INLAND WATERWAYS AUTHORITY OF INDIA

Ministry of Shipping, Government of India

"CAPACITY AUGMENTATION OF NATIONAL WATERWAY.1"

(Jal Marg Vikas Project)

ENVIRONMENTAL IMPACT ASSESSMENT REPORTS

VOLUME - 6:
Environmental Management Plan (EMP)
for
Haldia Terminal

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Chapter 1. EMP FOR HALDIA TERMINAL

1.1. Introduction

Inland waterways Authority of India (IWAI) has proposed to augment the navigation capacity of waterway NW-1 (Haldia to Allahabad) and continue to maintain the entire stretch. Under this project, IWAI has proposed to develop the infrastructure facility like Multimodal terminals, Navigation aids for day & night navigation, River information system with all hardware and software, Ro-Ro jetties, Bank & slope protection, River training works, Equipment like tow barges, inland vessels, survey vessels including rescue boats & survey equipment and Dredging of the navigation channel, to augment the navigation capacity of the waterway.

An inland water terminal at Haldia is proposed to be developed within Haldia Dock Complex at River Hooghly (NW-1) under this project to enhance the navigation facility of the NW-1. The project is also requirement of Haldia Dock Complex for its economy, better serviceability to end customer and to improve the primary / secondary logistic cost. Location map of the project is given in **Figure 1.1** below.

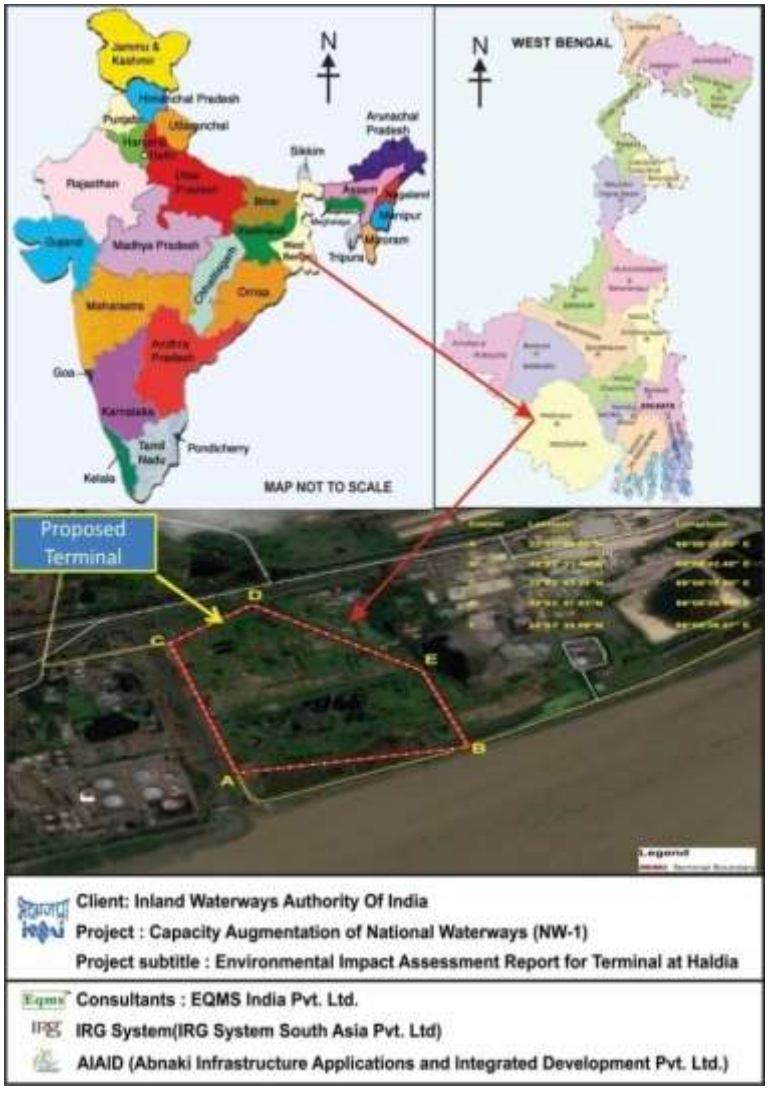

Figure 1.1 : Location Map

1.2. Brief On Haldia Terminal

Project involves development of an inland water terminal at River Hooghly (NW-1) proposed to be located at Haldia industrial area, near Durgachawk, Haldia, District Purbi Medinipur, West Bengal. Geographical coordinates of the centre of site are 22°03'38.34"N & 88°08'29.49"E. River Hooghly flows in South direction of the terminal site. Terminal site is well connected by the roads. Site is connected to NH-41 through 7 m paved road in North direction. Durgachak Railway Station is about 0.6 km away from the site towards North direction and Haldia railway station is about 12 km away towards west direction. Nearest Airport is at Kolkata which is about 135 km away from the site in north direction. River Hooghly in this stretch is navigable and local ferries are currently operating in the river for transportation of men and material. Internal roads of width 17 m & 10 m will be developed at project site.

Total area of terminal site is 61.0 acres. The identified land belongs to Haldia Dock Complex. Site is low lying area with elevation ranging from 4-9 m amsl. It is required to fill the site to achieve finished level of 7 m, i.e. 2.54 m above HFL. Soil required for filling is 3.3 lakh cum.

Terminal facility is designed to handle 3.18 MTPA of cargo. Cargo comprises of fly ash, fertilizer, stone aggregate, coal, edible oil & POL. These materials will be stored, loaded, unloaded and transported from the terminal site.

Facilities to be developed at terminal site include both onshore and off-shore facilities. Onshore facilities include 16 nos. of silos for fly ash storage, stockyards for stone aggregates, fertilizers & edible oil/POL, internal roads, administration building, worker's amenity building, lighting tower, power supply system, fire-fighting system, sewerage system, storm water management system, waste management system and green belt (3 acres). Off-shore facilities include 4 nos. of berths & approach trestles and water approach channel. The proposed terminal project will be developed in phases, i.e. phase 1A & 1 B. Phase 1 A will comprises of all the proposed developments except 8 nos. of fly ash storage silos and its conveyors out of proposed 16 nos. of silos, stockyard development area (future storage) and railway siding.

1.3. Description of Environment

The baseline environmental data generation has been done for the period of 15th September to 15th October 2015. The study area within a 10 km radius around the proposed terminal site has been considered as general impact zone and 2 Km radius as specific impact zone for EIA study. Primary and secondary data has been collected for both the zone however focus of primary data generation has been more for 2 Km radius. Data was generated by following the monitoring plan approved by IWAI and World Bank in line with prescribed TOR by IWAI.

The Salient Environmental Features of Haldia Terminal Project within 500m, 2 Km and 10 Km radius is summarised at **Table 1.1**.

Table 1.1 : Salient Environmental Features of Haldia Terminal Site

S. No.	Environmental Features	Within 500 m area around Proposed terminal site	Within 2 km area around Proposed terminal site	Within 10 km area around Proposed terminal site
1	**Ecological Environment**			
A	Presence of Wildlife Sanctuary/ National Park/Biosphere Reserves	None	None	None
B	Reserved /Protected Forests	None	None	None
C	Wetland of state and national interest	None	None	None
D	Migratory route for wild animals	None	None	None
E	Migratory routes for birds	None	None	None
F	Presence of Schedule-I Terrestrial Fauna	None	None	None
G	Presence of Schedule-I Aquatic Fauna	None	None	None
H	Tree cover	Yes General road side plantation	Yes General road side plantation	Yes General sparse vegetation and road side plantation.
I	Critically polluted Area	Haldia was declared by CPCB a "Critically Polluted Area (CPA's) by Advt. No. B-29012/ESS/CPA/2010. However, the moratorium has now been lifted vide MoEF Office Memorandum N. J - 11013/5/2010 -IA. II (i) dated 17.09.2013. The proposed project is identified as vital infrastructure requirement of the Haldia Dock complex for its economy, better serviceability to end customer and to improve the primary / secondary logistic cost		
J	CRZ Area	The project area falls within CRZ		
2.	**Physical Environment**			
K	Road connectivity	The site is well connected by roads	Haldia Mecheda Road.	Kolkata-Haldia National Highways (NH-41 about 6 km W) starts at Haldia near the Haldia refinery and meets NH-6 linking Kolkata to Mumbai at Mecheda.
L	Rail connectivity	Railway line is app. 200 m distance from terminal site in North direction	Durgachak railway Station about 600 m in NW of site	Durgachak railway Station about 600 m in NW of the site & Haldia Railway Station is at 12 km distance from terminal site

S. No.	Environmental Features	Within 500 m area around Proposed terminal site	Within 2 km area around Proposed terminal site	Within 10 km area around Proposed terminal site
M	Defence Installation	None	None	None
N	Densely Populated Area/Industrial Area	Haldia Dock Industrial Complex	Haldia town	Haldia town
O	Topography	Mainly flat with ground elevation ranging between 2-9 meters above mean sea level	Mainly flat with ground elevation ranging between 1-14 meters above mean sea level.	Mainly flat with ground elevation ranging between 0-16 meters above mean sea level.
P	Seismicity	Falls in Zone-IV high damage risk zone as per Seismic Zonal Map of India	Falls in Zone-IV high damage risk zone as per Seismic Zonal Map of India	Falls in Zone-IV high damage risk zone as per Seismic Zonal Map of India
Q	Surface Water Resources (Rivers)	Hooghly River passes along the southern boundary of the Terminal Green Belt Canal is flowing along the western boundary of the terminal site	Hooghly River passes along the southern boundary of the Terminal Green Belt Canal is flowing along the western boundary of the terminal site	Hooghly River passes along the southern boundary of the Terminal Haldi river is located about 9.5 km west of the proposed terminal. Green Belt Canal is flowing along the western boundary of the terminal site
R	Groundwater	Ground water in Haldia region occurs under confined condition. Pre-monsoon piezometric level -7-15 m bgl. Annual withdrawal - 24.63-MCM. Annual ground water recharge through the confined aquifer- 5.348-MCM leaving an annual deficit of 18.282-MCM.		
S	Soil and Land-use	Sandy clay Land use in 500m of site is under road, industrial use, and Settlements.	Sandy lay Land use in 2 km area of site is under road, industrial use, and Settlements.	Sandy lay Land use in 10 km of site: about 29.41% of the land is under agriculture. 10.76% of the land is under settlement, about 38.16% land is under water bodies and rest of the land is under other uses
3.	**Social Environment**			

S. No.	Environmental Features	Within 500 m area around Proposed terminal site	Within 2 km area around Proposed terminal site	Within 10 km area around Proposed terminal site
T	Physical Setting	Industrial /Urban	Industrial / Urban	Urban / Rural /industrial Settings
U	Physical Sensitive Receptors	None	Yes (Temples, Schools, College, Hospital)	Yes (Temples, Schools, College, Hospital)
V	Archaeological Monuments	None	None	None

Meteorology: Climate of the study area is typically moderate as it is located in coastal area. Dominant wind direction of the study area is S & SE during post-monsoon and N & NW during pre-monsoon period.

Air Quality: As per air quality monitoring study, it is found that ambient air quality of the site is within permissible limits as per NAAQS, 2009. However, levels of PM10 are observed to be higher. Project site is located in the Haldia Industrial Area. The area was classified as Critically Environmentally Polluted Area by CPCB and further exploitation of air & water quality was restricted in the area. However, moratorium has now been lifted from Haldia.

Noise Quality: Noise level monitoring was done in 3 location including project site, connecting road and nearest habitation “Durgachak”. Noise levels at the site and in nearby areas are also found to be within the permissible limits as per CPCB standards for Industrial area.

Water Quality: As per CPCB, it is also found that the area is classified as notified zone for extraction of ground water. No ground water extraction is proposed in the project in both construction and operation phase. Ground water in the shallow aquifers, i.e. to depth of 120-300 mbgl are brackish to saline. Ground water in deeper aquifers is fresh and potable for drinking purpose with some treatment. However, Fe levels in ground water is higher in some part of district. Water quality of the River Hooghly is found to be equivalent to D Class Water body as per CPCB classification and is fit for propagation of Wildlife & Fisheries.

Soil Quality: Soil of the area is Clayey sand and slightly alkaline in nature and is moderately fertile with low to medium NPK value.

River Bed Sediments: River bed sediments of the River Hooghly were also studied along the stretch near the terminal site and they are found to be non-toxic with very losw concentration of pesticides and other chemicals like DDT, Endosulphan, Lindane & methyl Parathion.

Flora and Fauna: Site lies within the Industrial area thus no significant vegetation or habitat for wildlife is present in the study area. Vegetation mainly comprises of the road side vegetation and some of the commonly found fauna species are Albizzia lebbeck, Casuarina equisetifolia, Phoenix sylvestris, Delonix regia, Acacia spp, Azadirachta indica, Delbergi sisso, Xanthium strumarium, Nerium indicum, Parthenium spp. Calotropis procera, Lantana camara, Casia tora, Vitex negundo, Zizyphus mauritiana, Canabis sativa, Argemon maxicana, Sida spp etc. No significant wildlife was observed at site and in study area.

Hooghly River is rich in flora and fauna and varied variety of planktons, fishes and other aquatic life is present in the River. However, no RET species was found to be present at terminal site or in study area

Sensitive Ecosystem: No sensitive eco-system including national parks, wildlife sanctuaries, migratory routes of wildlife, Biosphere reserve, tiger reserve, elephant reserve, wetlands under Ramsar convention are present within 10 km distance of the project site.

Land use: As per the land use analysis within the 10 km radius zone about 38.16% of the land is under water body, about 29.41% of the land is under agriculture, about 13.43% land is under vegetation, 10.76% land is under settlement and rest of the land falls under other uses

Sensitive Ecosystem: No sensitive eco-system including national parks, wildlife sanctuaries, migratory routes of wildlife, Biosphere reserve, tiger reserve, elephant reserve, wetlands under Ramsar convention are present within 10 km distance of the project site.

Socioeconomic Data: The proposed terminal site is located in Haldia Industrial area, Tehsil Haldia and District Purbi Medinipur, West Bengal. Administratively the villages and settlements with in 10 km area around the proposed Haldia terminal site fall in Purbi Medinipur and South Twenty-Four Parganas district of West Bengal. Maximum part of the study area falls in Purbi Medinipur District. There are 2 Municipality/town i.e. Haldia and Sutahata and 50 village falls within 10 km Area of the terminal site. According to 2011 census the total population of the 10 km study area including Haldia and Sutahata town is 301702 comprising 156769 males and 144933 females. The total population of Haldia and Sutahata Town is 205982 comprising 107458 males and 98524 females. Male female ratio of the study area is 925 female / 1000 males. Total no. of households is 66281. Total SC population in 10 km area is 70446 comprising of 36729 males and 33717 females. Total ST Population in the study area is 1804 comprising of 959 males and 845 females. Out of the total population the SC and ST population of the study area is 23% and 1% respectively. . Out of the total population about 68% and 70% population is non-working population in 2 km and 10 km area.

1.4. Environmental Management and Monitoring Plan

Effective measures are required to be proposed and implemented during design, preconstruction, construction and operation stage to eliminate or minimize the impact of the project development. **Table 1.2 & 1.3** provides details of mitigation measures with implementation and supervision responsibility.

Since project is likely to have impact on various components of environment, the monitoring requirement covering soil erosion, tree plantation, air quality, water quality noise, river sedimentation has been defined and included under respective head at **Table 1.4.**

It will be essential for contractor to comply with applicable regulations and World Bank safeguard requirements. Contractor will also have to comply with applicable standards with respect to Water, air, Noise, Dredge Material, soil and biodiversity as applicable to this project.

1.5. Environment Health and Safety Cell

It is essential to establish environment health and safety cell for the project by contractor to ensure the health & safety of workers and environmental management of study area

through effective implementation of EMP. Highly qualified and experienced persons in the field of Environmental Management of Similar projects shall be considered to man the cell who shall ensure the effective implementation of the environment management plan.

1.6. Reporting Requirements:

It is required that contractor will submit quarterly compliance report to Project Management Consultants (PMC) as well as to PMU (Project Management Unit) of IWAI. PMC will analyse the report and notify the corrective action if any required to contractor under intimation to IWAI.

Table 1.2 : Environment Management Plan Haldia Terminal During Construction Phase

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
DESIGN AND CONSTRUCTION PHASE							
1. Climate							
❖ Project is unlikely to cause negative effect on climate. However, project can contribute positively for climate	• Dense green belt in 3-acre area shall be developed along the project premises. • Tree species high in organic content like Neem, gulmohar, shisham, pongamia, siris Mango etc should be planted. • Provision of alternative energy options like solar energy • Adoption of best practices to cut down resources and energy requirement • All terminal buildings should have energy efficient design. It should follow GRIHA guidelines and aim for highest ratings under GRIHA. •	Kyoto Protocol, National Water Policy, 2012, Forest Conservation Rules & National Forest Policy	Construction site	During Design, and construction stage.	Plantation for 1200 trees	Contractor,	IWAI/PMU/PMC[1]
2. Natural & Man-made Hazard							
❖ Earthquake- Seismic Zone –	• Relevant IS code for structures shall be adopted for designing the civil structures to sustain the earthquake of high to very high	NBC, 2005, local building bye laws, state factory rules,	Construction site& Navigation	During Design and construction	Part of Project Costs	Contractor	IWAI/PMU/PMC

[1] It is proposed to set up Project Unit (PMU) in IWAI to manager social and environmental aspect of NW1 augmentation. PMC (Project Management Consultants) anticipated to be appointed for project management and quality check.

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
III damage risk zone[2] ❖ Risk of flood& Cyclones ❖ Risks due to occupational hazards and fire	intensity • All facilities developed shall be above HFL of River Hooghly • Regular maintenance and strengthening of the embankments to prevent the erosion and flooding • Emergency preparedness plan should be prepared for situations of cyclone, flood, earthquake and fire and should be available at the site all the time. This plan should be inline with and integrated with the off-site emergency plan prepared for the area. • Employee shall be given training to handle the emergency situation • Site should be vacated in case of cyclone alerts • Location of nearest cyclone shelters shall be located in the map and shall be displayed at the site. Coordination should be done with IMD to receive the cyclone threat and in case of cyclone threats the site should be vacated. • Mock drills to handle the emergency	Petroleum Rules and MSIHC Rules, 1989	Channel	stage.			

[2] *IS:1893 (Part 1): 2002 Indian Standard Criteria for Earthquake Resistant Design of Structures Part 1 General Provisions and Buildings Fifth Revision divides the Indian subcontinent into five seismic zones (*

II to V) depending on the magnitude and damage intensity of seismic activity.

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	situation shall be conducted for workers • Emergency collection area should be provided at the site near the exit gate of the site and all workers should be aware about this collection point and shortest route to reach this place • Availability of the first aid boxes and necessary medicine as per State Factory Rules • Compulsion for workers to wear PPE while working to prevent injury due to accidents while working • Only skilled/trained person should be allowed to do the tasks involving the risk of accidents with due permission of site supervisor/safety officers • Separate work procedures and safety procedures should be prepared, if any night time working is involved						
3. Site Preparation: Levelling Terminal Site, Construction Camp, Construction Works							
❖ Levelling of terminal site & Removal of vegetation	• Excavation and filling operations should be carried out in parallel so as to minimize the soil erosion • Compaction of soil shall be undertaken by sprinkling the water to minimize the erosion • Water sprinkling to be carried out for dust suppression • Top soil (15 cm) should be stripped and preserved under covered conditions for landscaping purpose in later stage. This should be stored in the form of the heap with the slide slopes covered with grass. Excavated soil should be used within the site for levelling purpose (1.5 lakh cum to be used for levelling). However most of the soil will be used for levelling within the site if	Municipal Solid Wastes (Management and Handling) Rules, 2015 Hazardous Waste (Management, Handling & Transboundary) Rules, 2008 Forest (Conservation) Act Social Impact Assessment	Construction site	During design and Construction Stage	Part of Project Costs	Contractor.	IWAI/PMU/PMC

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	remains any it should be used for realignment (diversion) of the existing road. • Dredge soil should be either utilised for construction activity or disposed off along with excavated soil to the identified debris disposal site • Green belt (area of 3 acres) should be developed at the site and as per the Green Belt Management Plan (**Annexure 1.1**) • Survival rate of tree should be regularly monitored. It is should be minimum 70%. • Work timings should be restricted from 6:00 AM to 10:00 PM. Adequate illumination should be provided at site during evening hours • Rest area should be provided for workers at site and sleeping/lying down at site should be strictly prohibited to prevent accidents • Develop and obtain approval from IWAI for occupational health & safety management. The plan should follow safety guidelines as given at **Annexure 1.2** and other tools such as OSHAS 18001 • Movement of construction vehicles shall be restricted to the designated haulage roads only to prevent compaction of soil in other areas • The earth stockpiles to be provided with gentle slopes to prevent soil erosion. • Sedimentation tanks shall be provided with storm water drain to arrest the sediments and these sediments shall be removed and stored with remaining excavated soil • Existing river bank protection is sufficient for shore protection. • Wash-off from concrete mixing tanks and wash from washing area shall not be allowed to enter the soil. This wash shall be collected	requirements					

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	through drains into tanks and concrete shall be settled, collected, dried and re-used in the site again **Solid Waste Management:** • Arrangement should be made for segregation of waste into recyclable and non-recyclable waste • Non-recyclable waste generated should be disposed regularly through authorized agency. Recyclable waste should be sold to authorized vendors. • Construction waste generated should be segregated at site into recyclable, reusable & rejected fraction. Recyclable should be sold to authorized vendor, reusable waste should be stored at site for usage and rejected fraction and debris should be disposed at waste disposal site of Haldia Development Authority. **(Annexure 1.3)** • Any waste oil generated from construction machinerythat should be stored on concrete platform and disposed off to authorized recyclers.						
❖ Setting of Labour Camps: contamination of land and water resources from municipal waste from Camps, worker's health, Pressure on natural resources due to establishment	**Location of Camp:** • Construction camp sitting, establishment, location and management should be as per proposed Construction & Labour Camp Management Plan **(Annexure 1.4)** • Labour camps should be located within the construction sites to the extent possible **Sanitation and Worker's Health & Safety:** • Hygiene in the camps should be maintained by providing good sanitation and cleaning facilities. Soak Pits can be provided only if labour camp is located away from river. • Camp should be well ventilated. It should have adequate provision for illumination,	The Building and Other Construction workers (Regulation of Employment and Conditions of Service) Act 1996 and Cess Act of 1996 and The Water (Prevention & Control of Pollution) Act, 1974 and amendments	Labour Camp Locations	During design and Construction Stage	For camp for sanitation and health facilities.	Contractor.	IWAI/PMU/PMC

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
of labour camps	kitchen and safe drinking water facility. Proper drainage to be maintained around the sites to avoid water logging leading to disease • Proper sanitation facility like toilet and bathing facility should be provided at site and labour camps. Wastewater generated from these facilities should be disposed off through septic tanks and soak pit • Preventive medical care to be provided to workers • Segregated, collection and disposal of solid waste on regular basis at municipal solid waste disposal location of Haldia development Authority. • Provision should be made essential material supply like cooking fuel (gas) • Provision should be made for day crèche for children • First aid facilities, first aid room, first aid trained personnel and ambulance should be provided at the site 24 X 7. Also tie-ups with local hospital should be done to handle emergency case, if any • Rest area should be provided at the site where labour can rest after lunch and should not lie on site anywhere • Working hours of labour should not exceed than standard norms as per state factory law • Wastewater from construction site should not be allowed to accumulate at site as standing water may lead to breeding of mosquitoes. Septic tanks/soak pits should be provided for its disposal • Temporary storm water drainage system should also be provided at camp site and construction site so as to drain the storm water and prevent accumulation of storm	thereof. Municipal Solid Wastes (Management and Handling) Rules, 2000					

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	water at site and thus breeding of mosquitoes/flies						
❖ Setting up Concert Mix Plant, Hot Mix Plant, Mechanical Workshop, Fuel storages, Lubricant storages	• All these facilities shall be installed at proposed terminal site itself. • All maintenance facilities, hot mix plant and concrete mixing plant shall be established with prior consent to establish to be obtained from WBSPCB. • All such equipment/plant shall be fitted with air pollution control system and shall comply with condition of consent to establish. • Periodic monitoring shall be carried as per consent conditions.	Air (Prevention and Control of Water Pollution) Act, 1981 and Water (Prevention and Control of Water Pollution) Act, 1974	Site construction Camp	During design and construction Stage	For camp for waste management facilities.	Contractor	IWAI/PMU/PMC
4. Site Preparation: Power supply, Water Supply, and Drainage, disposal of piling muck and debris							
❖ Power supply and Energy Conservation: Air Pollution, energy loss	• Power shall be sourced from State electricity board during construction stage as well as operation stage. • DG sets shall be used only in case of power failure. DG sets shall be enclosed in acoustic enclosures and shall be provided with stacks as per CPCB norms to discharge exhaust gases • Solar energy shall be used in common lighting area on 1:2 basis. • Energy Conservation Building Code shall be used as applicable to various office and other structures.	Air (Prevention and Control of Water Pollution) Act, 1981 & ECBC Norms, 2007	Construction Sites and Labour Camp Locations	During design and construction stage	Part of Project Costs	Contractor.	IWAI/PMU/PMC
❖ Water Supply, Drainage and effluent discharge	• Construction water requirement shall be sourced from municipal supply and necessary permission should be taken from concerned authority. No ground water or river water should be used because the CGWB has already classified the Haldia as Notified area. • Caution signage shall be placed at site for optimal use of water • Garland storm water temporary drains shall	Central Ground Water Board, Water (Prevention and Control of Water Pollution) Act, 1974	Construction Sites and Labour Camp Locations	During design and construction stage	For construction of grease traps and de-siltation chambers	Contractor.	IWAI/PMU/PMC

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	be provided around the excavated or activity area so as to divert rainfall run-off away from these locations. These pits shall be covered during rainy season to the extent possible. Excavation shall be avoided during monsoon season. • Storm water drains shall be connected to sedimentation tank for arresting the sediments before discharging into the river • All washing and maintenance effluent from the workshop area of vehicle maintenance area should Darin to separate collection areas fitted with oil and grease trap and de-siltation chamber. The treated water shall be used for dust separation and green belt development. This water shall not be discharged in to river at all. • Vehicle washing and maintenance workshops shall be located away from river • Rain water should be collected into rain water harvesting ponds which should be used for various construction activities and dust suppression.						
❖ Disposal of piling earth, muck and debris: uncontrolled disposal may lead to increased sedimentation of the river.	• Top soil (15 cm) should be stripped and preserved under covered conditions. This should be stored in the form of the heap with the slide slopes covered with grass. Excavated soil should be used within the site for levelling purpose (3.3 lakh cum to be used for levelling). All the soil will be used for levelling within the site. • Provision shall be made for collection and draining of water for the piling earth. Possibility should be explored for using it for filling land. If not feasible it should be disposed off to TSDF. • Piling earth or dredged soil shall not be disposed off on the River bank as they are	Solid Waste (Management & Handling) Rules, 2015	River Bank along the terminal site	Pre-Construction and construction Stage	Part of Project Costs	Contractor.	IWAI/PMU/PMC

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	critical habitats especially during the breeding and spawning season. • Provision shall be made for geo Synthetic Screen or turbidity traps for arresting silt flowing down stream.						
5. Embankment Design and Construction, Drainage Pattern							
❖ River Bank Erosion Protection: Construction of Embankment and construction of berths may lead to accumulation of sediments on the updrift side and erosion of the downdrift side.	• The existing river bank protection work is adequate to prevent river bank erosion. • Erosion monitoring shall be carried out periodically downstream as well. • River Bed material/dredged soil shall be tested for toxicity before its use or disposal for land fill site. If any level of heavy metal contamination or toxicity is found than it shall be disposed off in a secure manner to TSDF location of Haldia Dock complex.	Water (Prevention and Control of Water Pollution) Act, 1974	River banks along the terminal site	During design, Pre-Construction and construction Stage	Part of Project Costs	Contractor.	IWAI/PMU/PMC
❖ Dredging activities: Impacts on fishes, and benthic organisms	• As part of the detailed engineering design and when dredging is required, the Contractor shall prepare a Dredging plan that will ensure no adverse impacts shall occur on the local biodiversity. The Dredging Plan shall comply with the following: • Roles and Responsibilities. Define roles and responsibilities for implementing and adhering to the commitments made within this Dredge Management Plan. • Legislative Requirements and Guidelines. All dredging and disposal of dredge material will be undertaken in compliance with relevant national and state legislation. In case no standards exist, best	Part of EMP/Wild Life Protection Act, 1972	In river stretch along the terminal	During design and construction stage	Part of Project Costs	Contractor.	IWAI/PMU/PMC

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	international practice will apply. • Studies on the existing Environment: Contractor shall carry out supplementary EIA study including Key Environmental Sensitivities, Physical Freshwater Environment: Riverbed morphology and geology, Bathymetry, Hydrodynamics, Sediment quality. Fresh Water Quality: Physiochemical, Chemical, Sediment plume modelling. Biological freshwater Environment: Benthic Primary Producer Habitat, Freshwater Fauna. • Dredging Environmental Impact Assessment and Management: The Contractor shall prepare a supplementary EIA to establish potential impacts and its effective management in terms key performance indicators, mitigation and monitoring measures on the: freshwater quality, benthic primary producer habitat (BPPH), tidal, riverbank including bank, freshwater fauna, dredge materials disposal and spoil ground management • The Dredging Plan shall highlight the following: • Location of dredging sites must avoid key habitat areas such as breeding and feeding grounds etc. of key biodiversity species found in the project area. • The schedule or time of dredging must avoid breeding season of fishes etc. • Decisions on method of dredging and type of technology and equipment to be used must consider the noise and vibration levels and extent of siltation being generated. Noise and vibration levels must be far below levels that can cause injury to aquatic animals and other wildlife. The						

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	dredging space must include measures to contain silt or suspended solids to a minimum area within the river as excess siltation can hamper wildlife activities. • Appropriate protocols and procedures must be prepared for sighting of endangered wildlife species (migratory birds, reptiles etc.) within the vicinity of the dredging site. The objective of the protocols and procedures must be aimed at having no or minimal impacts on the respective wildlife species. • Dredged soil shall be tested for contamination and toxicity and accordingly shall be disposed • Dredged soil shall not be pilled on the River banks						
❖ Drainage Pattern	• Natural Drainage pattern of area around shall be maintained. • Storm water management drains shall be provided at site for management of storm water management		Construction Sites and Labour Camp Locations	During construction stage	Part of Project Costs	Contractor.	IWAI/PMU/PMC
6. Construction Material Sourcing							
❖ Borrow areas for sourcing earth for filling as required (erosion, loss of productive land, land degradation, air pollution)	• Earth will be required only for filling of land to achieve finished level of 7 m amsl. Sand may be required to be brought from borrow areas. Borrow areas should be established as per the borrow area management plans attached as **Annexure 1.5.** Following guidelines should be followed for establishment and closure of borrow areas • Non-productive lands, barren lands, raised lands; wastelands shall be used for borrowing earth with the necessary permissions/consents. • Agricultural areas not to be used as borrow areas unless requested by the landowner	IRC Guidelines on borrow areas and for quarries. EIA Notification 2006(under Environmental Protection Act and Rules, 1986;)	All Identified Borrow sites	During design and construction stage	Part of Project Costs	Contractor	IWAI/PMU/PMC

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	for lowering the land for making it cultivable. • Environmental Clearance from State Environmental Impact Assessment Authority under EIA Notification, 2006 and required permission from District Magistrate shall be obtained prior to excavation. Copy of this permission shall be submitted to IWAI before start of excavation. • Record of location, area, accessibility to the location and photograph of borrow area should be maintained prior to excavation • Site selected for borrow area should be approved by PMC/PMU & IWAI expert prior to excavation • Ridges of not less than 8m width will be left at intervals not exceeding 300m. Small drains will be cut through the ridges, if necessary, to facilitate drainage. • The slope of the edges will be maintained not steeper than 1:4 (vertical: Horizontal). • Topsoil to be stockpiled and protected for use at the rehabilitation stage. • Rehabilitation shall be satisfactorily undertaken immediately after the use has ceased and at least three weeks prior to monsoon. • Unpaved surfaces used for the haulage of borrow materials to be maintained. • Transportation of earth materials shall be through covered vehicles. • Borrowing should be carried out within 20 kms area of the project site so as to minimize the emission due to earth transportation. Dredged soil and debris resulting from realignment of road should be used for the site filling to the extent						

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	possible.						
❖ Quarries for sourcing stone and aggregates (loss of productive land, land degradation, air pollution. Any illegal quarrying may lead to land use change, unstable rock formation)	• Aggregates required for construction of terminal shall be sourced from nearby quarries • It shall be ensures that selected quarries are having requisite environment clearance, and comply with Air Pollution Control and Noise level requirements as per the law. • Material shall be transported in covered vehicles only. • Each Quarry shall be visited prior to its selection to ensure its compliance with lease conditions, EC and consent conditions.	EIA Notification 2006(under Environmental Protection Act and Rules, 1986;)	Quarry Site	During design and construction stage	Part of Project Costs	Contractor	IWAI/PMU/PMC
7. Protection of Flora and Fauna							
❖ Protection of terrestrial flora & fauna	• No significant flora is present at the site except some shrubs and herbs. Some trees are existing along the road to be diverted which will be retained as part of green belt. Project layout design shall be in a way to minimize tree cutting along the road. At present no tree cutting is envisaged • No terrestrial fauna is present in site except common avifauna. • Permission shall be obtained from forest department if tree cutting is required. • Thick green belt (3 acres) shall be developed as per the CPCB guideline at the periphery and along the roads on the project site which will prevent spread of dust and reduce noise propagation. • Areas reserved for future development at site shall also be made green by growing grass and shrubs and herbs						

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	• Provision shall be made for strict penalty for hunting/harming any animal • Construction activities shall be restricted to 6:00 Am-10:00 Pm especially noise generating activities. • Workers should not use any timber or firewood as fuel for any purpose. LPG should be made available to workers in construction camp. • No hazardous material or waste shall be disposed off in the other land or nearby area as it may harm the animals, if consumed accidently. • Speed limit will be regulated to prevent any leakage of oil so as to prevent pollution of the soil and impact on fauna and flora dependant on soil. • Regular Water Sprinkling shall be carried out to minimize dust generation and settling the dust on surface of flora. • Construction activities and vehicle washing should not be undertaken at the river or any other water body or close to the water body • Site should be barricaded to prevent entry of the animal in the site • Hunting, poaching and harming any animal (wild or domestic) by any worker or project related person should be strictly prohibited and monitored • Illumination at the night time should be reduced during the night time (if no activity is going on) as it may disturb the nocturnal animals • Noise generating activity should not be undertaken during night time to minimize disturbance to animals. Noise levels should be maintained within the prescribed CPCBs						

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	limits to the extent possible during the day time. • Workers should not use any timber or firewood as fuel for any purpose						
❖ Protection of Aquatic Fauna from high sound generation during piling	• The area in which the construction of the Berth (jetty) is planned, advisable to carefully determine drop sites before anchor placement to ensure that fish and other aquatic faunal communities that could locally still be present in the area are not unnecessarily damaged. • Before starting piling allow some time to aquatic fauna to displace from the piling area. Bubble curtains can be provided at the time of pilling so as to displace the aquatic fauna prior start of construction activities • The piling activities must be carried out in shortest possible timeframe as possible • All the debris shall dispose away from river course as per debris management plan of the project. • Decisions on method of construction and type of technology and equipment to be used must consider the noise and vibration levels and extent of siltation being generated. Noise and vibration levels must be far below levels that can cause injury to aquatic life. • Noise reducing devices like mufflers, enclosures shall be fitted with the equipments as much as feasible. Erecting barriers shall also be installed • Fish exclusion devises shall be installed in water column around the pile driving area to prevent fish access • Geo Textile synthetic sheet curtain & turbidity traps shall be placed around pilling	Wild Life (Protection) Act, 1972	Around Pilling Area	During design and construction stage	Part of project costs	PMU through DFO	IWAI/PMU/PMC

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	and construction area to prevent movement of sediments and construction waste						
❖ Protection of Aquatic Fauna from increased sedimentation in water body during piling & dredging and other construction activities	• To avoid the construction debris wash or blown into the water the area shall be surrounded by silt screens, which must be placed in the water before the work starts. Geo-Textile synthetic sheet curtain can act silt screen which should be placed around pilling and construction area to prevent movement of sediments and construction waste. The screens should also be placed around storage areas, to prevent waste from blowing away and to prevent sediment run-off into the river. The storm water drain shall be connected to temporary sedimentation pit and collected water shall be used for dust suppression. Run-off from site should also pass through oil/grease traps and flow down to the same sedimentation tank before its reuse • In addition to silt screens, building guidelines of the Bonaire National Marine Park require that storage areas for sand and soil, and all work areas, must be at least 20 meters away from the high water mark and construction equipment must not be cleaned or washed within 50 meters of the high water mark. • Piling and dredging activities should be carried out rapidly. Piling should not be carried out during breeding and spawning season means during rainy season. It should be carried out in low water season, i.e. pre-monsoon • Equipments shall be maintained in good condition to prevent leaks or spills of potentially hazardous materials like hydraulic fluid, diesel, gasoline and other	Wild Life (Protection) Act, 1972	Around Pilling Area	During design and construction stage	Part of project costs	PMU through DFO	IWAI/PMU/PMC

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	petroleum products • Excavation and filing activities onshore should not be undertaken during monsoon season so as to minimize sediment load of run-off • Workers should be trained to handle the equipment and material at site so as to minimize the spillage of materials and contamination of water • All workers should be made aware of not throwing any waste in the river or any drain • No construction debris/ already accumulated solid waste at site or waste generated from labour camp should be thrown in river or any drain • Sewage generated from labour camp should not be directed into river but should be disposed off through septic tank/soak pit • Aquatic ecology monitoring should be carried out prior start of construction and after completion of construction so as to assess the impact of construction activities on aquatic life. • All construction and operation equipment shall be maintained in good condition shall be checked for oil & grease leakage • Dredged soil shall not be disposed off in river or its banks especially during breeding spawning seasons of aquatic organisms						
8. Air Quality							
❖ Fugitive Dust Generation due to construction activities and Exhaust gas emissions from machinery and	• Barricading the site to prevent dust dispersion to nearby areas • Excavation and filling to be carried out in parallel and in phases. • Water spraying on earthworks, unpaved haulage roads, other dust prone areas and construction yard. Flow of water sprinklers	Environmental Protection Act, 1986 and amendments thereof; The Air (Prevention and Control of	Construction sites, Loading areas, storage areas,	During the Construction phase	Part of project Costs	Contractor	IWAI/PMU/PMC

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
vehicular traffic	shall be maintained to avoid water accumulation. • Proper servicing and maintenance of excavators/levellers/loaders and other machinery to minimize the emission generation • Top soil stripping before excavating the soil and storage under covered conditions for usage in landscaping at later stages • Storage of surplus excavated soil in covered conditions for its use for construction of roads and railways or for filling the depressions areas. • Plantation to be undertaken as per Green belt development plan • Transport of loose and fine materials in covered conditions only • Loading and unloading of construction materials in covered area. • Make Provision of PPEs like face masks to workers. • Raw materials like cement, sand and construction debris should be stored under covered conditions • Development of green belt should be started in the construction stage only within the identified 3 acres of area. • LPG should be used as fuel source in construction camps instead of wood. Tree cutting shall not be allowed for fuel wood. • Mixing Plant, crushers and batching plant shall be located on downwind direction of the site fitted with adequate stack height to ensure enough dispersion of exit gases. with appropriate pollution control measures • Loading and unloading of construction materials shall be made at designated	Pollution) Act, 1981 and amendments thereof					

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	locations in project area with provisions of water fogging around these locations • Low sulphur diesel should be used for operating DG sets and construction equipment. • Regular maintenance shall be carried out of machinery and equipment. • Diesel Generating (DG) sets shall be fitted with stack of adequate height as per regulations (Height of stack = height of the building + 0.2 √ KVA.) • Monitoring of air quality for PM_{10}, $PM_{2.5}$, SO_2, NO_x, and CO shall be carried out quarterly at construction site • Efforts shall be made to move construction material early morning and late evening period. • Transportation vehicle shall strictly adhere to the designated routes and timings and shall avoid the peak traffic hours • Parking space for dumpers shall be provided within the site so as to prevent parking of vehicles on road and other area and thus preventing traffic jams.						
❖ Emissions at access road: avoidance of traffic Jams	• Efforts shall be made to move construction material early morning and late evening period. • No construction, material, equipment or vehicle shall be stored or parked at any road or the non-project area • Transportation vehicle shall strictly adhere to the designated routes and timings and shall avoid the peak traffic hours • Parking space for dumpers shall be provided within the site so as to prevent parking of vehicles on road and other area and thus preventing traffic jams	Environmental Protection Act, 1986 and amendments thereof; The Air (Prevention and Control of Pollution) Act, 1981 and amendments thereof	Existing roads	During the Construction phase	Part of project Costs	Contractor	IWAI/PMU/PMC

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
9. Noise and Vibration							
❖ Noise from construction vehicle, equipment and machinery.	• Barricading (Temporary noise barrier) the construction site to minimize the noise level outside the site boundary • Restriction on Honking at the project site • Hearing test for the workers prior to deployment at site and high noise areas followed by periodic testing every six months. • Job rotations systems for workers, working in high noise level areas • Restriction of high noise generating activity between 6:00 AM to 10:00 PM. • Periodic monitoring (monthly level) of noise levels to check the level of pollutants and effectiveness of proposed EMP • Protection devices (earplugs or earmuffs) shall be provided to the workers operating near high noise generating machines. Construction equipment and machinery shall be fitted with silencers and maintained properly. Noise measurements should be carried out to ensure the effectiveness of mitigation measures and develop a mechanism to record and respond to complaints on noise. • All equipment shall be fitted with silencers/noise mufflers and will be properly maintained to minimize its operational noise. Noise level will be one of the considerations in equipment selection, which will favour lower sound power levels	Noise Pollution (Regulation and Control) Rules, 2000 and amendments thereof	Terminal site	During the Construction stage	Part of project Costs	Contractor	IWAI/PMU/PMC
10. Land-use and Landscape							
❖ Loss of agricultural land and productive	• No agriculture land will be lost for terminal construction. The land is industrial land. However,15 cm of top soil layer shall be	Design requirement	Around project site area	During construction Stage		Contractor	IWAI/PMU/PMC

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
top soil	stripped off prior to excavation and shall be stored separately in covered condition and used for landscaping purpose within the site • Agriculture land should be avoided for establishing borrow areas and waste land preferably be considered for borrowing earth required for filling the terminal site						
❖ Soil erosion due to construction activities, earthwork	• The earth stockpiles to be provided with gentle slopes to prevent soil erosion. • Sedimentation tanks shall be provided with storm water drain to arrest the sediments and these sediments shall be removed and stored with remaining excavated soil • Provision of cross drainage structure like culverts shall be made in the access road if required to maintain the natural drainage pattern and prevent soil erosion. • Provision of side drain shall be made in access road if required to prevent water logging. • The existing bank protection work is adequate for shore protection.	Municipal Waste Rules, 2015, Hazardous Waste Rules, 2008	Terminal site and river bank	During construction Stage	Part of project costs	Contractor	IWAI/PMU/PMC
• Compaction and contamination of soil due to movement of vehicles and equipment	• Excavation, filling and levelling work should be carried out in parallel so as to minimize the soil erosion. Unusable debris material should be suitably disposed off at pre designated disposal locations, with approval of the concerned authority. • Levelling activity shall not be carried out during monsoon season. Levelled areas shall be compacted. • Compaction of soil shall be undertaken by sprinkling the water to minimize the surface runoff and erosion. • Excavated soil shall be used for levelling purpose and left if any shall be stored in covered conditions for use in existing road	Municipal Waste Rules, 2015, Hazardous Waste Rules, 2008	Terminal site	During Design & Construction stage.	Part of project costs	Contractor	IWAI/PMU/PMC

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	diversion. • Dredge soil shall also be either utilised for construction activity or disposed off. • Fuel shall be stored in HDPE containers on paved surfaces with provision of catchment pit to prevent soil contamination from oil spillages. • Municipal waste likely to be generated at site shall be collected in segregated manner with the use of two bin system at site. It shall be segregated into biodegradable and non-biodegradable waste. Provision of bio composter shall be made at site. The biodegradable material shall be decomposed for production of compost for use at site. The non-biodegradable waste shall be disposed off to predefined land fill site of Haldia Development Authority. • Septic tank or mobile toilets fitted with anaerobic treatment facility shall be provided at construction camp. • Aggregates will be sourced from existing licensed quarries. Copies of consent/ approval / rehabilitation plan for a new quarry or use of existing source will be obtained by contractor and submitted to IWAI. • Hazardous waste like used oil from DG sets shall be stored in HDPE containers and shall be stored on paved surfaces in isolated location to prevent its spillage and contamination of soil. Used oil shall be disposed off through authorized vendors only. • Movement of construction vehicles shall be restricted to the designated haulage roads only. • Wash-off from concrete mixing tanks and						

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	wash from washing area shall not be allowed to enter the soil. This wash shall be collected through drains into tanks and concrete shall be settled, collected, dried and re-used in the site again.						
11. Water Resources							
❖ Depletion of Groundwater resources due to unregulated abstraction for construction purpose	• No ground water should be used for construction purpose. However, the rain water shall be stored in rain water harvesting pond and shall be utilized for dust suppression and watering the greenbelt • No waste water should be stored on the site in unlined ponds	Water Act, 1972		During Construction stage	Part of project costs	Contractor,	IWAI/PMU/PMC
❖ Increase in water Siltation levels due to construction of terminal and contamination due to disposal of domestic waste	• Washing of vehicle and equipment shall not be carried out at river, green belt canal or any water body. Washing area should be provided with the storm water drains fitted with oil & grease trap. • Piling of the raw materials & debris shall be avoided at the site. Storage of debris and raw material shall be carried out in paved and covered areas. This will minimize interface of run-off with raw material and debris. • Site should be cleaned regularly • Septic tank/soak pit shall be provided at site for disposal of sewage from the toilets at site and from the labour camps. Adequate toilets & bathrooms shall be provided to prevent open defecation. Wherever septic tanks are not provided mobile toilets with anaerobic digestion facility shall be provided and no domestic waste shall be discharged in to river.	Water Act, 1972	Terminal Site	During Construction stage	Part of project costs	Contractor	IWAI/PMU/PMC

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	• Water use shall be minimized by using RMC, practicing curing by water sprinkling, maintaining flow of sprinklers, covering the water storage tanks to minimize water evaporation, creating awareness for water conservation and regular inspections at site to monitor the leakages in water storage area • Temporary rain water storage structures should be provided at the site to store rain water and this water should be used for sprinkling and construction activities • In case RMC is not used then concrete transit mixer should be washed and cleaned daily. Wash from these mixers shall be collected in block work tanks which will allow settling of concrete, removal of aggregates and allowing the waste to wastewater drain. This collected waste concrete can be dried and used for various purposes at site like construction of temporary roads at site. • Wastewater generated from the washing/cleaning area after passing through oil & grease trap & curing area shall be re-used for water sprinkling and wheel washing • Fuel shall be stored in leak proof containers and containers shall be placed on paved surface. • The piling work in river shall be undertaken during low flow period. • Drains along with turbidity traps/curtains should be provide or Geo-Textile synthetic sheet curtain shall be placed around pilling and construction area to prevent movement of sediments and construction waste. • Sedimentation tanks shall be provided at the site so as run-off from site shall enter the sedimentation tanks before discharging into						

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	the river. Sedimentation tanks will trap the sediments in the run-off • Provision shall be made for geo Synthetic Screen for arresting silt flowing down stream. • Proper collection, management and disposal of construction and municipal waste from site shall be made to prevent mixing of the waste in run-off and entering the water bodies • Natural Drainage pattern of area around shall be maintained • Dredged soil shall be tested for toxicity & contamination, if toxic/contaminated shall not be disposed off back in water and should be send for disposal to TSDF • Monitoring of surface water quality shall be carried out on monthly basis to check the level of pollutants and effectiveness of proposed EMP						
12. Socio-economy, Accident and Safety Risks							
❖ Impact on Social life	• Separate SIA is being carried out to anticipate the impact on socio-economy of the area which can be referred to understand the impact on socio-economy on the project in detail. • Skill training and assistance should be given to local people so as they can preferably be employed at the site • Local labour should preferably be employed for construction purpose • Site should be barricaded and should have entry guarded by security guard. Register should be maintained for entry of outsiders. No unauthorized person should be allowed to enter the site.	Labour Laws	Construction sites and labour camps	During construction period	Included in project design	Contractor	IWAI/PMU/PMC

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	• A board should be displayed at entrance of site displaying name of project, area and hazards associated with the site on entrance and activities prohibited within and near site area in local language. • Fishermen should be consulted prior restricting fishing activity in the activity area • Necessary permits should be obtained from concerned authorities in case any quarry site, batching plant, hot mix plant, WMM plant etc. is set up. • Management, rehabilitation and closure of these sites should be as per the Management plans proposed for these sites. • Implementation of EMP adequately so as to prevent environmental pollution and its impact on socio-economy due to project development						
❖ Accident risk from construction activities and health & safety of workers	• Adequate illumination should be provided at site during evening and night time till the work is being carried out. • Rest area should be provided at site in which workers can rest after the lunch hours • Workers should wear the personal protective equipment like helmet, gum boots, safety shoes, safety jackets, ear plugs, gloves etc. while working. • Noise level in the work zone should be maintained and followed as per OSHAS norms • Contractors should adopt and maintain safe working practices. SOPs should be prepared for each and every activity and all activities should be undertaken as per SOPs under supervision of site engineer. • Training should be given to workers to handle the heavy equipment so as to	Central Motor and Vehicle Act 1988 EP Act 1986 Noise Rules 2002	Construction sites	Construction period	Part of project costs	Contractor	IWAI/PMU/PMC

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	prevent accidents • Training should be given to workers to handle emergency situation like fire, earth quake, cyclone and flood. • Emergency preparedness plan should be available at the site all the time and mock drills for workers should be conducted from time to time • Complete medical check-up should be done for workers prior to joining and after six months of joining. • First aid facilities, first aid room, first aid trained personnel and ambulance should be provided at the site 24 X 7. Also tie-ups with local hospital should be done to handle emergency case, if any • List of emergency nos., hospital contacts, ambulance contacts and doctors contacts should be displayed in first aid room, rest area and at all required location • Working hours of labour should not exceed than standard norms as per state factory law • Labour camps should be located at neat and clean location with no water logging issues and should be well ventilated with adequate illumination, kitchen and safe drinking water facility • Construction labour camps and site should be properly cleaned and hygiene should be maintained • Proper sanitation facility like toilet and bathing facility should be provided at site and labour camps. Wastewater generated from these facilities should be disposed off through septic tanks and soak pit • LPG should be provided as fuel for cooking to workers and open burning of fuel should not be allowed						

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	• Temporary storm water drainage system should also be provided at camp site and construction site so as to drain the storm water and prevent accumulation of storm water at site and thus breeding of mosquitoes/flies • Safety officers should be appointed at site so as to ensure all safety measures are taken at the site • Activity like smoking and consuming liquor should be prohibited at the site • Awareness on AIDS should be spread among the workers • Traffic manager should be present at the site all the time to manage incoming and outgoing traffic to prevent accidents • Crèche facility should be provided for kids if female workers are employed • Speed limit of vehicles should be restricted at site to prevent any accidents and fines should be imposed on vehicles if same is not maintained. All construction vehicles should follow the designated routes & timings only. • Dustbins should be provided at labour camps for collection of waste and waste should be regularly disposed off through the concerned agency • Arrangement of fire-fighting should be made at site and workers should be trained to use the system in case of fire • Sprinkling of water should be carried out in haul road to minimize dust generation due to movement of construction vehicles.						

Table 1.3 : Environment Management Plan Haldia Terminal During Operation Phase

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
OPERATION AND MAINTENANCE STAGE								
1. Climate								
1.1 Impact on Climate	• Ensuring survivability of trees planted under greenbelt minimum 70% survival rate and create additional GHG sink by planting additional trees • Adopting all energy efficiency measures e.g. the terminal building should have a platinum rated for Green building provisions • Street lighting solar lighting provisions (on 1:3 ratio of minimal needs) along with solar power generation system should also be provided as to meet the other power requirements of the terminal thus reducing dependence on power grid supply.	Kyoto Protocol, National Water Policy, 2012, Forest Conservation Rules & National Forest Policy	Terminal site	Survival rate of trees and monitoring performance of energy conservation equipments	• Observations and inspection	Aftercare & Monitoring of 1200 trees	IWAI	IWAI
2. Air Quality								
2.1 Air pollution due to due to vehicular movement& loading and unloading areas	• Construction raw material and debris shall be transported and stored in covered condition • Transportation vehicle shall be properly serviced and maintain and shall carry PUC certificate • Thick green belt shall be developed as per the	Environmental Protection Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981	Through out the project area	MI: Ambient air quality (PM_{10}, CO, SO_2 NO_x) PT: Levels are equal to or below	• As per CPCB requirements • Site inspection	Included in Operation / Maintenance cost	IWAI	IWAI

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	provision already made in the design (3 acres green belt area) and maintained all along the periphery and along the roads. The green belt shall be developed in canopy shape with local species of broad leaf variety. Species selected for development of green belt shall also be tolerant to expected pollutants and shall have the ability to adsorb the pollutants. Suggested species are suitable for different areas are also listed under CPCB guidelines for green Belt development. • Water sprinkling should be carried out during all loading and unloading activities and in storage yards. Further dust suppression measures should be taken at the site like vaccum collectors at dust generation areas. • Fly ash will be stored in ash silos with dust extraction system and pneumatic conveying system shall be used for loading unloading • Moisture should be maintained in coal to prevent the fire in coal. Also the fire-fighting facility where coal			baseline levels given in the EIA report				

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	storage, loading & unloading is done • Fire-fighting facility should be provided at the edible oil/POl storage area so as fire can be controlled immediately • Mechanical conveying system with provision of dust collection should be provided for barge loading for stone aggregates& fertilizers • Green belt planted should be maintained and survival rate of plantation should be maintained to minimum 70% • Monitoring of air quality shall be carried out on monthly basis to check the level of pollutants and effectiveness of proposed EMP • It is recommended to provide mechanical conveying system with provision of dust collection system for loading/unloading material from barges. Pneumatic transfer only should be preferred for flyash transportation • Minimizing free fall of materials to reduce the dust generation • Minimizing dry cargo pile heights and containing piles							

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	with perimeter walls • Removing materials from the bottom of piles to minimize dust re-suspension • Regularly sweeping docks and handling areas, truck / rail storage areas, and paved roadway surfaces • Keeping transfer equipment (e.g. cranes, forklifts, and trucks) in good working condition[3] • Upgrading the land vehicle fleet with less-polluting trucks and vehicles, and using alternative fuels and fuel mixture							
2. Noise Quality								
2.1 Noise due to operation	• Site boundary should be provided which can act as noise barrier • Provision of thick green belt along the boundary and roads which will act as noise buffer • Earplugs should be provided to workers involved in unloading operations • Provision of thick green belt along the boundary and roads which will act as noise buffer	Noise Rules, 2000	Site and Nearby areas	MI: Noise levels–day& night PT: Levels are equal to or below baseline levels given in the EIA report	Measuring by noise meter 24 hourly	Included in Operation / Maintenance cost	IWAI	IWAI

[3] IFC Environmental, Health & Safety Guidelines-Ports, Harbors and Terminals

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	• Timely maintenance and servicing of transportation vehicles and the machinery/pumps to be used during operation phase to reduce the noise generation due to friction and abrasion • Honking shall be prohibited at the project site • Hearing test for the workers shall be undertaken before employing them and thereafter shall be done after every six months • Job rotations should be practised for people, working in high noise level areas • No noise generating activity shall be carried out between 6:00 AM to 10:00 PM • DG sets shall be provided with acoustic enclosure • Monitoring of Noise levels shall be carried out on monthly basis to check the level of pollutants and effectiveness of proposed EMP							
3. Land and Soil								
3.1 Soil erosion at embankment during heavy rainfall.	• Periodic checking to be carried to monitor the soil erosion along the River Banks at and near terminal area	Project requirement	Along river bank	MI: Existence of soil erosion sites	On site observation	Included in Operation / Maintena	IWAI	IWAI

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	• Necessary maintenance should be undertaken wherever it is required			Number of soil erosion sites PT: Zero or minimal occurrences of soil erosion		nce cost		
3.2 Soil contamination	• Fuel shall be stored in HDPE containers on paved surfaces only to prevent spillage of fuels on the soil and thus soil contamination. • Edible oil and POL shall be stored in HDPE drums on paved surface. • Dustbins shall be provided at all the required locations at the site for collection of recyclable and non-recyclable waste. • Recyclable waste shall be sold to authorized vendors and non-recyclable waste shall be disposed off through authorized agencies and shall not be dumped in open. • Used oil from DG sets and other equipment shall be stored in HDPE containers in isolated location on paved surfaces and shall be	Project requirement	Terminal site, access road and along river bank	MI: Existence of soil erosion sites Number of soil erosion sites PT: Zero or minimal occurrences of soil erosion	On site observation	Included in Operation / Maintenance cost	IWAI	IWAI

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	disposed through authorized vendors only and shall not be dumped in open. • Room shall be provided for storage of E-waste at site and this waste shall be sold to authorized vendors periodically and shall not be dumped in open. • Bio- medical waste likely to be generated at first aid centre shall be disposed of following the bio medical waste disposal rules • Dredged soil shall be tested for toxicity prior disposal, if toxic it shall not be disposed off back in water and should be send for disposal to TSDF of Haldia Dock Complex • Municipal waste generated at terminal should either be sent for landfilling through authorized agencies or shall be composted within the terminal site and manure should be used for maintaining the green area within the site • Vessel waste reception facility should be available at the terminal site incase maintenance facility is not in place. The waste should be received from the vessel in							

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	proper segregated and packed form. This waste should be treated and disposed within the terminal site only but in case it is not feasible, tie ups with Government and authorized private agencies can be made for handling, treatment, storage and disposal of this waste. Also fee can be imposed on the vessel operator for letting them dispose their waste at terminal/maintenance facilities.							
4. Water resources/Flooding and Inundation								
4.1 Siltation	• Regular checks shall be made for bank protection works so as to check the bank erosion and increased sediment level in the river	Project requirement	Near surface Water bodies	MI: Water quality PT: No turbidity of surface water bodies due to the terminal activity	Site observation	Included in Operation/ Maintenance cost	IWAI	IWAI
4.2 Water logging due to blockage of drains, culverts or streams	• Regular visual checks and cleaning of drains provided at site shall be done to ensure that flow of water is maintained and prevent water logging. Drains and cross drainage structures	Project requirement	Near surface Water bodies	MI: Presence/ absence of water logging along the	Site observation	Included in Operation/Maintenance	IWAI	IWAI

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	shall be regularly cleaned and de-silted • Drains shall be regularly cleaned and de-silted • Monitoring of water borne diseases due to stagnant water bodies • Storm water drains provided in parking & road areas shall be provided with oil & grease traps			approach road/terminal area PT: No record of overtopping/ Water logging		cost		
4.3 Waste Water treatment and conservation	• Provision of storm water harvesting system at site. Surface storm water shall be collected in collection pond at the site and will be retained for 30 min. This water can be again used for dust suppression purpose within the site. Roof top rain water should be collected ins separate collection pond and should be used for horticulture and cleaning purpose at site. • Sludge from the dump pond for storm water shall be sent for disposal along with other municipal waste • Toilets to be provided with running water facility to prevent open defecation. • Sewage generated at terminal site shall be treated in house. STP of 30 KLD	Project requirement	Project area	MI: proper treatment PT: treated water quality check	Treatment parameter, ph, BOD, TDS etc.	Included in Operation/Maintenance cost	IWAI	IWAI

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	shall be provided for treatment of sewage and treated water shall be reused in green belt development and dust suppression. No waste/wastewater shall be discharged in river or dumped into the ground • Water conservation fixtures shall be installed in toilets and kitchen area. Some of the water conservation fixtures which can be installed are dual flushing cisterns, sensor taps, low water urinals etc. • No wastewater shall be received from vessels and vessels should not be allowed to discharge their wastewater and solid waste in river • Fuel shall be stored in leak proof containers and containers shall be placed on paved surfaces • Dredged soil shall be tested for toxicity, if toxic shall not be disposed off back in water or river banks and should be send for disposal to approved TSDF of Haldia Dock Complex. • Monitoring of surface water quality shall be carried out							

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	on monthly basis to check the level of pollutants and effectiveness of proposed EMP • Oil should be stored in leak proof containers and storage area should be provided with facility of collecting the oil in case of spillage. The storage facility should be so designed that spilled oil shall not enter the storm water and sewage drains or storm water storage pits. Oil storage facility should be contained. Oil & grit seperators should be provided in the storm water drains in these areas. • Fuelling of vessels is not proposed at terminal facility but in case fuelling is carried out then Fuel dispensing equipment should be equipped with "breakaway" hose connections that provide emergency shutdown of flow. Fuelling equipment should be inspected daily to ensure all components are in satisfactory condition							
5. Flora& Fauna								
a. Terrestrial Flora & fauna	• Thick green belt in area of 3 acres will be developed at site by the time operation	Forest Conservatio	Project tree	MI: Tree/plants	Records and field	Operation/	IWAI/Forest	IWAI

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	starts at the project site. This will improve the ecology of the area and will provide the habitat to avifauna. • 70% survival of the plantation shall be maintained. The tree survival audit to be conducted at least once in a year to assess the effectiveness • Dust suppression should be carried out • Water sprinkling should be carried out on internal as well as existing approach road to the site • Stack height in DG set shall be provided as per the CPCB norm. • Native plant species should preferably be planted at site • Shed leaves, branches and flowers should be composted and should be used as manure within the site • STP sludge should also be used as manure at the site. No chemical fertilizers, pesticides or insecticides should be used at site as it may wash-off with run-off and may enter the river impacting aquatic ecology • Possibility of composting the	n Act 1980, Wild Life Protection Act, 1972	plantation sites.	survival rate PT: Minimum rate of 70% tree survival	observations. Information from Forestry Department	Maintenance Cost	Department	

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	food waste within the site should be explored and composted waste should be used as manure within the site • Instruction should be given to all the workers and visitors that no harm to the plantation at the site or any animal should be done within the project premises •							
b. Impact on Aquatic Flora & Fauna due to vessel movement & discharge of waste c. Impact Due to Oil spillage	• Water sprinkling should be carried out at the storage yards to minimize the dust generation and settling the dust on the River surface • Stone aggregates and fertilizers should preferably be loaded or unloaded from barges through mechanical covered conveyor system than through pay loaders/trucks/barge loaders • Moisture should be maintained in coal to reduce coal dust generation during loading/unloading at berth. • The solid wastes, sewage, oily ballast, bilge water and bunker fuel bottoms generated from barge should not be discharged directly and it should be discharged as per the norms. Cargo Operators	Bio-diversity conservation rules, Wildlife Protection Act, 1972	River stretch along the terminal	MI: Aquatic species PT: Should and similar to baseline	Surveys	For Aquatic Ecology Survey	IWAI	IWAI

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	needs to exercise all caution to avoid any kind of accidental discharge of such wastes. No provision of maintenance and repairing and fuel refilling of barge and vessels is proposed at terminal site hence chances of oil spillage is almost negligible due to maintenance activities. • No wastewater or waste should be disposed off in river from terminal site or from vessel into the water. Penalty should be imposed on the vessels reported of disposing waste/wastewater in the river • Surface run-off from site should be collected and re-used at site for dust suppression. Run-off from building should be collected separately and should be used for plantation and cleaning purpose. • STP should be provided at site for treatment of sewage generated. No sewage should be allowed to enter in the river. Treated water from STP should be reused completely at site and should not be discharged into river							

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	• Dredged sand should not be disposed off in river or dumped near the river banks. • Dredging should be avoided during the breeding and spawning seasons • Instruction should be given to all vessels and all employee and staff that no aquatic faunal species should be harmed due to any reason • Waiting time of ships should be reduced at the terminal by providing the adequate loading and unloading equipment and vehicles. • Ships should be instructed for not using sharp lights and sounds as they may disturb aquatic organisms • Propeller guards should be provided for all the vessels to minimize the propeller inflicted injuries and scars to the aquatic organisms. • No developments should be brought up on other bank of river opposite to terminal site so as to provide the ground to aquatic organisms for their activities • Nesting grounds, breeding & spawning grounds shall be identified and project							

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	activities shall be minimized in those areas • Time schedule and the quantity of material allowed shall be strictly checked and monitored for each ship. This will prevent overcrowding of the vessels at terminal site and thus no obstruction will be there on movement of the aquatic organisms due to ships. • Waiting time of ships shall be reduced at the terminal by providing the adequate loading and unloading equipment and vehicles. • Ships shall be instructed for not using sharp lights and sounds as they may disturb aquatic organisms • Ship design (of capacity >5000 dwT) should be as per MARPOL and should be provide with double hulls/double bottoms. Speed of oil carrying vessels should be maintained to prevent accidents due to high speed. Sensors and hooters should be fitted with ships which can notify the closeness of another ship or any other potential matter which can cause accident. • Immediate/quick clean-up of							

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	such spills shall be undertaken and ship owners should eb liable for the same. • Crew of the ships carrying the oil should be competent and experienced so as they can prevent the accidents to happen as much as possible • IWAI should carry out the inspections of the vessels which are transporting the material to and fro from the terminal. • Aquatic ecology monitoring should be carried out yearly so as to assess the impact of terminal activities on aquatic life.							
6. Safety								
6.1Accident risks associated with traffic movement.	• Traffic control measures, including speed limits should be forced strictly. • Monitor/ensure that all safety provisions included in design and construction phase are properly maintained • Movement of traffic shall be restricted to designate hours and routes. • Adequate illumination should be provided at the site during evening • Separation of people from	IRC:SP:55	Throughout the Project route	MI: Number of accidents Conditions and existence of safety signs, rumble strips etc. on the road PT: Fatal and non-fatal accident rate is reduced after	Review accident records Site observations	Included in operation /Maintenance cost	IWAI	IWAI

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	vehicles and making vehicle passageways one-way, to the extent practical. • Existence of spill prevention and control and emergency responsive system at the site. Preparation of spill control and management plan for the terminal facilities & jetties • Locating means of access to ensure suspended loads do not pass overhead, to the extent practical • Constructing the surface of terminal areas to be: of adequate strength to support the heaviest expected loads; level, or with only a slight slope; free from holes, cracks, depressions, unnecessary curbs, or other raised objects; continuous; and skid resistant • Providing safe access arrangements suitable for the sizes and types of vessels calling at their facilities. These access arrangements should include guard rails and / or properly secured safety nets to prevent workers from falling into the water between the vessel side and the adjacent quay.			improvement				

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	• Inspecting and approving all slings before use • Clearly marking (indicating its own weight) all lifting beams and frames, vacuum lifting, or magnetic lifting device which does not form an integral part of a lifting appliance and every other item of loose gear weighing more than 100 kilograms (kg) • Inspecting disposable pallets and similar disposable devices before use and avoiding re-use of such disposable devices, Equipping lifting appliances with means of emergency escape from the driver's cabin and a safe means for the removal of an injured or ill driver • Risk of free fall of materials should be minimized by installing telescoping arm loaders and conveyors • Materials handling operations should follow a simple, linear layout to reduce the need for multiple transfer points							
6.2. Transport of Dangerous Goods	• Existence of spill prevention and control and emergency responsive system. • Emergency plan for vehicles	-	Throughout the project	MI: Status of emergency system –	Review of spill prevention	Included in operatio	IWAI	IWAI

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	carrying hazardous material should be available at the site and be implemented if required		stretch	whether operational or not PT: Fully functional emergency system	and emergency response plan Spill accident records	n/Maintenance cost.		
6.4 Accidents Risks Due to Movement of Vessels and other hazards associated with site	• Emergency preparedness plan for natural (flood, earthquake & cyclone) and other hazards like fires, fall/trip, electric shocks etc shall be prepared and should be implemented during emergency condition. Mock drills should be conducted for workers to handle such emergency situation • Emergency collection area should be designated at the site which is safe. All workers should be directed to collect at this area in case of emergency. • Implementation of the environment management plan as proposed to prevent the environmental pollution during operation phase • Ships should comply with safety norms and should maintain the speed so as to	-	Throughout the project stretch	MI: Status of emergency system – whether operational or not PT: Fully functional emergency system	Review of spill prevention and emergency response plan Spill accident records	Included in operation/Maintenance cost.	IWAI	IWAI

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	prevent the accidents like oil spillage. In case of accidents, ship owner should be responsible for clean-up operations • Employment should preferably be given to local people. Women should be given equal opportunity for work. • Safety norms should be followed for all operational phase activities at terminal • Development activities should be carried out in the nearby areas for development of area • Fishing activity should not be restricted in the river. • Alternate provision for fishermen should be given in case fishing activity is restricted. • Firefighting facility should be provided at site and trained personnel should be available at site that can operate the fire extinguishers and other fire-fighting equipment. Fire-fighting facility should be asper the norms for oil/POl & coal storage area, buildings, berth and other facility at the site							

Table 1.4 : Environment Monitoring Plan of Haldia Terminal for Construction & Operation Phase

S. No.	Aspect	Parameters to be monitored	No of sampling locations & frequency	Standard methods for sampling and analysis	Role & Responsibility	
					Implementation	Supervision
Construction Period						
1.	Air Quality (Ambient & Stack)	PM_{10}, $PM_{2.5}$, SO_2, NO_x, CO	Three Locations up wind and downwind direction including project site. once in two months	• Fine Particulate Samplers for $PM_{2.5}$ • Respirable Dust Sampler for PM_{10}fitted with Gaseous sampling arrangements for SO_2 and NO_x, • CO analyser;	Contractor	IWAI & PMC
2.	Surface Water Quality	Physical, chemical and biological	Hooghly river u/s and d/s of terminal Once a month	Grab sampling and analysis by using standard methods	Contractor	IWAI & PMC
3.	Drinking water Quality	Physical, chemical and biological	Drinking water for labour camps Once a month	Grab sampling and analysis by using standard methods	Contractor	IWAI & PMC
4.	Noise Level	Day time and night time noise level (max, min & Leq levels)	Construction labour camp, construction site and nearest habitation Once a month	Noise meter	Contractor	IWAI & PMC
5.	Soil Quality	Soil texture, type, Electrical conductivity, pH, infiltration, porosity, etc.,	Construction site, labour camps and debris disposal site Once in 6 months	Collection and analysis of samples as per IS 2720	Contractor	IWAI & PMC
6.	River Bed Sediment	Texture, type, Electrical conductivity, pH, infiltration, porosity, etc., and biological compounds	River bed near site Once in 6 months	Collection and analysis of samples as per IS 2720	Contractor	IWAI & PMC
7.	Green Belt	Plantation survival rate	All along the premises of Terminal site Once in year	Survey, counting, recording & reporting	Contractor	IWAI & PMC

8.	Soil Erosion	---	Upstream & downstream of project site near river bank-- Once a month	Survey & observation; Extent and degree of erosion; Structures for controlling soil erosion	Contractor	IWAI & PMC
9.	Aquatic ecology	Phytoplankton, Zooplankton and species diversity index	River Hooghly (u/s and d/s of the site) Six monthly	Plankton net of diameter of 0.35 m, No.25 mesh size 63 and analysis by using standard methods.	Contractor	IWAI & PMC
10.	Integrity of embankment	---	Upstream & downstream of terminal site along River Banks- Once a month	Survey & observation; Extent and degree of erosion; Structures for controlling soil erosion	Contractor	IWAI & PMC
Operation Phase						
1.	Air Quality (Ambient & Stack)	PM_{10}, $PM_{2.5}$, SO_2, NO_2, HC and CO	Three Locations upwind and downwind direction including project site, Six monthly	• Fine Particulate Samplers for $PM_{2.5}$ • Respirable Dust Sampler for PM_{10}fitted with Gaseous sampling arrangements for SO_2 and NO_x • CO analyser	NABL accredited Lab to be contracted by IWAI	IWAI
2.	Surface Water Quality	Physical, chemical and biological	River Hooghly Once in quarter (Upstream & Downstream)	Grab sampling and analysis by using standard methods	NABL accredited Lab to be contracted by IWAI	IWAI
3.	Drinking water Quality	Physical, chemical and biological	Drinking water for staff Once a quarter	Grab sampling and analysis by using standard methods	NABL accredited Lab to be contracted by IWAI	IWAI
4.	Noise Level	Day time and night time noise level (max, min & Leq levels)	Two locations: Project site & nearest habitation -Once in quarter	Noise meter	NABL accredited Lab to be contracted by IWAI	IWAI
5.	Wastewater Management	Physical, chemical and biological of sewage and	Terminal site, testing of sewage and STP	--	NABL accredited Lab to be	IWAI

		STP treated water	treated water Once in quarter		contracted by IWAI	
6.	Plantation	Plantation survival rate of 70%	Maintenance and survival loss of existing - Once in year	Survey, counting, recording & reporting	IWAI	IWAI
7.	Soil Erosion	---	Upstream & downstream of project site near river Bank- Monthly	Survey & observation; Extent and degree of erosion; Structures for controlling soil erosion	IWAI	IWAI
8.	Aquatic ecology	Phytoplankton, Zooplankton and species diversity	River Hooghly (u/s and d/s of the terminal site) Six monthly	Plankton net of diameter of 0.35 m, No.25 mesh size 63 and analysis by using standard methods.	IWAI	IWAI
9.	River Bed Sediments	Physio-Chemical Parameters	Once in Six Month at Terminal Site Area	Depth Sampler	IWAI	IWAI
10.	Integrity of embankment	---	Upstream & downstream of terminal site- Once in six month	Survey & observation; Extent and degree of erosion; Structures for controlling soil erosion	IWAI	IWAI

Annexure 1.1: Green Belt Development Plan

1.0 Introduction

Site for terminals/jetty/lock may support vegetation such as trees, shrubs herbs etc. Sahibganj site is the one out of four sites selected for terminals/locks support significant vegetation, i.e. mango orchards and other trees. Remaining sites supports some trees which may be required to cut or can be retained. Other sites which are not finalized may also support the vegetation which will be required to remove. Tree cutting shall be required at such sites and it should be carried out only after obtaining clearance from forest department. Only identified & permitted tree species shall be cut.

As per state forest policy compensatory afforestation should be carried out in ratio of at least at 1:2 ratios. Compensatory afforestation shall be carried out by forest department. It is preferable that compensatory afforestation is carried out in nearby land patch. Survival rate of the afforestation carried out by forest department shall be monitored by IWAI.

Apart from above compensatory plantation as part of environmental management, it is proposed to develop 15-20 m thick green belt all along the site boundary and along the roads within the site. Green belt shall be developed as per the following guidelines

1.1 Selection of Tree Species

The Project involve movement of vehicle for transportation of material Thus emissions like particulate matter, SO_2, NO_x& CO shall be generated at site. Also there is potential of generation of coal dust while unloading the materials at stock piles. Thus the plantation species tolerant to these pollutants and mitigate these from air shall be planted. Species selecting criteria is given below:

1. Tolerant to expected pollutants at site
2. Longer duration of foliage
3. Freely exposed foliage (adequate height of crown, openness of foliage, big leaves, small stomata apertures, stomata well exposed)
4. Leaves supported on firm petioles

1.2 Recommended Plant species

Based on nature of pollutants following tree species are recommended to be planted

S. No.	Plant Species	Common Name	Habit
1.	Termanilia catappal	Jagali Badam	Tree
2.	Anthocephalus cadamba	Kadam	Tree
3.	Ficus bengalensis	Badh	Tree
4.	Magnifera indica	Aam	Tree
5.	Tectona grandis	Teak	Tree
6.	Ficus religiosa	Peepal	Tree
7.	Hibiscus rosa sinensi	Hibiscus	Shrub
8.	Wrightia arboriea	Dudhi	Shrub
9.	Tabernaemontana	Chandani	Shrub

	divaricata		
10.	Bougainvillea glavra	Bougainvillea	Shrub
11.	Codium variegates	Cockscomb	Herb
12.	Celosia argentea	Croton	Herb
13.	*Ilex rotunda*	Kurogane holly	Tree
14.	*Cassia surattensis*	Golden Senna	Tree
15.	*Cinnamomum camphora*	Camphor tree	Tree
16.	Lagerstroemia flos-reginae	Lagerstroemia	Tree
17.	Alstonia scholaris	Devil tree	Tree
18.	Cassia fistula	Golden shower	Tree
19.	Delonix regia	Gulmohar	Tree
20.	Pongamia pinnata	Indian beech	Tree
21.	Terminalia arjuna	Arjun	Tree
22.	Terminalia belerica	Baheda	Tree
23.	Butea superb	Tesu	Tree
24.	Cassuarina sp.	Cassuarina	Tree
25.	Bahunia acuminate	White orchid green	Tree
26.	Swetania mohogini	Cuban Mahagony	Tree
27.	Azadiracta indica	Neem	Tree
28.	Artocarpus integrifolia	Jackfruit	Tree
29.	Gmelina arborea	Gamhar	Tree
30.	Putranjiba roxburghii	Putranjiba	Tree

1.3 Plantation Methodology

Components of green belts on roadside fence should be both absorbers of gases as well as of dust particles, including even lead particulates. Thus the choice of plants should include pollution tolerant shrubs of height 1 to 1.5 m and trees of 3 to 5m. The intermixing of trees and shrubs should be such that the foliage area density in vertical is almost uniform. For effective removal of pollutants, it is necessary that (i) plants should grow under conditions of adequate nutrient supply, (ii) absence of water stress and (iii) plants are well exposed to atmospheric conditions (light & breeze).

Multiple rows of green belt shall be developed. Green belt should be pyramidal in shape. Plantation pattern shall be kept as given below:

- Short trees and tall shrubs shall be planted as first row (from road) followed by tall tree plantation which will be followed by another row of medium and small trees and tall shrubs.
- Planting of trees should be in appropriate encircling rows, each rows alternating the previous one to prevent further fanning and horizontal pollution dispersion;
- Since tree trunks are normally devoid of foliage, it would be appropriate to have small shrubs in front and in between the tree spaces;

- The open areas between the process installations where trees cannot be planted should be covered with lawn grasses for effective trapping and absorptions of air pollutants.
- Fast growing trees with thick canopy and perennial foliage should be selected so that the effective tree height with envisaged objective will be attained in minimum span of time.

1.4 Plantation Pattern

A standard horticultural practice involving planting of saplings in pits of substantial dimensions i.e., 1m × 1m × 1m for big trees and along half of these dimensions for smaller trees and shrubs. The pits are then filled with earth, sand, silt and manure in pre-determined proportions. Saplings planted in such pits are watered liberally during dry months.

1.5 Time of Plantation

Plantation of the tree sapling should be done only after the first shower during the rainy season. The best time for plantation is after 15 days from the day of first shower during rainy season.

1.6 Protection of Tree saplings

Circular tree guard should be placed after the plantation of the saplings for the protection of these young plants from the ravages of cattle, sheep and goat and other animals. If tree saplings died or damage occur after placing the circular tree guard, timely replacements of damaged plant and thereafter care is important.

1.7 After Care & Monitoring

The growing plants are cared at least for the first two years under favourable conditions of climate and irrigation. Nutrients in pits are supplemented and the juveniles provided protection.

Thinning shall start after the stand is 3-4 years old and repeated every 4 years until the stand is 15 years old. Between 15-25 years old, thinning should be conducted every 5 years and after 25 years old, thinning shall be done after every 10 years. When the canopy closes, at about 6 years, 30-40% of the stems shall be thinned to selectively remove suppressed, diseased and badly formed trees.

Periodic assessment shall be carried for survivability of the trees. Minimum 70% survival rate shall be achieved.

1.8 Records Keeping & Reporting

The following records shall be maintained:

1. Record of Tree plantation
2. Record of Survivability rate

Inspection shall be carried out at site to know the survival rate of the plantation. The tree plantation and survivability report shall be prepared every six monthly.

1.9 Responsibility

Compensatory plantation shall be carried out by forest department. Survival rate of plantation shall be inspected of the by IWAI. Plantation within the terminal/jetty/lock site shall be carried out by IWAI and shall be monitored by IWAI.

Annexure 1.2: Occupational Health & Safety Management Plan

1.0 INTRODUCTION

Many emergencies can occur on any construction site and need to be effectively handled. The environmental and occupational health and safety aspects and related emergency can include incidence such as Collapse / subsidence of soil / Fire / Explosion / Gas Leak, Collapse of Building / Equipment and other Occupational Accidents. On site and off site emergency management plan shall be developed to effectively handle them.

Thus every contractor shall have an approved on-site emergency plan. The contractor should submit a copy of this plan to PIU and Supervision consultant before the start of the work. Contractor shall develop the onsite emergency plan considering the potential environmental, occupational health and safety emergency situation at site and activities involved. This plan shall include a list of these potential emergency situations in the onsite emergency preparedness & response plan. Contractor shall get the plan approved from IWAI/PMC

1.1. ANTICIPATED EMERGENCIES AT CONSTRUCTION SITE

The potential emergency situations have been defined below for guidance purposes. The contractors can follow these for developing site specific on site emergency preparedness plan.

Emergency conditions / situations	Sources
Collapse / subsidence of soil	▪ Civil structures
Bulk spillage	▪ Hazardous substance / inflammable liquid storage ▪ Vehicular movement on highway
Fire and explosion	▪ Inflammable Storage Areas ▪ Gas Cylinder Storage Areas ▪ Electrical Circuits ▪ Isolated Gas Cylinders (LPG / DA) ▪ Welding / Gas Cutting Activity
Electrical Shock	▪ HT line ▪ LT distribution ▪ Electrically Operated Machines / Equipment / Hand Tools / Electrical Cables
Gaseous Leakage	▪ Gas Cylinder Storage Areas ▪ Gas Cylinder used in Gas Cutting / Welding Purposes
Accidents due to Vehicles	▪ Heavy Earth Moving Machinery ▪ Cranes ▪ Fork Lifts ▪ Trucks ▪ Workman Transport Vehicles (cars / scooters / motor cycles / cycles) ▪ Collapse, toppling or collision of transport equipment
Slips & Falls (Man & Material)	▪ Work at Height (Roof Work, Steel Erection, Scaffold, Repair & Maintenance, Erection of equipment, Excavation etc.) ▪ Slips (Watery surfaces due to rain) ▪ Lifting tools & Tackles (Electric Hoist & Forklifts)
Collision with stationary/ moving objects	▪ Vehicular movement

Emergency conditions / situations	Sources
Other Hazards	▪ Cuts &Wounds ▪ Confined Space (under & inside machinery etc.) ▪ Hot Burns ▪ Pressure Impacts (Plant contains several Pressure Vessels & pipefitting containing CO_2, air, water, product & steam, which can cause accidents & injuries to person around.)

1.2. Design of 'On-Site Emergency Plan'

The 'On-site emergency plan' to be prepared by contractor and shall include minimum the following information:

- Name & Address of Contractor
- Updation sheet
- Project Location
- Name, Designation & Contact Numbers of the organization, nearby hospitals, fire agencies etc. and key personnel including their assigned responsibilities in case of an emergency.
- The roles and responsibilities of executing personnel
- Site Layout Diagram showing location of fire extinguishers, emergency collection area and fire alarm
- Identification of Potential Emergencies Situations/ preventive measures / control & response measures
- Location of Emergency Control Centre (or designated area for emergency control / coordination) with requisite facilities.
- Medical services / first aid
- List of emergency equipment including fire extinguishers, fire suits etc.

1.3. Emergency Control Centre

The emergency control centre shall be equipped with following facilities

- Copy of current on-site emergency plan
- Display of the name of site emergency controller
- Two numbers of artificial respiratory sets
- Two numbers of Stretchers
- Vehicle for 24 hours (for large construction sites)
- Inter personnel/section telephone (2 numbers)
- Site layout diagram with entry and exit routes / Assembly points
- Directory of internal / external emergency phone Numbers
- A set of fire extinguishers (DCP type / Foam Type / CO2)
- List of fire extinguishers installed in the construction site including maintenance record
- A set of personal protective equipment (PPE)
- Two numbers of first-aid boxes with prescribed first-aid medicines
- List of competent first-aiders
- List of fire trained personnel
- Two numbers of blankets

- Drinking water
- Two numbers of rescue ropes
- Two numbers of high beam torches
- Two numbers of gas leak detectors
- Life boat & jackets (if working in or near water course)

1.4. Records

The following records shall be maintained:

1. Record of emergency preparedness plan with emergency contact numbers
2. Mock drill/emergency preparedness exercise records
3. Corrective preventive action record after emergency is occurred

1.5. Reporting

The accident and incident records and emergency preparedness drill reports shall form part of quarterly report to EA

1.6. Responsibility

Contractor shall be responsible to handle emergency condition and shall be liable to compensate the damage against accident, if any occurs at site.

Annexure 1.3: Construction Debris Management Plan

Introduction

Waste will be generated from the construction site and labour camps during the construction phase. Type of the waste to be generated during construction phase is given below.

Excavated Soil

Site is undulating and thus will require cut & fill for levelling. Finished level of the soil will be 37 m. Top excavated soil of 15 cm shall be stripped and shall be stored separately under covered sheds. This soil shall be used for green belt plantation.

Lower layers of excavated soil shall be re-used within the site for flling purpose, construction of approach & internal roads & railway link. If any extra soil is remained, then that should be disposed of to the approved debris disposal site

Dredged Material

Dredging shall be carried out in the river for construction of off-shore structures like jetty & berths (pilling) and navigation channels. Dredged soil shall not be disposed along the river bank as they are sensitive habitat for various aquatic species and provide as the spawning and breeding grounds also. Dredged material shall be tested for its quality. If non-toxic then should be disposed at disposal site but if toxic & contains heavy metals, then it should be disposed to TSDF site.

Construction Waste

Construction waste will comprise of broken bricks, dry cement, discarded timber, metal piece, cement bag, dry asphalt/bitumen, glass, paint/varnishes box etc. These wastes should be segregated into recyclable and non-recyclable waste. Recyclable waste shall be stored in the covered area and shall be sold to authorized vendors regularly. Non-recyclable waste shall be disposed at approved debris site in covered vehicles.

Municipal Waste

Municipal waste will be generated from labour camp. Dustbins for recyclable and non-recyclable waste shall be provided in labour camp area. Recyclable waste shall be sold to authorized vendors and non-recyclable shall be disposed through authorized agency in area responsible for waste collection and management.

Waste generated requires proper management so as to minimize the negative impacts on environment. Concept of reduce, re-use and recycle shall be followed at site. The rejected waste should be disposed in a secured manner. Thus a site should be identified for disposal of the rejected waste.

1.1 SELECTION OF DISPOSAL SITES:

The locations of Disposal sites have to be selected such that:

- Disposal sites are located at least 1000 m away from sensitive locations like settlements, water body, notified forest areas, wildlife/bird/dolphin sanctuaries or any other sensitive locations.
- Disposal sites shall not contaminate any water sources, rivers etc so the site should be located away from water body and disposal site should be lined properly to prevent infiltration of water.
- Public perception about the location of debris disposal site has to be obtained before finalizing the location.
- Permission from the village/local community is to be obtained for the Disposal site selected.
- Environment Engineer of PMC and Executive Engineer of Contract Management Unit must approve the Plan before commencement of work.

1.2 PRECAUTIONS TO BE ADOPTED DURING DISPOSAL OF DEBRIS / WASTE MATERIAL

The Contractor shall take the following precautions while disposing off the waste material.

- During the site clearance and disposal of debris, the Contractor will take full care to ensure that public or private properties are not affected, there is no dwellings around the dumpsite and that the traffic is not interrupted.
- The Contractor will dispose debris only to the identified places or at other places only with prior permission of Engineer-in-Charge of works.
- In the event of any spoil or debris from the sites being deposited on any adjacent land, the Contractor will immediately remove all such spoil debris and restore the affected area to its original state to the satisfaction of the Engineer-in-Charge of works.
- The Contractor will at all times ensure that the entire existing canal and drains within and adjacent to the site are kept safe and free from any debris.
- Contractor will utilize effective water sprays during the delivery and handling of materials when dust is likely to be created and to dampen stored materials during dry and windy weather.
- Materials having the potential to produce dust will not the loaded to a level higher than the side and tail boards and will be covered with a tarpaulin in good condition.
- Any diversion required for traffic during disposal of debris shall be provided with traffic control signals and barriers after the discussion with local people and with the permission of Engineer-in-Charge of works.
- During the debris disposal, Contractor will take care of surrounding features and avoid any damage to it. The debris should not be disposed along the bridges & culverts and near the water bodies.
- While disposing debris / waste material, the Contractor will take into account the wind direction and location of settlements to ensure against any dust problems.
- Contractor should display the board at disposal site stating the name of project, usage of the site and type of debris being disposed.
- A guard shall be kept at disposal site to prevent any unauthorized disposal of waste at the debris disposal site
- Material should be disposed through covered vehicles only
- No contaminated/hazardous/e-waste shall be disposed at the debris disposal site

1.3 RECORD KEEPING

Site approved by site engineer only can be used as disposal site. Record of all such site should be maintained along with the area of disposal site, type & quantity of material disposed daily and capacity of disposal site.

1.4 GUIDELINES FOR REHABILITATION OF DISPOSAL SITES

The dumpsites filled only up to the ground level could be rehabilitated as per guidelines below and to be decided by the Engineer and the supervision consultant.

- The dumpsites have to be suitably rehabilitated by planting local species of shrubs and other plants. Local species of trees has also to be planted so that the landscape is coherent and is in harmony with its various components.
- In cases where a dumpsite is near to the local village community settlements, it could be converted into a play field by spreading the dump material evenly on the ground. Such playground could be made coherent with the landscape by planting trees all along the periphery of the playground.
- Closure of the disposal site should be upto the satisfactory level of site engineer

1.5 PENALTIES

Stringent action & penalties should be imposed off on contractor for dumping of materials in locations other than the pre-identified locations. Grievance Redressal mechanism should be in place for taking note and action on such complaints.

Annexure 1.4: Construction and Labour Camp Management Plan

1.0 Objective of the Plan

The objective of this plan is to provide guidance to the contractor or other agency involved in setting up of the construction and labour camp for keeping the health & Safety of workers and impacts of setting up such camps on the local community in consideration while developing and establishing such camp. This plan is prepared in reference to the Workers accommodation: processes and standards (A guidance note by IFC and EBRD). The plan aims to promote "safe and healthy working conditions, and to protect and promote the health of workers."

2.0 Selection and layout of construction camp

Labour camps, plant sites and debris disposal site shall not be located close to habitations, schools, hospitals, religious places and other community places. A minimum distance of 500 m shall be maintained from the habitations, sensitive locations like temple, school & hospitals, forest areas and other eco-sensitive zones for setting up such facilities.

3.0 Facilities at workers' camps

During the construction stage of the project, the construction contractor will construct and maintain necessary (temporary) living accommodation, rest area and ancillary facilities for labour. Facilities required are listed and elaborated below.

- Site barricading
- Clean Water Facility
- Clean kitchen area with provision of clean fuel like LPG
- Clean Living Facilities for Workers
- Sanitation Facilities
- Waste Management Facilities
- Rest area for workers at construction site
- Adequate Illumination & ventilation
- Safe access road is required at camps
- Health Care Facilities
- Crèche Facility & Play School
- Fire-fighting Facility
- Emergency Response Area

3.1 Attendance& Working hours

Supervisor of the camp should take the attendance of the employee at each camp twice in a day (morning and evening) and should maintain the record. Further work hours of the workers should be maintained in accordance to the labour law and as mentioned in the labour licence. All workers should be provided with ID card and entry to the site should be through ID card only and should be ensured by security guard.

3.2 Site Barricading

Site should be completely barricaded from all the sides to prevent entry of outsiders and animals into the site. Entry gate should be provided at the site and labour camp which should

be guarded by security guard. All workers should be issued ID cards and entry of outsiders shall be maintained in the register at the gate. Board should be displayed at the site and the labour camp, the name of project, capacity of project, authority carrying our projects, restriction of entry without authorization, no smoking zone and associated risks. Plant operation shall be restricted to 6:00 Am to 10:00 PM

3.3 Clean Water Facility

Potable water shall be provided for construction labour for drinking & cooking purpose. Clean water shall be provided for bathing, cleaning and washing purpose. Water quality testing for drinking water provided for workers shall be carried out on monthly basis. Water dispensers should be cleaned on monthly basis. Adequate water per person should be provided at site for drinking, cooking, barhing, cleaning and other use purpose

3.4 Clean Kitchen Area

Provision of clean kitchen area for cooking and storage of eatables shall be provided. Clean fuels like LPG shall be provided for cooking purpose. Burning of firewood, garbage, paper and any other material for cooking or any other purpose shall strictly be prohibited at the site. Separate utensil washing area should be provided with proper drainage system. Kitchen waste should be daily cleaned and disposed off. Water storage facility at kitchen should be covered and cleaned on monthly basis. Kitchen area should be away from washing, toilets and bathing area.

Wall surfaces adjacent to cooking areas are made of fire-resistant materials. Food preparation tables are also equipped with a smooth durable washable surface. Lastly, in order to enable easy cleaning, it is good practice that stoves are not sealed against a wall, benches and fixtures are not built into the floor, and all cupboards and other fixtures and all walls and ceilings have a smooth durable washable surface.

3.5 Clean Living Facility for the Workers

Workers should be provided with proper bedding facility. Single bed should be provided to each workers and each bed should be atleast 1 m apart from another. Double deck bedding should be avoided, in case provided, adequate fire-fighting facility should be provided. Bed linen should be washed regularly and should be applied with repellent and disinfectants so as to manage the diseases caused due to pests. Facilities for storage of personal belongings for workers should be provided in form of locker, shelf or cupboard. A separate storage area for the tools, boots, PPE should be provided. Proper ventilation through mechanical systems and lighting system should be ensured in construction camps.

3.6 Sanitation Facilities

Construction camps shall be provided with sanitary latrines and urinals. Toilets provided should have running water availability all the time. Bathing, washing & cleaning areas shall be provided at the site for construction labour. Washing and bathing places shall be kept in clean and drained condition. Adequate nos. of bathing & toilet facility should be provided at site and should not exceed 1 unit per 15 person. Toilets and bathing facility should be closed to the camps. Workers shall be hired especially for cleaning of the toilets and bathing area. Septic tanks and soak pits shall be provided at site for disposal of the sewage generated. The toilets should be cleaned on daily basis. These tanks should be evacuated through authorized vendors if filled and at the time of closure. Pest management should be carried out at the camps if the

area is infected by any pests. Adequate lighting should be ensured in camp area especially during night time. The area should be guarded by security guard to minimize the crime and thefts.

3.7 Waste Management Facilities

Waste generated should be segregated at the site by providing the different colour bins for recyclable and non-recyclable waste. Recyclable waste shall be sold to authorized vendors and non-recyclable shall be handed over to authority responsible in area for waste management. Waste management for construction site shall be as per waste management plan proposed in EMP. Waste management area should be cleaned on regular basis to avoid germination of flies, mosquitoes, rodents and other pests.

3.8 Rest Area for Workers at Site

A rest area/shelter shall be provided at the site for construction workers where they can rest after lunch time and shall not lay down at site anywhere. The height of shelter shall not less than 3m from floor level to lowest part of the roof. Sheds shall be kept clean and the space provided shall be on the basis of at least 1.0 Sq. m per head.

3.9 Adequate Illumination & Ventilation

Construction worker camps shall be electrified and adequately illuminated. Illumination level shall be maintained after 5.30 P.M. at the site to minimum 200 lux. Labour camps shall be adequately ventilated. Fans shall be provided for ventilation purpose.

3.10 Safe Access Road for Labour Camps

Temporary paved surface shall be constructed to approach the labour camp from the site. Movement shall not be hampered during monsoon season due to water logging and muddiness.

3.11 Health care Facilities:

First aid box, first aid room and personnel trained in first aid (certified first-aider) shall be available at labour camp and site all the time (24X7). Equipment in first-aid box shall be maintained as pet State Factory's Law. Ambulance/ 4 wheeler motorized vehicle shall be available at the site for carrying injured to the nearby hospital. Tie-ups should be made with nearby hospital to handle emergency, if any. Nos. of ambulance, doctors and nearby hospital s hall be displayed in first-aid room, site office & labour camps. List of contact nos. of emergency personnel, hospitals, fire brigade and other emergency contact should be displayed at camp site, guard's room and first aid room. Workers shall be made aware about the causes, symptoms and prevention from HIV/AIDS through posters and awareness programs. Workers shall have access to adequate preventive measures such as contraception (condoms in particular) and mosquito nets.

3.12 Crèche Facility & Play School

Crèche facility and play school should be constructed at the site temporarily so as children of construction labour can be kept there. Care takers should be hired for taking care of children. Attendance records of children shall be maintained. Children should not be allowed to enter active work areas.

3.13 Fire-Fighting facilities

Fire-fighting facility such as sand filled buckets and potable fire-extinguishers shall be provided at labour camps and at site. Fire-extinguishers shall be provided as per NBC norms. Personnel trained in handling fire-fighting equipment should be available at the site. Fire evacuation plan should be displayed at the site and should be communicated to all the workers and other staff at camp site.

3.14 Emergency Assembly Area

Area shall be demarcated as emergency collection area near the gate where all the workers shall be guided to collect in case of any emergency like fire, flood and earthquake.

4.0 Activities prohibited at site

Activities which should be strictly prohibited at site shall include

- Open burning of wood, garbage and any other material at sit for cooking or any other purpose
- Disturbance to the local community.
- Adoption of any unfair means or getting indulgence in any criminal activity
- Non-compliance of the safety guidelines as communicated be safety officials and during the trainings
- Adoption and proper usage of PPEs all the time as required
- Operation of the plant and machinery between 10 pm to 6 am unless approved by team leader
- No animal (wild or domestic or bird) shall be harmed by any construction worker in any condition at site and nearby areas
- Cutting of tree without permission of team leader/authorized person
- No indigenous population shall be hurt or teased

5.0 Guidelines for night time working at the site.

No activity generating noise shall be carried out at the site after 10:00 PM. Night working protocol should be followed (if required) as per guidelines prepared by IWAI. Site should be well illuminated to maintain minimum illumination level of 200 lux. Personnel working shall obtain permit to work from the team leader prior carrying out any work in night time and the record of such working shall be maintained in register. Any accidents, if occurs at site during night time working shall be immediately reported and recorded. Penalty shall be imposed on the contractor for the accident. Analysis shall be carried out to find the reason for such accidents for future learning.

6.0 Record keeping & Maintenance

Record of entry/exit of the people in the construction site and labour camp area shall be maintained in register at gate. Record of material coming in and going out from site also shall be maintained.

7.0 Auditing & Inspection

Conditions of labour camp and site shall be inspected and audit report shall be submitted to IWAI on monthly basis.

8.0 Grievance readressal System

CA complaint register and a complaint box should be provided at the site so any person from local community can register their complaint, if any due o the camp, workers and other facilities. The system shall be communicated to local communities through consultations. Open house meetings should be conducted with workers on monthly basis to identify their problems and issues if any related p health, hygiene, safety, comfort and other issues.

9.0 Security System

Site should be barricaded and should be guarded by security guards at all the gates. Security guards should allow only authorized personnel to the campsite. Guards should be available during both morning and night time. Guard should allow entry of workers to the site only be seeing the ID cards. Guard should report if any unusual or unfair practise happening at site and nearby area. Guards should be trained to handle emergency situations like fire-fighting and should be responsible to contact the emergency personnel in case of any emergency.

10.0 Closure of the Construction Site and Construction labour Camps

Construction site and labour camps shall be restored back to the original site conditions. Following measures are required to be taken during closure

1. Septic tanks/soak pits should be dismantled
2. Any temporary/permanent structure constructed shall be dismantled
3. Construction/demolition waste, hazardous waste and municipal waste at site and labour camp site shall be disposed as per waste management plan in EMP
4. The site shall be cleaned properly
5. Tree plantation to be carried out, if any required for stabilizing the area
6. Any pit excavated shall be filled back
7. Closure of the site and labour camp shall be approved by authorized person.

Annexure 1.5: Borrow Area Management Plans

1.0 Introduction

Borrow areas will be finalized as identified by Contractor as agreed by the PMC and IWAI as per the requirements of the contract. Environment clearance under EIA Notification, 2006 from competent authority and NOC from state pollution control board under Air Act, 1981 as applicable shall be obtained by contractor prior excavation. Consent from land owners and DC of the area shall also be taken prior undertaking any excavation. The Contractor in addition to the established practices, rules and regulation will also consider following criteria before finalizing the locations. Contractor should submit borrow area establishment plan along with the locations marked in map and the environmental settings of the planned area to PMC/IWAI for approval of the "Engineer" through RFI.

1) The borrow area should not be located in agriculture field unless unavoidable i.e. barren land is not available.
2) The borrow pits should not be located along the roads, close to project site
3) The loss of productive and agricultural land should be minimum.
4) The loss of vegetation is almost nil or minimum.
5) Sufficient quality of soil is available.
6) The Contractor will ensure the availability of suitable earth.

The Contractor shall obtain representative samples from each of the identified borrow areas and have these tested at the site laboratory following a testing programme as approved by the concerned Engineer. It shall be ensured that the fill material compacted to the required density. The Contractor shall submit the following information to the Engineer for approval at least 7 working days before commencement of compaction.

- The values of maximum dry density and optimum moisture content obtained in accordance with ARE: 2720 (Part 7) or (Part 8), as the case may be, appropriate for each of the fill materials he intends to use.
- A graph of density plotted against content from which, each of the values in (i) above of maximum dry density and optimum moisture content are determined.

After identification of borrow areas based on guidelines and full filling the following requirements are to be fulfilled

- Quantification of Earth
- Land Agreement
- Clearance from local authorities
- Environmental Clearances from SEIAA should be obtained. All EC conditions are to be followed by contractor and contractor should submit EC to IWAI/PMC/PMU

After receiving the approval Contractor will begin operations keeping in mind following:

- Haulage of material to the areas of fill shall proceed only when sufficient spreading and compaction plants are operating at the place of deposition.

- No excavated acceptable material other than surplus to requirements of the Contract shall be removed from the site. Contractor should be permitted to remove acceptable material from the site to suit his operational procedure, then be shall make good any consequent deficit of material arising there from.
- Where the excavation reveals a combination of acceptable and un-acceptable materials, the Contractor shall, unless otherwise agreed by the Engineer, carryout the excavation in such a manner that the acceptable materials are excavated separately for use in the permanent works without contamination by the un-acceptable materials. The acceptable material shall be stockpiled separately.
- The Contractor shall ensure that he does not adversely affect the stability of excavation or fills by the methods of stockpiling materials, use of plants or siting of temporary buildings or structures.

1.1 Borrow Area Management

Borrow areas located in different land will require different management. Management measures to be taken in different land types are given below.

1.1.1 Borrow Areas located in Agricultural Lands

- The preservation of topsoil will be carried out in stockpile.
- A 15 cm topsoil will be stripped off from the borrow pit and this will be stored in stockpiles in a designated area for height not exceeding 2m and side slopes not steeper than 1:2 (Vertical: Horizontal).
- Borrowing of earth will be carried out up to a depth of 1.5m from the existing ground level.
- Borrowing of earth will not be done continuously throughout the stretch.
- Ridges of not less than 8m widths will be left at intervals not exceeding 300m.
- Small drains will be cut through the ridges, if necessary, to facilitate drainage.
- The slope of the edges will be maintained not steeper then 1:4 (Vertical: Horizontal).

1.1.2 Borrow Areas located in Agriculture Land in un-avoidable Circumstances:

- The preservation of topsoil will be carried out in stockpile.
- A 15 cm topsoil will be stripped off from the borrow pit and this will be stored in stockpiles in a designated area for height not exceeding 2m and side slopes not steeper than 1:2 (Vertical: Horizontal).
- The depth of borrow pits will not be more than 30 cm after stripping the 15 cm topsoil aside.

1.1.3 Borrow Areas located on Elevated Lands

- The preservation of topsoil will be carried out in stockpile

- A 15 cm topsoil will be stripped off from the borrow pit and this will be stored in stockpiles in a designated area for height not exceeding 2m and side slopes not steeper than 1:2 (Vertical: Horizontal).
- At location where private owners desire their fields to be levelled, the borrowing shall be done to a depth of not more than 1.5m or up to the level of surrounding fields.

1.1.4 Borrow Areas near Riverside

- The preservation of topsoil will be carried out in stockpile
- A 15 cm topsoil will be stripped off from the borrow pit and this will be stored in stockpiles in a designated area for height not exceeding 2m and side slopes not steeper than 1:2 (Vertical: Horizontal).
- Borrow area near to any surface water body will be at least at a distance of 15m from the toe of the bank or high flood level, whichever is more.

1.1.5 Borrow Areas near Settlements

- The preservation of topsoil will be carried out in stockpile
- A 15 cm topsoil will be stripped off from the borrow pit and this will be stored in stockpiles in a designated area for height not exceeding 2m and side slopes not steeper than 1:2 (Vertical: Horizontal).
- Borrow pit location will be located at least 0.75 km from villages and settlements. If un-avoidable, the pit will not be dug for more than 30 cm and drains will be cut to facilitate drainage.
- Borrow pits located in such location will be re-developed immediately after borrowing is completed. If spoils are dumped, that will be covered with layers of stockpiled topsoil in accordance with compliance requirements with respect MOEF&CC/CPCB guidelines.

1.1.6 Borrow Pits along the Roads

- The preservation of topsoil will be carried out in stockpile
- A 15 cm topsoil will be stripped off from the borrow pit and this will be stored in stockpiles in a designated area for height not exceeding 2m and side slopes not steeper than 1:2 (Vertical: Horizontal).
- Borrow pits along the road shall be discouraged.
- If permitted by the Engineer; these shall not be dug continuously.
- Ridges of not less than 8m widths should be left at intervals not exceeding 300m.
- Small drains shall be cut through the ridges of facilitate drainage.
- The depth of the pits shall be so regulated that its bottom does not cut an imaginary line having a slope of 1 vertical to 4 horizontal projected from the edge of the final section of bank, the maximum depth of any case being limited to 1.5m.
- Also, no pit shall be dug within the offset width from the toe of the embankment required as per the consideration of stability with a minimum width of 10m.
- Minimum distance from road/ railway should be 50 metres.

1.1.7 Re-development of Borrow Areas

The objective of the rehabilitation programme is to return the borrow pit sites to a safe and secure area, which the general public should be able to safely enter and enjoy. Securing borrow pits in a stable condition is fundamental requirement of the rehabilitation process. This could be achieved by filling the borrow pit approximately to the road level.

Re-development plan will be prepared by the Contractor before the start of work in line with the owner's will and to the satisfaction of owner.

The Borrow Areas will be rehabilitated as follows

- Borrow pits will be backfilled with rejected construction wastes (unserviceable materials) compacted and will be given a turfing or vegetative cover on the surface. If this is not possible, then excavation slope should be smoothened and depression is filled in such a way that it looks more or less like the original ground surface.
- Borrow areas might be used for aquaculture in case landowner wants such development. In that case, such borrow area will be photographed after their post-use restoration and Environment Expert of Supervision Consultant will certify the post-use redevelopment.
- The Contractor will keep record of photographs of various stages i.e. before using materials form the location (pre-project), for the period borrowing activities (Construction Phase) and after rehabilitation (post development), to ascertain the pre and post borrowing status of the area.