development by IWAI (proposed) and Navigation Development from Neamati to Pandu Port	Majuli Cluster of Tourism Properties by Assam Tourism Development in Majuli Island	Guwahati Metro City / Tourism development / Urbanization	Access Road Development	Cumulative Impact
Micro-Climate	Climate change is being observed in terms of erratic rainfall, flash floods, droughts etc	Will reduce GHG emissions ultimately thus positive impacts	Will reduce GHG emissions ultimately thus positive impacts	Will enhance GHG emissions will impact negatively	WillenhanceGHG emissions will impact negatively	Will reduce GHG emissions ultimately thus positive impacts	GHG emissions will increase significantly if too many polluting industries will come and no proper APC measures are taken
Natural Drainage Pattern	Drainage pattern may get altered due to construction of various structures and this results into flooding at various locations but affect minimized byprovidings tormwater drainage system and cross drainage structures	Natural drainage pattern will not be disturbed	Construction of infrastructure and related facilities of waterways may impact the drainage pattern of river	Effects thenaturaldrainage pattern but impact will be insignificant as storm water drainage system will be provided to divert the storm water witheach such development	Effects the natural drainage pattern but impact is insignificant as storm water drainage system is provided to divert the storm water with each such development Increased sealed surfaces and thus disturbs natural drainage pattern resulting into urban flooding and water lodging during monsoons	Natural drainage pattern will be disturbed as alignment may cross various streams, nallahs& rivers but effect can be minimized by providing cross- drainage structures	Natural Pattern will be altered significantly but impact can be minimized by providing adequate cross drainage structures andstormwat erdrainsofad equate capacity

# 5.5 Mitigation Measures

Tuble v-v. Broad mitigation measures on the basis of interaction matrix of Bevelopments and valuative impacts
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Project	Mitigation Measures	Responsible Agency	Time
			Frame
Passenger Ropeway project connecting South and North Guwahati and North Guwahati Bridge is the major upcoming project connecting Pan bazar to North Guwahati and nodal	Coordination of AIWTDS with planning authority of ropeway project during Implementation and Operation of the Assam IWT project at North Guwahati and Guwahati Gateway Ghat. Should ensure implementation of the EMP prepared.	AIWTDS, PWD,	Immediate
agency is Urban Development Department, Government of Assam.	AlWTDS should consult with ropeway planning authority to discuss the effectiveness of the EMP prepared and to learn from their experience. AlWTDS should share their experience which may help them while expanding their network as well. This will help in institutional building, coordination and strengthening of future ropeway project in the area which matters related to environment		
	management		
Neamati port development by IWAI (proposed) and	AIWTDS should coordinate with IWAI for development of	AIWTDS, IWAI	Immediate
Navigation Development from Neamati to Pandu Port	connecting link between proposed		
	Neamati Port Terminal to Pandu Port. AIWT EIA and EMP should be shared and Integrated Environmental Management Plan should be prepared in consultation with IWAI like		
	· Air Quality Management Plan		
	· Water Resources Management Plan		
	· Noise Level Management Plan		
	· Soil Quality & erosion Management Plan		
	· Bio-diversity Management Plan		
	<ul> <li>Bio-diversity Conservation Plan (endangered species)</li> </ul>		

	· Oil Spill Management Plan		
	· Plant Site /Labour camp Management Plan		
	· Borrow Area Management Plan		
	· Landscaping Plan		
	· Disaster Management Plan		
	· Occupational Health & Safety Management Plan		
	· Traffic Safety Management Plan		
	· Environment Monitoring Plan		
Majuli Cluster of Tourism Properties by Assam Tourism Development in Majuli Island	River Island of Majuli in midstream of Brahmaputra River in Assam is UNESCO World Heritage Centre. Majuli is purely a region of fluvial geomorphology. It rises from the Brahmaputra basin and in course of time turned into a flat-level alluvial plain. Asignificant feature of this system is the formation of the islets locally called the Chaporis around the Majuli Island. All of the above the river, its tributaries, the wet lands and the chaporis along with the island of Majuli make it the largest mid river delta system in the world. There are 30 Sattras in Majuli many of which are in the mainland, few of them are in Chapori areas, with a distinct spiritual influence region. Amongst these 30, 3 sattras are coming within 10 km from Aphalamukh Terminal.	AlWTDS & Assam Tourism Development Corporation, Tourism Department	Immediate
	There are tremendous potentialities of Rural and Eco-tourism industries in Majuli. AIWTDSshouldcoordinate with Assam Tourism Development corporation for development of tourism zones these areas. So that ATDC views and demand with incremental passenger load can be thought of during the design of the terminals. The allied development activities at terminals can be implemented in coordination with ATDC for tourist's convenience. This will be helpful in the integrated development at terminal locations. Integrated Environmental Management Plan should be prepared in consultation with ATDC before commencing work of tourism development		

Brahmaputra River Front Development (Guwahati Smart City) / Tourism development / Urbanization	AIWTDS should coordinate with GMC Development Authority to construct IWT Terminals so that the incremental loads of passengers expected from the smart city project can be considered during design of the terminals. AIWTDS should also identify the sensitive locations like hospitals, schools, worshipcontested within the 100 m, 300 mt and 10 km of the proposed terminals through these zones and take appropriate mitigation measures by providing noise barriers as suggested in EIA/EMP.	AIWTDS & Guwahati Smart City Development	Immediate
	Brahmaputra River Front Development project by Guwahati Smart City Limited is an attraction for its tourist's importance. People from all across the India visit Guwahati frequently to enjoy the nature, ecology. Apart from tourists the main devotee often visits the place for worship of Kamakhya Temple, Umananda, and Ashwalakhanta Temple. People often come and stay at Guwahati and travels from here to all north east places. So, during planning of the terminals all these requirements should be taken into consideration.		
Access Road Development	AlWTDS Should assess the status of roads connecting the proposed terminals to major towns, villages. Should organize quarterly meetings with local Road & Bridge Development Authorities to provide their suggestion and requirement of construction/improvement of access roads.	AIWTDS & PWD	Immediate

#### Table 5-7: Specific Mitigation Measures Interaction Matrix of Developments and Identified VECs and Cumulative Impacts on VECs

Sr. No.	Project Ghat	VECs identified to be impacted majorly	Hotspots based on VECs	Assessment based on anticipated impacts and mitigation measures	Response Agency	Time Frame
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Guwahati Gateway Ghatand North Guwahati	Air Quality	<ol> <li>Proposed Brahmaputra River Front Development Project &amp; Guwahati North Guwahati Bridge and Elevated Roads</li> <li>Pandu Port (maintenance of vessels shall lead to water and noise pollution)</li> <li>Upcoming Ropeway (reduction in distribution of passengers)</li> <li>Access Road Development</li> </ol>	It has been envisaged that the development of the Guwahati region in terms of transportation shall lead to better passenger distribution due to various mode of transportation. This could also lead to reduction in pollution levels if the facilities provided are maintained properly.	AIWTDS, PWD, Guwahati Smart City Limited, IWAI	Immediate
	Water Resources & Water Quality	<ol> <li>Proposed Brahmaputra River Front Development Project, Guwahati North Guwahati Bridge &amp; Elevated Roads</li> <li>Pandu Port (maintenance of vessels shall lead to water and noise pollution)</li> <li>Upcoming Ropeway (reduction in distribution of passengers)</li> <li>Proposed Navigation development from Neamati Port to Pandu Port by IWAI</li> </ol>	It has been envisaged that the development of the Guwahati region in terms of transportation shall lead to better passenger distribution due to various mode of transportation. This could also lead to reduction in pollution levels if the facilities provided are maintained properly.	AIWTDS, PWD, Guwahati Smart City Limited, IWAI	Immediate

	Under Water	Dolphin locations	1) Noise deterrent devices for vessels	AIWTDS, PWD, Guwahati Smart City	Immediate
	Noise	Dredging Locations	2) Water curtains for dredging	Limited, IWAI	
	levels		3) Signagesidentifying the presence of dolphins along with instructions and information about the species		
			4) Maintaining low vessel speeds in dolphin hotspots		
	Ecology	Dolphin locations	1) Noise deterrent devices for vessels	AIWTDS, Guwahati Smart City Limited,	Immediate
		Dredging Locations	2) Water curtains for dredging	IWAI	
			3) Signagesidentifying the presence of dolphins along with instructions and information about the species		
			4) Maintaining low vessel speeds in dolphin hotspots		
	Social	Employment opportunity	Positive impact is envisaged on the living conditions	AIWTDS	During Project Execution
	Tourism	1) Umananda Temple	Positive impact is envisaged	AIW/TDS Tourism	р ·
		, , ,	on the living conditions	Dept.	During Project Execution
		2) Urvashi Island	on the living conditions	Dept.	During Project Execution
		2) Urvashi Island 3) Majuli Island	on the living conditions	Dept.	During Project Execution
	Landuse	2) Urvashi Island 3) Majuli Island River Front Development & Guwahati-North Guwahati Project	Positive impact is envisaged on the living conditions	AlWTDS, Fourish Dept. AlWTDS, PWD, Guwahati Smart City Limited, IWAI	During Project Execution Immediate
	Landuse	2) Urvashi Island 3) Majuli Island River Front Development & Guwahati-North Guwahati Project Proposed Ropeway	Positive impact is envisaged on the living conditions Positive impact is envisaged on the living conditions	AIWTDS, FOURISH Dept. AIWTDS, PWD, Guwahati Smart City Limited, IWAI	During Project Execution Immediate

AphalamukhGhat	Air Quality	1) Satras	Development in transportation	AIWTDS, IWAI,	Immediate
		2) Neamati port development by IWAI (proposed)	services shall lead to less accidents and better safety. This would in turn lead to more usage of the inland waterway	Majuli District Administration	
		3) Access Road Development	facility		
	Water	1) Satras	Development in transportation	AIWTDS, IWAI,	Immediate
	& Water Quality	2) Neamati port development by IWAI (proposed)	accidents and better safety. This would in turn lead to more usage of the inland waterway facility	Majuli District Administration	
	Under Water	Dolphin locations	1) Noise deterrent devices for vessels	AIWTDS, IWAI,	Construction Stage
	Noise	Dredging Locations	2) Water curtains for dredging		
			3) Signages identifying the presence of dolphins along with instructions and information about the species		
			4) Maintaining low vessel speeds in dolphin hotspots		
	Ecology	Dolphin locations	1) Noise deterrent devices for vessels	AIWTDS, IWAI,	Construction Stage
		Dredging Locations	2) Water curtains for dredging		
			3) Signagesidentifying the presence of dolphins along with instructions and information about the species		
			4) Maintaining low vessel speeds in dolphin hotspots		
	Social	Employment opportunity	Positive impact is envisaged on the living conditions	AIWTDS, IWAI	Construction Stage
	Tourism	Majuli Island	Positive impact	AIWTDS, Tourism Dept.	Post Construction Stage

# 5.6 Environment Monitoring Plan

	Table 5-8: Monitoring Plan						
Sr.	Valuable E	nvironmental	Indicators	Location	Frequency	Coordination Agency	
No.	Comp	onents					
1.	Physical	Urban Centres /	Population	District Wise	Once in 5	Municipal Corporations /	
2.	Features /	Agglomerations	Literacy		Years	Gram Panchayats	
3.	Habitats		WFPR				
4.			GDP				
5.			Standard of living				
6.			Pressure on				
			existing resources				
7.		Land Resources	Soil Erosion	District Wise	Once in a	Municipal Corporations /	
8.			Land Use Change		Years	Gram Panchayats / WRD / AIWT / Agriculture department / PWD / DTP	
9.		Proposed / Upcoming	Roads / Bridges	Within 10 km	Yearly	State Road / PWD / DTP/ MC	
10.		Infrastructure projects	Traffic Congestion (IWT Routes)	Within 10 km	Yearly	Traffic control room	
11.			Traffic Congestion (Feeder Routes)	Within 10 km	Yearly	Traffic department	
12.			Rails	Within 300 mt	Yearly	IR	
13.			Air Connectivity	Within 10 km	Yearly	AAI, DGCA	
14.			Health Facilities (Number)	District / Village	Yearly	DTP/ MC / GP	
15.			Education Facilities (Number)	District / Village	Yearly	DTP/ MC / GP	
16.	-		Number of Industries	District / Village	Yearly	DTP/ DIC / SIDC	
17.			Power Production	District / Village	Yearly	NTPC, SIDCs & DIC	
18.	Ecological Profile	Bio Diversity (Forests / Wildlife Sanctuaries / National Parks / Tiger Reserves / Bird Areas)	Impact on flora & fauna	District / Village	Yearly	Forest Department/ Universities / NGO / AIWTDS EMC Cell	
19.		Wetlands	Impact on				

	Sr. No.	Valuable Environmental Components		Indicators	Location	Frequency	Coordination Agency
Γ		-		Wetlands			
	20.		Dolphins	Impact on			
				Dolphins			
	21.		Migratory Birds	Impact on			
				migratory bird			
	22.		Turtles	Impact on Turtles			
				and its breeding			
				Locations			
	23.	Physical	Air	Air Quality Index	District Wise	Six Monthly	As per EMP of EIA
		Environmental			& within		SPCBs & CPCBs
	0.4	Profile	NA/ /	0 114 1	300m		
	24.		Water	Ground Water			As per EMP of EIA
	05			Resources		Oix Manthelia	SPCBs & CPCBs
	25.			vvater quality	District wise	Six Monthly	AS PER EMP OF EIA
							CCWB
-	26		Noise	Noise Levels	District Wise	Six Monthly	As per EMP of EIA
	20.		INDISE		& within		SPCBe & CPCBe
					300m		01 003 0 01 003
	27.			Underwater Noise	Navigation	Six monthly	As per EMP of EIA
					route and	During	· · · · · · · · · · · · · · · · · · ·
					dredging	Dredging	
					locations	respectively	
	28.		Sediment	Sediment Quality	Terminal	Yearly	As per EMP of EIA
				and impacts of	locations		
				sediment on water			
				quality			
	29.		Climate Change	GHG	Terminal	Yearly	AIWTDS EMC Cell
	00				locations		
	30.			Erratic Rainfall	District Wise	Yearly	IMD
	31.			Flooding	District wise	rearly	
-	32	Social	Infrastructure	Education Health	District /	Vearly	
	JZ.	Infrastructure	แแลรแน่งเนเย	Connectivity	Village	rearry	
	33	masuucluid	Industrial	Proposed /	District /	Yearly	DTP/ DIC / SIDC
	00.		Corridor	Planned)	Village	rearry	
	34.		Power Plants	Existing &	District /	Yearly	NTPC, SIDCs & DIC
				Proposed)	Village	·y	2,•

Sr. No.	Valuable Environmental Components		Indicators	Location	Frequency	Coordination Agency
35.	Cultural Aspects	Archaeological / Heritage Sites	Impact on Archaeological Monuments	Within 300 m	Yearly	ASI

## 5.7 Conclusions

The maximum interaction will take place in the zones which carries majorexisting/proposed/planned developments and will cater the maximum anticipated developments. These zones are the zones which are identified above on basis of ElAandstakeholder consultation asthey are the ones which are experiencing or will experience developments. Due to these interactions, VECs in these zones will experience the cumulative impacts, i.e. impact due to these developments individually and impact due to other developments in the surrounding areas. Cumulative impacts anticipated on VECs are listed in the last column of **Table 5.5** above.

AlWTDS will regularly monitor the status of the VECs in the study area on regular basis. The report shall be uploaded regularly on official AlWTDS website (<u>www.aiwtdsociety.in</u>) so as any new developer or state authorities can know the status of the VEC in the study area and can plan the development accordingly. Suggested mitigation measures given above will help the agencies to include the cumulative impact in their mind while finalizing the mitigation plans.

Management of the AIWTDS Society is conducted by a structure, which consist of a two-tier administrative system comprising of a 'Project Guidance Council (PGC), headed by the 'Chief Secretary to the Government of Assam' and a 'Governing Body' (GB) headed by the 'Senior Most Secretary of the Transport Department, Government of Assam. 'PGC' is the Apex Policy Making Body of the AIWTD Society and the GB is the Executive Authority of the Society, which function as per the direction and guidance of the PGC.

SI. No.	Official	Designation in PGC
1	Chief Secretary of Assam	President
2	Senior Most Secretary, Transport Dept.	Member Secretary
3	Senior Most Secretary, Finance Dept.	Member
4	Senior Most Secretary, Planning & Development Dept.	Member
5	Senior Most Secretary, PWD Dept.	Member
6	Senior Most Secretary, Environment & Forest Dept.	Member
7	Senior Most Secretary, Panchayat & Rural Development	Member
8	State Project Director, AIW/TD Society	Member
0		INIEITIDEI
9	Director, Inland Water Transport, Assam	Member
10	Two Non-Official Members to be decided by President <sup>4</sup>	Member

#### Table 5.9- Structure of PGC

The meeting of the PGC held as decided by the President, PGC and notified by or on behalf of the Member Secretary, provided that at least one meeting held every year. 'Minutes of the Meetings (MoMs)' are published in the official website of the AIWTDS. Thus, there shall be coordination with all the other developers for mitigation measures of the CumulativeImpact in the project area through the meetings of 'Project Guidance Council' of AIWTDS.

<sup>&</sup>lt;sup>4</sup>Director, IWAI, Guwahati Division is a nominated member of the PGC