Ref. No.: JV-ALDLP-BR-20- 036 Date: 17 February 2020

Mr. Md. Arifuzzaman
General Manager / Project Director
Bangladesh Railway, Rail Bhaban
16 Abdul Gani Road, Dhaka- 1000, Bangladesh

Project: Contract No.: BR/PD/ALDLP/ADB-EIB/2015: Construction of Dual Gauge Double Line and Conversion of Existing Railway into Dual Gauge between Akhaura-Laksam

**Subject: Submission of Revised Semi-annual EMR Jul-Dec. 2019**

Reference: Appendix A-Terms of Reference, Part 4, G (vii) & L. Reporting Requirement L.3.1

Dear Sir,

To meet the above contractual requirement, a Semi-annual EMR Jul-Dec.2019 had already been sent to you for your kind review. Based on your review on that document and following your email dated 23 January 2020, now we do hereby again submit the Revised Semi-annual Environmental Monitoring Report (EMR) July 2019 - December 2019 incorporating ADB's comments for your kind necessary action please.

Sincerely yours,

17/2/20

**Md. Khairul Alam**
Acting Team Leader
Construction Supervision of Akhaura –Laksam Double Track Project
E-mail: khairulalammd59@gmail.com

Attachment: 1. Semi-annual Environmental Monitoring Report July-December, 2019
2. Reply to ADB's comments

**Comments on ALDLP EMR (Jul-Dec.2019)**

**As per ADB's Comments on our earlier submitted EMR (July – Dec 2019) followings are the replay about ADB's Comments:**

1. The executive summary consolidated did not provide summary of the EMR - no information is available to understand status of EMP implementation at a glance.
   Comment: Provide Executive Summary with compilation from findings of EMR.
   **CSC Reply:** Executive summary section has been revised briefly to represent the information stated in EMR July-December 2019 as much as possible. I hope that CSC will submit next EMR (January-June 2020) with more improvement and in well-organized way. Findings of the EMR will be provided in the Executive Summary.

2. Information and data organization and presentation: Report is not well organized. Information of EMR must follow the sequence of the CEMP/EMP. EMR is a compilation of follow up of the environmental issues highlighted in the EMP.
   Comment: Make report concise with relevant information only. Avoid redundancy in report writing and presentations.
   **CSC Reply:** CTM JV will be requested to prepare report with well-organized information. Their field monitoring reports do not match the sequence of EMR. Baseline monitoring sites in EMP, EIA and CTM's site monitoring are not same. CTM did not submit CEMP, they submitted EMP from EIA report and previous TL approved it. We will write them to organize the information based on the specific site activities.

3. Lab testing reports were found Compliance while in many cases direct observation of environmental management and quality did not correspond with the observation feedback given by CTM JV and CSC consultants. Subcontractor engaged by CTM for air quality and noise testing adopted methodology of collecting air samples for 2 hours. This methodology was rejected by ADB.
   Comments: Implementation of EMP put equal emphasis on both lab testing reports and direct observation for making Compliance/Non-compliance related statements. CSC must review CTM's monthly environmental reports based on their knowledge from direct observation and lab testing reports and then evaluate statements.
   Lab testing of air quality, noise and water must follow sample collection and testing protocol of DOE. EMR must raise this issue for correction of CTM JV and their sub-contractors.
   **CSC Reply:** CSC has started reviewing of CTM's monthly and quarterly environmental reports based on their knowledge from direct observation and lab testing reports and then will evaluate statements accordingly.

4. Figures 11, 15, 16, 23: In many cases environmental test reports, particularly for Noise, air quality and surface water were reported higher compared to baseline record and sometime higher than DOE standards.
   Comments: Suggest mitigation measures for controlling environmental status within baseline record and national standards.
   **CSC Reply: Noise level** increases due to sudden train pass. This exists for few second. Exposure time for noise level 85 dBA is 8 hours. Vehicle and equipment are not producing noise more than tolerable limit. Sometimes **Air quality** deteriorates due to dust pollution. Old vehicles and equipment also produce emission that causes air pollution. When construction debris and different types of wastes are thrown in water body, it causes **surface water pollution**. **Temperature** increased due to 55,000 tree cut. Mitigation measure is suggested in EMR for all these matter.

5. Para 112: Environmental Issues should be specific with respect to location, work type and status of compliance.
   Comments: Recommend what mitigation measures are suggested to get environmental problems in compliance. Avoid generic writing.
   **CSC Reply:** In respect to location, work type and status of compliance contractor should mention the environmental issues and mention their mitigation measures taken. In this regards CTM JV are requested to provide CSC site specific issues for which mitigation measures have been taken or is being taken shortly.

6. Table 6: As reported, CTM and CSC initiated consultation with relevant government agencies to obtain details relating to fisheries in the major rivers. Already discussed about developing appropriate arrangements for restoration of Borrow pits as fishponds wherever possible as suggested by local communities.
   Comments: This is a good work indeed. What progress so far were made on restoration of Fish species, Fish habitat and water bodies? Please provide some specific notes, such as which Borrow pits were selected with specific chainage information, photos in the appendix for substantiation.
   **CSC Reply:** Restoration of fish species is under consideration. But some Borrow pits are being prepared as fish pond. In rainy season fish culture in these Borrow pond will be started. Photographs of such fish pond is attached as Appendix: F in the EMR.

7. Section 9: Tree Plantation and Replacement Programme – In the 3rd line of first para avoid mentioning that ADB had approved the tree plantation plan.
   Comments: Avoid writing about detail tree plantation program in the EMR, rather state about progress on the activities.
   **CSC Reply:** In this section in the 3rd line "ADB had approved the tree plantation plan" is deleted. Plantation progress had been stated in sub-section 9.4 in EMR.

8. Section 10: CSC's Environmental Safeguard Activities performed recently: Bentonite slurry sample collected for toxicity test from the Salda River work Site by EQMS with the presence of CSC Environment Team and samples were sent to BUET for testing.
   Comments: Please provide Bentonite slurry sample testing results here. The report did not find any hazardous chemicals and heavy metals above threshold level. Safe to dispose in designated landfill site. **CSC Reply:** Summary of Bentonite slurry test results had been stated in sub-section 12.3. Also detail Bentonite slurry sample testing results are attached herewith in reply to your comment as Appendix- H.

9. Sub-Section 13.20: Preparation of the safety execution plan: You have given contents of your plan. EMR is not relevant to present plan.
   Comments: Please mention about status of implementation of safety execution plan.
   **CSC Reply:** Status of implementation of safety execution plan is mentioned in this sub-section 13.20.

10. Sub-section 13.22: Recommendations for health and safety: Some recommendations contradict with the environmental measures that were appreciated in Sub Section 13.21. Such as, reports on PPE use.
    Comments: Make consistencies in giving statements throughout the report.
    **CSC Reply:** The sub-section 13.21 has been revised. So sub-section 13.22 on recommendation for health and safety authentic and remain same.

11. Table 13. Compliance measures (TOMA part) during July-December 2019: Table of this figures are not consistent with our observation during several field visits of the reporting period.
    Comments: Please be realistic while writing status of compliance measures.

**CSC Reply:** The data of table had been used from the monthly report of CTM JV though our field observation does not match with these data. Based on the actual field observation the table has been revised to make information realistic. CTM will also be requested to provide real information.

12. Table 17. Present environmental progress status during July-December 2019: This is not clear, how percentile figures were compiled for each environmental issue implemented.
    Comments: Please provide an explanation how calculated results within table were derived.
    **CSC Reply:** Actually it is difficult to quantify the environmental progress as there is no such indicator for this measurement. It is only visual and qualitative assumption and based on this assumption tentatively numeric progress has been provided in the table 17. More attention will be given in this matter in next time.

**Bangladesh Railway**
**Ministry of Railways**
**Government of the People's Republic of Bangladesh**

**CONSULTING SERVICES CONTRACT FOR CONSTRUCTION SUPERVISION OF AKHAURA-LAKSAM DOUBLE TRACK PROJECT**

## ADB Loan No.: 3170-BAN (SF)

# ENVIRONMENTAL MONITORING REPORT




## Semi-annual Monitoring Report: July-December 2019

**Prepared by: Dr. Md. Kabil Hossain, Senior Environment Specialist**
**For**
**DOHWA Engineering Co. Ltd., Korea**
***In Joint Venture with* Korea Rail Network Authority, Korea;**
**Oriental Consultants Global Co. Ltd., Japan;**
**Balaji Railroad Systems Limited, India; and**
**Development Design Consultants Ltd., Bangladesh**

# EXECUTIVE SUMMARY

Akhaura-Laksam, being a part of Dhaka-Chittagong Railway corridor, is a part of Trans-Asian Railway Network, SASEC, SAARC & BIMSTEC corridors in Bangladesh.

The project entails double tracking of a 72 km rail line, construction of 11 stations and a few hundred meters of access roads in eastern Bangladesh. The land use in the project area is mainly agricultural with no significant environmental features or protected areas. Therefore the project is classified as category B in accordance with the Safeguard Policy Statement (SPS) of the Asian Development Bank (ADB). Accordingly an Initial Environmental Examination (IEE) has been prepared for the Project. The European Investment Bank (EIB) as a co-financier for this project requires the preparation of an Environmental Impact Assessment (EIA) in accordance with the requirements of EIB Environmental and Social Handbook, (2013). In accordance with the requirements of the Department of Environment (DoE), Ministry of Environment and Forests, Government of Bangladesh the project is classified as red category and requires a full EIA. The 69 types of projects listed as red category in the Environmental Conservation Rules 1997 includes engineering works where the capital investment is more than 1 million taka and construction of bridges longer than 100 m. The project investment is more than 1 million taka and includes bridges longer than 100, and hence is a red category project.

Environmental Safeguard is one of the most important issue in project funding and implementation. ADB is seriously concerned about this issue and strictly ensure that any development project financed by them will not affect the natural and social environment of the borrower/loan recipient country like Bangladesh. According to ADB's Safeguard Policy Statement (SPS-2009) borrowers need fulfill the safeguard policy requirements. So the Environment Management Plan (EMP) for Akhaura-Laksam Double Line project must have been prepared, implemented, monitored and reported semiannually so that the project does not impart any serious adverse impact on the natural and social environment.

**Project Status**

Contractor has submitted their Programme on 29th November 2016 as per SubClause 8.3.

The Programme was reviewed and returned for remaking with comments because the Programme does not comply with the Contract on 14 December 2016.

Engineer was able to issue Instruction only on 31st October, 2016 to commence from 1st November, 2016 as the commencement of the works were delayed.

physical works have been started.

**On-going activities (in Up & Down Lines)**

Clearing Grabbing and Stripping works,
Embankment bed preparation / Filling,
Laying Geotextile / Sand Drainage / Sand Blanket preparation, PVD installation
Sand Compaction Pile (SCP) construction (Variation Works) Sub-Grade Construction
Sub-Ballast Construction
Supply of special equipment and materials for track work is ongoing. All rails are stacked at different stockyards of the project. Ballast supply is ongoing and paid quantity based on approved frequency tests and delivery challans is 331,218.0 cum (83%) received to date. Sleeper production & supply are ongoing and about 294,868 nos.(all types) being produced/ supplied to the project.

Contractor had prepared Mobilization for followings:

(i) All construction plant and equipment as stated in the bid proposal: 229 nos, of Heavy Equipment from Plan 579 Nos. mobilized as of 30 November 2016 and continued more

Equipment mobilization in March 2018.

(ii) Construct and equip the site laboratory: Temporary Laboratory has been set up in Cumilla.

**Environmental Monitoring**

All impacts, mitigation measures and monitoring requirements have been defined in Environment Management Plan (EMP), included in the EIA. Monitoring works focus on inspection of contractor work areas, their waste disposal sites, their rehabilitation/re-vegetation, proper landscaping, re-establishment of local access, debris clearance from reconstructed station buildings, culverts as well as the Engineers Main Office, etc. BR is being implemented an air and noise quality monitoring programme during construction years to establish the noise and air quality degradation (if any) at sensitive sites, identified during the Environmental Impact Assessment and to implement proper noise and air quality attenuation measures. In this regard, the contractor is being conducted a regular air, water and noise quality monitoring programme, specified in the Environmental Management Plan and submitting reports on a monthly, quarterly and annual basis. Monitoring photographs are presented in **Appendix: D&E.**

**Water Quality Monitoring**

Surface water quality monitoring had been performed monthly during July to December 2019. There is a possibility to pollute the surface water during the construction period from housekeeping garbage, construction debris discharged by the workers, spillage of fuel and other chemicals from construction equipment, accidental spillage of oil and other noxious chemicals. The quality of surface water tested and analyzed in the project area is compared with EMP**.** In some month the result of the parameters found more than the EMP but acceptable limit. The contractor is requested to take necessary measures for mitigation.

Groundwater sources can be contaminated by the seepage of wastes from workers' camps through the soil profile into the GW aquifer when wells access the shallow aquifer. Groundwater contamination also occurs when gasoline, oil, lubricants, petroleum products and chemicals get into the groundwater and cause it to become unsafe and unfit for human use. Materials from the land's surface can move through the soil and end up in the groundwater. The quality of groundwater is being tested and analyzed in the project area monthly basis by CTM JV. The result of the parameters of ground water found little bit more than the EMP in some month but within the standard limit. The contractor is advised to take necessary measures for mitigation.

**Air Quality Monitoring**

A total of 12 ambient air samples were collected from the Railway Station areas of the project Rail corridor between Akhaura and Laksam. The ambient status of major air pollutants viz. Particulate Matter (SPM, $PM_{10}$ and $PM_{2.5}$), Sulphur Dioxide ($SO_2$), Oxides of Nitrogen ($NO_x$), and Carbon Monoxide (CO) have been assessed by monitoring air quality. All parameters of air quality are found within the acceptable limits specified by the DoE. Previously air sample was collected for 2 hours but at present they are taking the sample for about 8 hours.

## Noise Level Monitoring

Ambient noise levels have been monitored from Railway Stations of the ALDLP project. Twenty four (24) noise level sampling locations had been selected from the nearby sensitive receptor of the stations. Before noise level was monitoring for 60 minutes but at present noise level is being measured for 8 hour at every location and was recorded. Potential noise impacts vary and are based on the noise amplitude, frequency, distance from receivers, site landscape features, topography, presence of obstacles and meteorological effects. Project related key noise sources are train traffic, generators, vehicles, construction equipment and people. Noise level found more than EMP and DoE. Noise attenuation measure is suggested for mitigation.

**Tree Plantation `**

More than 55,000 trees have been cut and will be cut. Three times that is 1,65,000 trees will be planted to compensate the loss. Moreover it will keep the ecological balance.

Tree plantation had been started in the month of May 2019. In May about 1700 saplings had been planted. Plantation had been started from Zero point at Laksam end. As of December 2019 it was found that 15% saplings are alive and rest of 85% plants have been died. These saplings will be replaced by fresh ones. A training program on tree plantation had been performed on 22 December 2019 at Lalmai Railway Station. Local people participated in this program. The training program was organized by CTM JV. ADB BRM and Bangladesh Railway Officials along with ALDLP Project Director visited during training session. CSC's Acting Team Leader was also present during visit. CSC Environmental Specialists assisted the training program. More training program will be performed next time involving female persons.

**Results of Environmental Monitoring and Compliance Measures**

The monitoring results revealed that there were some major significant environmental issues that are being raised during the reporting period. But there are a number of working sites where more mitigation action is need to be taken by the contractor to meet up full compliance with the EMP, as many more activities have been started on site already. In respect to location, work type and status of compliance contractor should mention the environmental issues and mention their mitigation measures taken.

**Conclusions**

Akhaura-Laksam Double Track project could generate a number of environmental impacts, such as those associated with the embankment construction, the river crossings or workers poor campsite housekeeping by the contractor. The EMP provides the specific guidelines which BR has put in place to prevent or mitigate these effects. BR is committed to implement these measures have fully endorsed into the EIA which is the basis for the EMP. BR will ensure that the work is carried out in an environmentally acceptable manner and the monitoring and reporting are completed in a compliant and timely fashion, acceptable to DoE, ADB and EIB.

**Further Action Required**

Bangladesh Railway needs to initiate a station cleaning protocol that addresses garbage and solid waste strewn around the station and on the tracks beside the platforms.

BR needs to fully address the mitigation and monitoring actions defined in the EMP, starting with the management of stations and the provision of clean toilet facilities and maintaining adequate separation of male and female toilet facilities.

BR needs to seriously consider installing sewage collection tanks on its trains, thereby stopping the present practice of dumping raw sewage onto the tracks.

**Lessons Learned**

The Engineer needs to be given authority through more workable provisions in the contract to act very quickly when non-compliance is observed whereby it is clear to the contractor that serious consequences including financial penalties are possible should the contractor decide to be non-responsive to Environmental Safeguard Issues.

## ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| ADB | Asian Development Bank |
| ADF | Asian Development Fund |
| BDT | Bangladesh Taka |
| BOQ | Bill of Quantities |
| BR | Bangladesh Railway |
| BG | Broad Gauge |
| CSC | Construction Supervision Consultancy |
| DB | Dispute Board |
| DG | Dual Gauge |
| DPP | Development Project Proforma/Proposal |
| EIA | Environment Impact Assessment |
| EIB | European Investment Bank |
| GIBR | Government Inspector of Bangladesh Railway |
| GOB | Government of Bangladesh |
| INGO | Implementation Non-Government Organization |
| IPC | Interim Payment Certificate |
| MPR | Monthly Progress Report |
| INGO | Implementing Non-Government Organization |
| ITC | Instruction to Commence |
| LA | Land Acquisition |
| LAR | Land Acquisition and Resettlement |
| LC | Level Crossing |
| MG | Meter Gauge |
| MOF | Ministry of Finance |
| MOR | Ministry of Railways |
| OCR | Ordinary Capital Resource |
| PAM | Project Administrative Manual |
| PVD | Prefabricated Vertical Drain |
| RoB | Rail Overbridge |
| RoW | Right-of-Way |
| SAARC | South Asian Association for Regional Co-operation |
| SASEC | South Asia Sub-regional Economic Cooperation |
| TL | Team Leader of Dohwa Joint Venture |
| Dohwa JV | Dohwa Engineering Co.,Ltd. Korea In Joint Venture with<br>Korea Rail Network Authority, Korea,<br>Oriental Consultants Global Co. Ltd., Japan;<br>Balaji Railroad Systems Limited, India; and<br>Development Design Consultants Ltd., Bangladesh |
| ALDLP | Akhaura- Laksam Double Line Project |
| TOR | Terms of Reference |

# Table of Contents

# List of Tables



# List of Figures

# 1. Project Background

## 1.1 Purpose of the Report And Rationale

1. The Contract for implementation of Consulting Services between Bangladesh Railways (BR) and Dohwa Engineering Co., Ltd and 4 Joint partners mandates submission of "Semi-annual Environmental Report" in compliance with Sub-Clause 26.1 Reporting Obligation of the General Conditions of Contract and Appendix A.

Appendix –A, Item C – "Scope of Work" of the Terms of Reference(TOR) of the Consultancy Services Contract relates to the Construction Supervision Activities where in the Consultant, according to the Contract will work as "the Engineer" to provide the following major categories of services.

Part 1: Project Management, Administration and Planning

Part 2: Technical Support

Part 3: Construction Supervision, Testing and Inspection

Part 4: Environmental Aspects

Part 5: Gender and Other Social Aspect

Part 6 : Resettlement Aspects

Part 7: Defect Liability Period

2. Most important requirement for this phase is to submit semi-annual Environmental Reports with emphasis mainly on the details of construction activies and progress of the Works. Construction Contract has commenced according to the Instruction to Commence(ITC) issued by the Engineer on 31st October, 2016 for the Contractor to commence the Works from 1st November, 2016. However even if ITC was delayed due to non-payment of some part of Advance Payment since the Agreement of Construction Contract was made on 15th June, 2016 the Contractor actually has started mobilization in various provisional disciplines' area.

3. During this period Contractor had been busy performing their duties imposed on Contract for preparation and submission of required documentations and procurement of materials.

This report has been prepared by Project Team of Dohwa Engineering Co., Ltd and 4 Joint partners as the project implementation consultant.

### 1) Sector Objective

4. Government of the People's Republic of Bangladesh adopted the National Land Transport Policy (NLTP) in April 2004 following recommendations from DFID and other agencies, through which the Institutional and Operational Capacity of Bangladesh Railway are to be enhanced and improved. The Asian Development Bank (ADB) and European Investment Bank (EIB) is financing to achieve the targets set in the NLTP.

5. Bangladesh Railway (BR) needed both reform and investment before it can achieve the targets set for the railway sector, the GOB requested the ADB to help finance a Railway Sector Investment Program. This financial support is being extended through a multi-tranche financing facility (MFF). The Government committed to implement a Roadmap and Investment Program that consists of two components viz:

- The Reform Project to improve the performance of the railway sector through organizational, institutional strengthening & policy reforms;

- The Investment Project to finance implementation of priority investments ("Investment Subprojects") to overcome capacity bottlenecks in areas of the railway network where such investments are both economically and financially viable (e.g. the Dhaka-Chittagong Corridor.)

### 2) Project Inception

6. Under ADB's TA-Loan-2688-BAN (SF), the Sub regional Transport Project Preparatory Facility(STPPF), a design project is going on for feasibility study and detailed design for 7(seven) sub-projects. The feasibility study , detailed design and tendering services of the above sub-projects were carried out against STPPF.

7. The investment project will be funded by Asian Development(ADB), European Investment Bank(EIB) and Government of Bangladesh(GOB). Hence, the project will be guided by the guidelines of ADB, EIB and GOB.

## 3) Project Objectives:

8. To convert Dhaka-Chittagong Railway corridor from Meter Gauge (MG) to Broad Gauge (BG) by constructing Dual Gauge and to construct the Double Tacks of the whole project segment.

To improve the traffic capacity by constructing double track of 72km section and to improve of existing track so that more trains can be introduced. After the implementation of the Project, the current capacity of 23 pairs of trains per day will be increased up to 72 pairs of trains per day.

9. By improving the load bearing capacity of railway track new locomotives of heavier axle load can be operated in Dhaka-Chittagong corridor.

10. This project will contribute to improve connectivity for regional and International Freight (Container) traffic along the Trans Asian Railway from India North East to Chittagong and will improve the punctuality of train services by clear off the temporary speed restrictions. Moreover, double track and improved section of existing track will save 25 minutes off the present travel time.

11. The improvement of the financial performance through lowering operating costs will provide a better quality of service for the passengers.

To improve reliability for freight services by providing capacity that affords container block trains with equal priority to intercity passenger trains.

To reduce traffic congestion and air pollution through diversion of some road traffic to rail.

### 4) Project Implementation

12. For Consultancy Services for the Construction Supervision of Akhaura-Laksam Double Track Project an International Tender was called on 19th May,2015. Dohwa Engineering Co., Ltd in joint venture with 4 other companies( Dohwa JV) was resulted in the successful tenderer and a consultancy contract was signed on 28th February, 2016.

13. The detailed design of Construction of Akhaura-Laksam Double Track Project was completed in 2015. Based on the completed design, tender documents were prepared and issued to prequalified contractors in May, 2015. A contract for ALDLP was signed between BR and CTM JV( China Railway Group<CREC>,Toma Construction & CO. Ltd.<TCCL> and Max Infrastructure Limited.<MAX> on 15th June, 2016 for a Contract Amount of BDT 34,734,882,272.43(USD446,636,007 of which ADB will finance 68.3%, EIB,27.8% and GOB,3.9%).

14. After signing of the contract for construction works, Dohwa JV was appointed as the " Engineer"

for the construction on 15th June, 2016.

15. Dohwa JV started mobilizing from 10th April, 2016 and CTM JV started mobilizing as from 15th June, formal Instruction to Commence of the Contract was given to CTM JV on 31st October, 2016 for their Commencement from 1st November, 2016 under the total construction period of 1,456 days (48months).

16. The whole line is devided into 3 sections with different completion dates as intermediate milestone term schedule.

## 1.2 Project Location And Components

### 1.2.1 Project Location

17. The Rail network is divided into two zones: east and west, separated by the Jamuna River. The network includes 659.33km of broad gauge track with the west zone, i.e., 1.676 meter width track. In addition the west zone gauge track has 534.67 km track and 374.83 km of dual gauge track (catering for both broad and meter gauge trains). The east zone has 1,273.38 km of meter gauge track, 34.89 km of dual gauge track. Jamuna multipurpose bridge, which has a dual gauge rail link, provides the only east-west rail link.

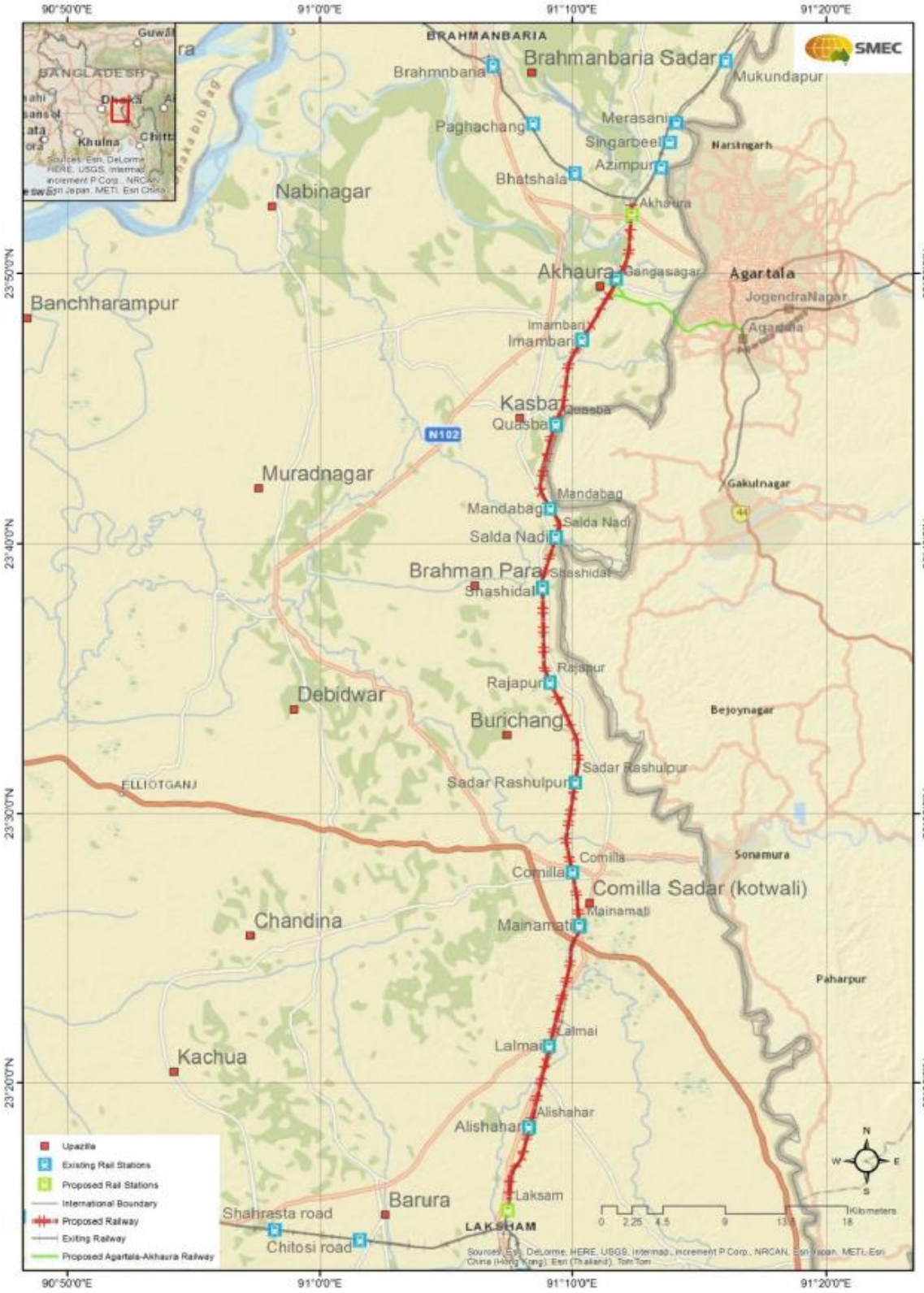
18. The project will support the Government of Bangladesh to upgrade about 72 km Akhaura-Laksam section of Dhaka Chittagong railway corridor to a double track railway line with modern signaling and telecommunication equipment. The section is part of a major sub-regional corridor and the Trans-Asia Railway network.

19. The rainy season in this area starts between April and July and ends between September and November. The track passes through low, flat and alluvial land and crosses several major rivers viz, Titas River, Howrah River, Bijni River, Sald River and Gumti River and many smaller rivers, streams and canals some of which become dry during the dry season.

**Table 1. Location of the Laksam-Akhaura Double track Project**

| Division | District | Upazila |
|---|---|---|
| Chittagong | Brahmanbaria | Akhaura, Quasba |
| | Cumilla | Bhramanpara, Burichang, Cumilla Sadar, Cumilla Sadar Daksmin, Laksam. |

**Figure 1. Akhauar-Laksam double line Project Location Plan**


BRAHMANBARIA
Brahmanbaria Sadar
Brahmnbaria
Mukundapur
Paghachang
Merasani
Singarbeel
Narsingarh
Azimpur
Bhatshala
Nabinagar
Akhaura
Akhaura
Gangasagar
Agartala
JogendraNagar
Banchharampur
Imambari
Kasba
Quasba
N102
Muradnagar
Gakulnagar
Mandabag
Salda Nadi
Brahman Para
Shashidal
Rajapur
Debidwar
Burichang
Bejoynagar
Sadar Rashulpur
ELLIOTGANJ
Comilla
Sonamura
Comilla Sadar (kotwali)
Mainamati
Chandina
Paharpur
Lalmai
Kachua
Alishahar
Laksam
Barura
Shahrasta road
Chitosi road
LAKSHAM
Upazila
Existing Rail Stations
Proposed Rail Stations
International Boundary
Proposed Railway
Exiting Railway
Proposed Agartala-Akhaura Railway
90°50'0"E
91°0'0"E
91°10'0"E
91°20'0"E
23°50'0"N
23°40'0"N
23°30'0"N
23°20'0"N

### 1.2.2 Project Components

20. The scope of the Akhaura-Laksam Double Line Project(ALDLP) and major activities are summarized as follows:

(i) Constructing a second track in dual gauge of 72 Km

(ii) Reconstructing of the present track to dual gauge

(iii) Lengthening passing loops

(iv) Construction of new bridges

(v) Reconstruction of existing bridges and culverts

(vi) Modernization of signaling and telecommunication system

(vii) Construction of 11 new stations

21. A modern computer-based interlocking signaling system will be installed; this will be integrated with the Centralized Traffic Control system.

Additional details are shown below.

| Property | Qty | Properties | Qty |
|---|---|---|---|
| Major Bridge | 12 Nos. | Level Crossing | 23 Nos. |
| Minor Bridge (Culverts) | 49 Nos. | Station to be modified In Signalling and Telecommunication | 2 Nos. |
| New Station | 11 Nos. | Station Building with Total plinth area and New station | 11 Nos. |
| Route Km | 72 Km | Other functional and Residential building With total plinth | 54 Nos. |
| Track Km | 180 290m | | |

## 1.3 Environmental Classification of the project and Responsibilities

### 1.3.1 Environmental Category

22. This project was classified as environment Category B according to the ADB Safeguard Policy Statement (SPS) 2009 as there are no environmentally sensitive sites within the project area and the project includes construction of tracks alongside an already existing track. Hence an Initial Environmental Examination (IEE) has been prepared.

23. The European Investment Bank (EIB) a co-financier for this project requires the preparation of an Environmental Impact Assessment (EIA) in accordance with the requirements of EIB Environmental and Social Handbook, 2013-Version 9.0.

24. In accordance with the requirements of the Department of Environment (DoE), Ministry of Environment and Forests, Government of Bangladesh the project is classified as red category and requires a full EIA. The 69 types of projects listed a red category in the Environmental Conservation Rules 1997 includes engineering works where the capital investment is more than 1 million Taka and construction of bridges lomger than 100 m. The project investment is more than 1 million taka and includes bridges longer than 100 m, and hence is red category project.

### 2) Environmental Clearances

25. According to the Environmental Conservation Rules, 1997, the project falls under Red category and thus under the provisions of the Bangladesh Environment Conservation Act, 1995, Bangladesh Railway (BR) needed to obtain Environmental Clearance Certificate (ECC) from the Department of Environment, Government of Bangladesh before commencement of the construction works.

26. The Environmental Clearance Certificate (ECC) for the project, valid for one year, was obtained by BR from the DOE on 2nd May 2016, according to their memo no. DOE/Clearance/ 5209/2013/188. Dated: 02/05/2016. Subsequently renewals of the ECC has been obtained before 02/05/2017 for the year 2017 (1 year). BR had to lodge an application for a renewal of the environmental clearance certificate up to 30th Jun 2017. Last year it was renewed on 29 May 2018. This year the renewal is found on 25 July 2019.

### 3) Institutional Setup and Responsibilities

27. During the preparation and construction of the Project, BR's Project Director is giving the final approval for all administrative and technical decisions at all times. The key agencies or units which are playing major roles in the implementation of the EMP are:

- Bangladesh Railway's newly proposed Environmental and Social Safeguards Unit (ESSU)
- The Contractor;
- Engineer (usually an international firm);

28. The implementation oversight of all safeguard items in the EMP and indeed the construction contract are with BR and its ESSU. When the Engineer is appointed BR's technical management of the work is being delegated to the Engineer, but with final approval always passing through BR (Figure 21 in the EIA report**)** with annual audit reports submitted to ADB and EIB, who may undertake periodic inspection trips to confirm that safeguards are being fully implemented.

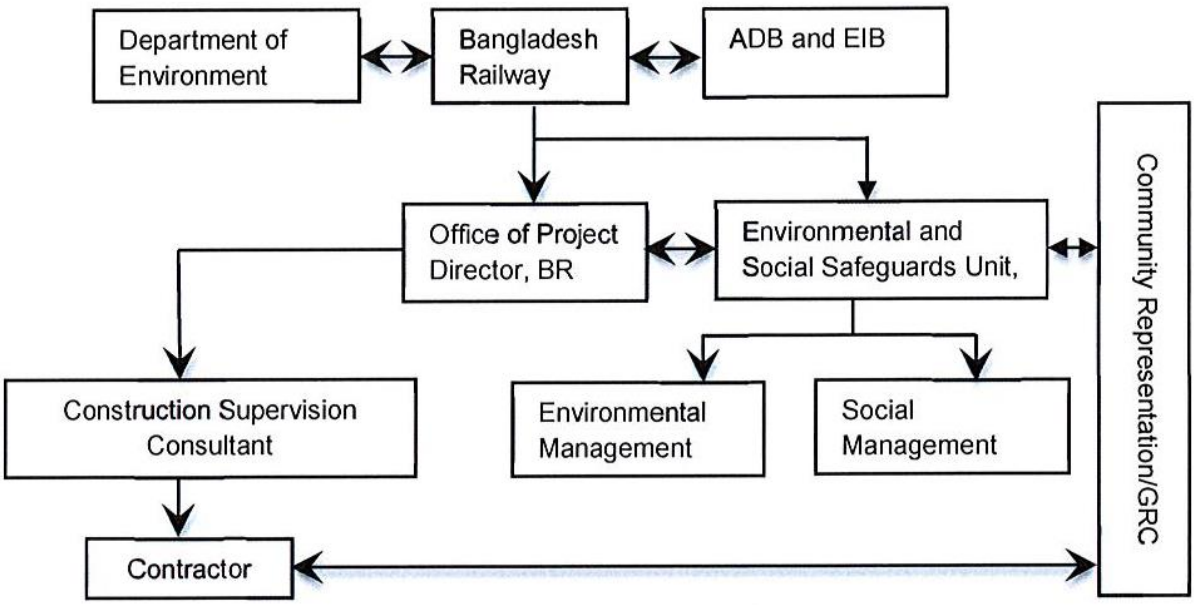



**Figure 2. Safeguards Implementation and Reporting Work Flow**

29. **BR's Environmental and Social Safeguards Unit (ESSU) –** The objective of an ESSU is to build enough technical capacity within BR to permit it to oversee environmental and social safeguard matters arising from donor projects and to respond with technical knowledge to specific safeguard issues triggered by Project activities, or community complaints. Secondly, the ESSU should be able to manage Consultant and oversee the Consultant's deliverables. Thirdly it will need to be able to fully address EIA requirements of the Project when the Engineer is no longer on the job. The ESSU will have to be able to assess environmental data, analyses it and define actions required to address non-compliant findings in a credible and timely manner. Finally the ESSU should be able to provide training as needed to both contractors and BR staff in all aspects of environmental and social safeguards management. Therefore the ESSU's main tasks will be:

- Oversee the implementation of the LAP and RP;
- Implementing the EMP;
- Supervise and monitor the progress of the Consultant engaged by BR, for addressing safeguard requirements, such as air quality or resettlement plan implementation monitoring;
- Liaise with all regulatory agencies, including DoE and the public;
- Prepare all manner of safeguard monitoring and compliance reports; and
- Providing training to contractors and BR staff.

30. At this time BR is in the early stages of planning such a unit within its organization. During this planning stage BR will appoint at least one safeguards person to look after the Project safeguard needs, and be the direct contact for safeguard matters between stakeholders, regulators, donors and BR.

31. **BR's Regional Offices and Staff –** The day-to-day oversight of the construction work on this Project has not been decided but will likely be done by the Regional BR Office and its Chief Engineer in charge. Therefore, the Engineer will work closely with the BR's Regional office.

32. **Construction Supervision Consultant/The Engineer –** The proposed framework for implementation of the Project shall utilize consultancy services from both international and national companies for the overall management and supervision of construction work and for preparation of the associated documents.

33. **Contractor(s) –** A contractor selected on the basis of international completive bidding shall carry out construction work based on a contract containing a set of environmental clauses, conditions and/or specifications (Section 6, Subsection H of contract technical specifications and **Annex 11).** The contractor will need to demonstrate environmental capacity in the proposal submitted to BR, and be prepared to have that person(s) participate in the mandatory pre-construction training exercise delivered by BR's ESSU or its Consultant.

34. **Other GoB Organizations –** The organizations involved in regulating the project are Department of Environment (DoE), Bangladesh Water Development Board (BWDB), Roads and Highways Department (RHD) and Department of Forest (DF), Local Government Engineering Department (LGED), Bangladesh Inland Water Transport Authority (BIWTA), and local administration (UNO, DC, Police, etc.). They will provide supporting services as required.

**4) Key Findings in the EIA report**

35. The conclusion and recommendations of the EMP of 2016 are as follows:
The project involves the doubling of an existing rail line; therefore new impacts are really the magnification of impacts taking place along the corridor for many decades given that it has been in operation since the late 19th Century.

36. Most of the impacts associated with the project will occur during the construction period since a large and high embankment, between 2-6 n, will be put in place and requiring millions of tons of fill

material. Much of that will be dredged from nearby rivers and pumped as slurry to the work sites. As much ballast, as possible will be hauled on roads. The problems arising when the contractor does not follow environmentally responsible operating procedures or does not provide proper housing or cleaning, hygienic quarters for the workers is also addressed in detail.

37. The EIA identified eight mitigative actions needing to be addressed during the pre-construction period, another 20 during the construction period and eight during the operating period of new rail line. To track the mitigation work an air, noise and surface water quality monitoring programme will be started during the construction period and carried through into the operating period for operating period for operating years 1, 3 and 5.

38. There is little chance that impacts will extend much beyond the 50 or 100 m wide corridor of impact centred over the rail line, given that all work will be strictly confined to the railways existing Right of Way.

39. Careful implementation of the pre-construction mitigative measure will make the likelihood or scale of the construction period impacts less.

40. The climate risk associated with sea level rise and the need to adjust bridge deck clearances was calculated and found to be negligible given the distance of the bridges to a location where sea level rese can be measured (Meghna River estuary).

41. The fuel saving, due to diversion of road use to rail travel during the first year of full operation, i.e. , 2020, will be 10,743,000 litre of fuel, with 6 additional train sets operating on the new track. However by 2023, with 44 train sets in operation, estimated fuel saving will be around 54 million litres/year (including the added fuel used by the larger number of train sets. After 2023 the diversion is expected to have peaked and no increase is predicted through 2044.

42. Based on these data, the diverted traffic in 2023, when 44 train sets are I operation an estimated 64.4 million litres of diesel fuel per year would be saved, with a net benefit, once train consumption is deducted, of 53.78 million litres/year. A net fuel saving of 53.78 million litres per year, translates into a saving of 145,000 metric tonnes of equivalent $CO_2$ per year. (using an equivalent $CO_2$ emissions factor of 2.69 kg $CO_2$ per litre of diesel fuel consumed).

43. The establishment of BR's Environmental and Social Management Unit will be essential and will make the job of implementing environmental safeguards much easier and more credible, since some expertise will reside in BR, overseeing the entire EIA procedure, instead of it being only with outside Consultant.

44. Social impacts especially associated with land acquisition and the need to relocate people and to use productive agricultural lands, will be significant and will affect thousands of people. The procedure for determining entitlement and compensation is defined in the LAP and RP documents which the Project must follow closely. The actions defined in these two documents are being implemented by BR.

45. No red-flag environmental safeguard issues were identified and all likely impacts can be prevented or mitigated to an acceptable level.

46. BR will fully implement the EIA's environmental management plan and quarterly monitoring will be used to adjust the monitoring programme defined in the EIA. Should problems be noted with the data, BR will recommend immediate actions, and the annual reporting will be used to adjust mitigative actions. These activities, coupled with the timely reporting will provide the appropriate level of environmental oversight and demonstrate to the ADB that the natural environment is being protected while the rail line is built and the system becomes operational.

47. The potential impacts on the Gumti River Bridge were examined, focusing on pile driving in water, use of drilling lubricants, work camp operation near the shore and work over a navigation channel. To address these issues a separate EMP, designed to deal with all possible effects that might endanger the river's aquatic environment, was prepared and will be implemented.

48. The reconstruction of 11 stations and construction of other building s will be managed through a programme of maximum recycling of materials and management of all wastes and dust suppression. The design of each station and building, to accommodate sewage, waste, water, lighting and universal design features has been completed as a separate report and will be verified as part of the pre-construction check by BR and its ESSU.

49. BR concludes that this EIA is complete and addresses all relevant likely impacts and proposes a full set of time-bounded mitigative and monitoring actions, including assignment of responsibility. The application of the detailed EMP will ensure that the nature and socio-cultural environment are not unduly affected by the work or the operation of the second line. Therefore BR recommends that an environmental approval be granted by DoE, and that no additional studies be required.

50. The recommendations of the EMP were incorporated into the detailed design and the tender documents and have then became a part of the civil works contract. The cost for the implementation of the EMP was included in the contract and the approved Revised Development Project Proforma /Proposal (RDPP).

## 1.4 Project Status

**1) Project Status as of 31 December 2019**

64. Processing Status of Materials and Others:

(i) **Rails:** Approved manufacturer of rails as to "Inner Mongolia Baotou Steel Union Co, China"

(ii) **Third Party Inspector:** the Engineer approved NMCI for rails only, other track material not approved.

(iii) **Ballast source:** Approved 4 suppliers.

(iv) **Temporary Laboratory** has been set up in Cumilla at the end of November 2016.

(v) **Aggregate Source:** approved 4 suppliers

(vi) **Cement suppliers:** Approved 4 suppliers

(vii) **Rebar:** Approved 3 suppliers

(viii) **PSC Sleepers:** GPT Infra-project Technologies/India will be acceptable, but TOMA and MAX plants shall be checked in legal aspects.

(ix) **Embankment borrow source:** Private land and RoW is the borrow source.

(x) **Dumping yard:** Dumping yard has been selected and is under approval of DoE.

(xi) **Water purifiers** for Engineer's accommodation:

The Engineer concerned about the quality of ground water, so both planned to analyze the ground water quality to assure it to meet with the potable water criteria of user's country criteria.

### 2) Environmental Management Plan

65. For this project the EIA report included (Table 38, Table 39, Table 40 and Table 41 of the EIA report**)** the Environmental Management Plan (EMP)**.** The EMP defines a set of mitigation and monitoring actions to be taken, in response to potential impacts predicted to take place during the pre-construction, construction and operating period of the Project. The sources of the impacts and the impacts were identified during the EIA study. The EMP is presented as two tables, defining not only impacts and mitigative and monitoring actions to be implemented, but also, where when and who will be responsible for implementing them. The EMP describes well known and best practice mitigative action to be taken to prevent negative impacts from taking place and if that is not possible to mitigate them to an acceptable level. In addition this EMP will:

- define measures to off-set or compensate irreversible negative impacts;
- specify the institutional arrangement for the implementation of the EMP; and
- identify means to enhance and maximize positive impacts.

66. The EMP (Table 38 and Table 39 of the EIA report) will be the main tool with which BR will manage environment impacts by applying both mitigative and monitoring measures in a technically credible and timely manner. The mitigative measured are considered successful when the impacts have either been eliminated or the residual effect complies with the environmental quality standards, policies, and legal reqauirement set by DoE. Mitigative measures are tracked via the monitoring programme, which is described in the second of two EMP tables, and focuses on construction and operating period impacts.

67. As agreed with DoE, the construction of any large bridge (>100 m spans) which under DoE regulations would normally require their own EIA, and which DoE has exempted BR from doing, will be presented in more detail and with its own mitigative and monitoring requirements. These details for the Gumti River Bridge are provided in Chapter VI and Chapter IX in the EIA report.

68. The Contractor shall be responsible for preparing detailed documentation related to implementing this EMP. This should include information regarding scheduling, personnel, reporting and auditing requirements, training and detailed procedures for implementing the EMP. The Contractor's EMP and associated documentation shall be approved by BR prior to construction commences.

### 3) Environmental Management Implementation Works Schedule (EMWS)

69. The approved EIA and the certificate from DoE will trigger the implementation phase for the EIA, i.e. the actions to mitigate and monitor the predicted impacts resulting from the building and operation of the Project.

70. BR is committed to exploring the establishment of an ESSU and has included that as an action item in the Project's feasibility study. BR will address this internally, to establish if such a staff compliment is available. The EMP has been integrated into the contract specifications, making it a mandatory set of task for the contractor to implement. By preparing and approving the EIA and its EMP, BR has already confirmed its commitment to following through on the EMP. Until an ESSU is established BR will assign at least one safeguards specialist to deal with Project safeguard matters.

71. During the pre-construction period BR will be responsible for implementing the seven mitigative and monitoring measures, according the timetable defined in the EMP and submitting a final monitoring checklist - Prior to the start of construction. BR will insure that the contractors receive all relevant safeguard documents and that a training workshop be held to help the contractors understand the EMP, how to prepare their mandatory work plan, and deliver the required documentation.

72. The contractors will implement all 20 mitigative and monitoring actions (See EMP), providing environmental safeguard compliance update as a section of the overall Project monthly progress report. The contractor will also submit semi-annual summaries of surveys, findings and compliance. During the pre-mobilization workshop BR or its Engineer will review all these requirements (which are all defined in the EIA and its EMP). Construction bid documents have been prepared with a specific environmental bill of quantity section, allowing for unambiguous calculation of environmental penalties.

73. Monthly and quarterly progress reports on EMP implementation are being prepared by the Contractor in cooperation with the Engineer appointed by BR. All reports are being submitted to BR via the Engineer. The quarterly reports are being included a compliance monitoring checklist reporting (Annex 12 of the EIA report) on the progress of all 20 constructions period actions. Incidents of significant contamination/pollution caused by the Contractor's activities shall be reported. Recommendation shall be made for mitigation of environmental damage and for prevention of any recurrences.

74. During the construction period (four years) the Engineer will prepare annual environmental due diligence reports, based on the monthly and quarterly submissions by the contractor. Additional details describing the implementation arrangements are provided in Chapter XI in the EIA report.

## 1.5 Environmental Mitigation and Monitoring Requirements

### 1) The Environmental Management Plan in different Phases of the Project

75. In pre-construction period BR identified eight impacts which if not properly addressed could lead to impact during the other two Project phases or totally eliminate the objective of completing an EIA. These included, having a tree replacement plan in place, minimizing land requirements by fine tuning where the new alignment is placed, and giving a process in place that protects the three identify PCRs and the 46 community-level sites (CPR) identified during consultations as needing protection.

76. The Project will require the construction of several new stations as well as improved access. The EMP underscores BR's actions to make sure the designs and alignments are sensitive to local conditions and wishes.

77. During construction period BR identified 20 mitigative and monitoring actions that will need to be implemented if significant construction-related effects are to be minimized (see EMP **Table 32 33).** The following nine construction activities are likely to trigger negative effects which have been addressed in the EMP:

- Unrestricted movement of construction, machinery and vehicles;
- Railway embankments construction;
- Construction of station buildings and EMO building;
- Rail and loop/siding development;
- Station access road construction;
- Bridges crossing structures, culverts and any training works;
- Installation of signaling and interlocking system, platforms, foot over bridges at stations, platform sheds and level crossing safety facilities; and
- Poor good housekeeping practices by the contractor and failure to properly implement an occupational health and safety programme.

78. Of these, the most important will be the effects stemming from the placement of the two-six meter high embankment paralleling the existing rail line for around 70 km. the movement of around 56,000 truck-loads of material and pumping of dredged sand, generating noise and dust as well as traffic bottlenecks, will need to be properly managed. Dust suppression, and limits to truck traffic during

low noise periods, as well as care with fleet maintenance will be important. Insuring the trucks and construction machinery do not idle for more than three minutes if not in use will markedly reduce the emissions and provide considerable fuel savings.

79. The embankment slopes will easily erode if not re-vegetated quickly. Therefore, the contractor will implement a rehabilitation programme as the work is completed

80. To better track the air and noise pollution the contractor will be required to undertake a compliance monitoring programme, testing the parameters defined in Chapter IV of the EIA report and at the same station as shown in the strip maps (Annex 2 in EIA report) Noise monitoring will be completed at the three PCRs and selected CPRS (closest schools, mosques and residences). The schedule will be more or less the same as the sampling completed during the field work for this EIA.

81. Another common impact involves the failure of contractors to properly maintain work camps, allowing sewage to leak, garbage to be left unmanaged, fuel to leak and even bitumen to spill over the ground near the asphalt batch plant[57] occupational health and safety (OHS) practices are often ignored, the contractor either not providing adequate safety equipment or not enforcing its use. Contractors will be required to provide hard hats, ear plugs, dust masks and eye protection, and deliver OHS training sessions at least once a year.

82. Construction of one large bridge, 11 medium bridges and 47 culverts could result in impacts on surface water quality and to that end the Gumti River crossing work will undertake water quality monitoring, according to the design used in this EIA. This is particularly true if bentonite drilling mud is used during the pile boring operations on the six larger rivers. Contractors will be required to provide a bentonite recovery plan, should this material be used.

83. Finally, the Project will require concrete since all piles; piers and large culverts will be cast at casting yards requiring the establishment of a mobile concrete batch plant, generating noise and dust. The contractor will be required to have dust and noise suppression features built into any concrete batch plant. The plant will need to be located at a DoE approved site, at least 500 m from the nearest occupied dwelling.

84. Since the existing line has been in operation for over 100 years, producing noise, dust and air pollution, there will be added impact from the operation of a second line, but the extent of this impact should be compared with the establishment of a new railway line. Eight mitigative and monitoring actions will need to be implemented during the operating period. Three important impacts that BR will address are:

- Possible inadequate clean up and rehabilitation of contractors camps and yards and borrow areas;
- Added noise and air pollution from a doubling of the rail traffic, impacting on local sensitive receptors; and
- Lack of adequate new safety measures/equipment accounting for the large increase in train traffic across the level crossing.

85. These impacts, mitigative measures and monitoring requirements are listed in detail in the EMP.

### 2) Sampling Program

86. The extent of the impacts of environmental pollution related to surface water, ground water, air quality and noise level were determined in quantitative terms by sampling a range of related environmental parameters (sampling photographs is presented in **Appendix: B**) . The mitigative measures provided for in the EMP can be adjusted based on these results as well. The field sampling work was specified for the construction and operating period.

# 2. Environmental Monitoring Activities

## A. Pre-construction stage

87. Around 55,000 trees and saplings within 50m RoW of proposed alignment, workers camp setting, and station areas are being cut down during pre-construction period. Proper compensation to affected people is being provided with the house and property damage through resettlement activities of the project. The tree along the RoW were illegally planted and some are naturally grew. So no tree will be planted to compensate the tree loss but vegetation must be planted to protect erosion and potential ecological loss.

88. Based on preliminary topographical and social survey data of the project, the project involves land acquisition of around 37.38 hectares along the proposed alignment and station areas. A total of 2004 households will be affected. The detail guideline for land acquisition and compensation can be found in LAP and RP of this project.

89. Some utility lines such as electric transmission lines and water supply pipelines are being shifted or removed with proper agency approvals and permits. It will be confirmed that permits, Location and relocation site plans have been approved.

## B. Construction Stage

90. Although to date many of the mitigation measures have been implemented there are some significant deficiencies that need to be addressed as the number and range construction activities has increased on site. One important area where deficiencies continue to exist and that needs further on-going action is the occupational health and safety practices. Further improvement of the general condition of the camps and work areas in relation to waste disposal, hygiene, medical facilities, etc. is still required and general cleanliness and tidiness needs attention. Personal safety including the provision and use of the range of Personal Protective Equipment (PPE) for the workforce is also an area that requires continual attention with frequent and regular training and awareness sessions for all staff. This in fact is now taking place, with the CSC taking a leading role.

91. Safety at the many work sites with the provision of signs and notices, warning flags, safety barriers and fences, shoring of excavations and general safe working practices is also an area that requires continual attention with regular maintenance and frequent replacement of many of the precautionary devices used. Until December 2019, the extent of the impacts on surface and ground water, air quality, noise and vibration from the various work activities could not be determined. The sampling requirements for surface water, ground water, air and noise have been maintained at the agreed frequency with the results up to 31 December 2019.

92. A number of impacts mentioned several times in the past have been left unaddressed, namely the completion of the clearing of all pond site debris and diversion material and the complete stabilization of embankments with vegetation, the provision of solid waste disposal facilities (garbage cans) at stations, and the removal of construction debris/equipment and materials from station platforms.

93. The clean-up and demobilization of the main subcontractor's construction yard has not started and the area is in serious non-compliance, i.e. there is waste oil spilled throughout the site as well as construction debris scattered in the open, creating ideal stagnant water pools and mosquito breeding

areas. Finally, there remains the issue of filling in of large borrow areas and the arrangement with local residents to hand over these sites for other uses. This is mainly at the private land sites.

## C. Sampling Program Results and Analysis during July-December 2019

## 2.1 Water Quality Monitoring

## 2.2 Surface and Ground Water Quality

94. Surface water sampling was based on the identification of major surface water bodies which has crossed the Construction site. Groundwater sampling locations were selected to obtain a representative water sample from various zones within the study area. The samples were collected from existing tube wells of the railway stations.

95. The quality of surface water was compared with the standards for Inland Surface Water, Environment Conservation Rules (ECR) and 1997-Schedule 3 whereas the groundwater was compared with the Drinking Water Standard ECR Schedule-3, 1997. The standards have been presented along with the monitoring results of surface and groundwater for comparison.

Results of Sampling and Analysis

96. During July to December 2019 some major works were being undertaken. There is a possibility to pollute the surface water during the construction and operation period from untreated sewage effluent discharged by passing trains, spillage of fuel and other chemicals from freight trains, accidental spillage of oil and other noxious chemicals. The quality of surface water tested and analyzed in the project area is provided in the following **Table 2.**

There is a possibility to pollute the surface water during the operating period from untreated sewage effluent discharged by passing trains, spillage of fuel and other chemicals from freight trains, accidental spillage of oil and other noxious chemicals. Following Table provides the quality of surface water in the study area.

**Table 2. Surface Water Quality in the Study Area during July-December 2019**

| Sl# | Sampling Code | Location | pH | Temperature ($^0$C) | Electric Conductivity (EC) | Total Dissolve Solids (TDS) | Dissolve Oxygen (DO) (mg/L) | Biochemical oxygen demand (BOD) (mg/L) | Chemical Oxygen Demand (COD) (mg/L) | Total Suspended Solid (TSS) | Sampling Time | Sampling Date | Sample Collector's name With Mobile no. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **July 2019** | | | | | | | | | | | | | |
| 1. | SW 1 | Haora River Water (upstream) | 8.02 | 21.1 | 0.17 | 0.09 | 5.9 | 2.2 | 5 | 20 | 11:00 am | 15.07.2019 | . Wasim Uddin 01777654488 |
| 2. | EMP | Haora River Water (upstream) | NR | NR | NR | NR | NR | NR | NR | NR | | | |
| 3. | SW2 | Haora River Water (downstream) | 8.04 | 21.9 | 0.17 | 0.09 | 6.0 | 2.2 | 6 | 21 | 11:30 am | 15.07.2019 | . Wasim Uddin 01777654488 |
| 4. | EMP | Haora River Water (upstream) | NR | NR | NR | NR | NR | NR | NR | NR | | | |
| **August 2019** | | | | | | | | | | | | | |
| 5. | SW1 | Dakatia River Water (Upstream) | 6.53 | 32.2 | 0.16 | 0.08 | 4.1 | 1.0 | 17 | 18 | 11:10 am | 25.08.2019 | Wasim Uddin 01777654488 |
| 6. | EMP | Dakatia River Water (Upstream) | NR | NR | NR | NR | NR | NR | NR | NR | | | |
| 7. | SW2 | Dakatia River Water (down-stream) | 6.54 | 31.9 | 0.16 | 0.08 | 4.7 | 1.3 | 21 | 20 | 11:20 am | 25.08.2019 | Wasim Uddin 01777654488 |
| 8. | EMP | Dakatia River Water (down-stream) | NR | NR | NR | NR | NR | NR | NR | NR | | | |
| **September 2019** | | | | | | | | | | | | | |
| 9. | SW1 | Haora River water (Upstream) | 6.73 | 27.9 | 0.06 | 0.03 | 5.1 | 1.4 | 24 | 21 | 12:10 pm | 24.09.2019 | Washim Uddin 01777654488 |
| 10. | EMP | Haoara River water (Upstream) | NR | NR | NR | NR | NR | NR | NR | NR | | | |
| 11. | SW2 | Haora River water (Downstream) | 7.00 | 28.2 | 0.06 | 0.03 | 6.1 | 1.6 | 18 | 24 | 12:20 pm | 24.09.2019 | Washim Uddin 01777654488 |
| 12. | EMP | Haora River water (Downstream) | NR | NR | NR | NR | NR | NR | NR | NR | | | |
| **October 2019** | | | | | | | | | | | | | |
| 13. | SW 1 | Goniajuri River Water (upstream) | 6.71 | 28.3 | 0.58 | 0.30 | 6.2 | 1.4 | 32 | 20 | 11.55 pm | 20.10.2019 | Washim Uddin 01777654488 |
| 14. | EMP | Goniajuri River Water (upstream) | NR | NR | NR | NR | NR | NR | NR | NR | | | NR |

| Sl# | Sampling Code | Location | pH | Temperature ($^0$C) | Electric Conductivity (EC) | Total Dissolve Solids (TDS) | Dissolve Oxygen (DO) (mg/L) | Biochemical oxygen demand (BOD) (mg/L) | Chemical Oxygen Demand (COD) (mg/L) | Total Suspended Solid (TSS) | Sampling Time | Sampling Date | Sample Collector's name With Mobile no. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15. | SW 2 | Goniajuri River Water (downstream) | 6.68 | 28.1 | 2.58 | 0.30 | 5.4 | 1.2 | 41 | 21 | 12.15 pm | 20.10.2019 | Washim Uddin 01777654488 |
| 16. | EMP | Goniajuri River Water (downstream) | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| **November 2019** | | | | | | | | | | | | | |
| 17. | SW 1 | Salda River Water (Upstream) | 7.02 | 24.2 | 0.12 | 0.06 | 4.3 | 1.2 | 21 | 23 | 11:55 am | 13.11.19 | Washim Uddin 01777654488 |
| 18. | EMP | Sindai River water (upstream) | 7.5 | 23.8 | 0.09 | 0.05 | 5.6 | 6 | 24 | 18 | | | |
| 19. | SW 2 | Salda River Water (Downstream) | 7.04 | 24.4 | 0.12 | 0.06 | 4.1 | 1.0 | 18 | 20 | 12:15 pm | 13.11.19 | Washim Uddin 01777654488 |
| 20. | EMP | Salda River Water (Downstream | 7.5 | 23.8 | 0.09 | 0.05 | 5.6 | 6 | 24 | 18 | | | |
| **December 2019** | | | | | | | | | | | | | |
| 21. | SW 1 | Gumti River (Up-Stream) | 7.11 | 20.9 | 0.13 | 0.07 | 5.8 | 5 | 6 | 22 | 01.20 pm | 25.12.19 | Washim Uddin 01777654488 |
| 22. | EMP | Gumti River (Up-Stream) | NR | NR | NR | NR | NR | NR | NR | NR | NR | | |
| 23. | SW 2 | Gumti River (Down-Stream) | 7.30 | 21.0 | 0.13 | 0.07 | 5.6 | 4 | 5 | 20 | 01.35 pm | 25.12.19 | Washim Uddin 01777654488 |
| 24. | EMP | Gumti River (Down-Stream) | NR | NR | NR | NR | NR | NR | NR | NR | NR | | |
| **Bangladesh Standard** | | | | | | | | | | | | | |
| | | Source of drinking water for supply only after disinfecting | 6.5-8.5 | - | - | - | 6 or above | 2 or less | - | - | | | |
| | | Water usable for recreational activity | 6.5-8.5 | - | - | - | 5 of more | 3 or less | - | - | | | |
| | | Source of drinking water for supply after conventional treatment | 6.5-8.5 | - | - | - | 6 or above | 6 of less | - | - | | | |
| | | Water usable by fisheries | 6.5-8.5 | - | - | - | 5 of more | 6 of less | - | - | | | |
| | | Water usable by various process and cooling industries | 6.5-8.5 | - | - | - | 5 of more | 10 or less | - | - | | | |
| | | Water usable for irrigation | 6.5-8.5 | - | - | - | 5 of more | 10 or less | - | - | | | |

*Note: BDL = Below Detection Limit; NR= Not Reported; Source: EQMS Field Survey and DPHE Central Laboratory LA= Lab analysis*
** Bangladesh Environment Conservation Rules, 1997- Schedule 3 (Standards for inland surface water).*

## 2.3 Ground Water Quality

Results of Sampling and Analysis

97. Groundwater sources can be contaminated by the seepage of wastes from workers' camps through the soil profile into the GW aquifer when wells access the shallow aquifer. The contamination from train operations would be mostly bacteria, viruses and waste from the sewage-laden track runoff leaking into the well. The quality of groundwater tested and analyzed in the project area is provided in the following **Table 3.**

**Table 3. Ground Water Quality in the Study Area during July-December 2019**

| Sl# | Sampling Code | Location | pH | Temperature (0C) | Phosphate | Manganese, Mn | Arsenic, As | Iron, Fe | Fecal Coliform, FC | Sampling Time | Sampling Date | Sample Collector's name With Mobile no. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **July 2019** | | | | | | | | | | | | |
| 1. | GW 1 | Lalmai Railway Station | 6.81 | 27.9 | 0.6 | 0.2 | <0.01 | 0.12 | 0 | 11.35 am | 28.07.2019 | Md. Wasim Uddin 01777654488 |
| 2. | EMP | Lalmai Railway Station | 6.20 | 27.0 | 0.18 | 0.09 | 0.001 | 0.05 | 0 | | | |
| 3. | GW 2 | Mandabag Railway Station | 7.18 | 27.2 | 0.9 | 0.3 | <0.01 | 0.08 | 0 | 12.30 pm | 30.07.2019 | Md. Wasim Uddin 01777654488 |
| 4. | EMP | Mandabag Railway Station | 7.19 | 25.4 | NR | NR | NR | NR | NR | | | |
| **August 2019** | | | | | | | | | | | | |
| 1. | GW 1 | Alishahar Railway Station | 6.10 | 27.5 | 2.1 | 0.5 | <0.01 | 4.03 | 0 | 11:10 am | 25.08.2019 | Md. Wasim Uddin 01777654488 |
| 2. | EMP | Alishahar Railway Station | 6.90 | 25.0 | 0.24 | 0.33 | 0.001 | 0.05 | 9 | | | |
| 3. | GW 2 | Kasba Railway Station | 6.25 | 27.5 | 1.9 | 0.3 | <0.01 | 5.0 | 0 | 01.00 pm | 27.08.2019 | Md. Wasim Uddin 01777654488 |
| 4. | EMP | Kasba Railway Station | 6.79 | 28.6 | NR | NR | NR | NR | NR | - | - | - |
| **September 2019** | | | | | | | | | | | | |
| 1. | GW 1 | Sadar Rasulpur Railway Station Tube-well water | 6.78 | 30.4 | 0.08 | 0.01 | <0.010 | 0.09 | 0 | 12.05 am | 22.09.2019 | Washim Uddin 01777654488 |
| 2. | EMP | Sadar Rasalpur Railway Station Tube-well water | 6.76 | 28.6 | 0.21 | 0.06 | 0.001 | <BDL | 9 | - | - | - |
| 3. | GW 2 | Gangasagar Railway Station, tube-well water | 6.44 | 28.8 | 0.04 | 0.03 | <0.010 | 0.07 | 0 | 01.00 pm | 24.09.2019 | Washim Uddin 01777654488 |
| 4. | EMP | Gangasagar Railway Station, tube-well water | 7.12 | 26.2 | NR | NR | NR | NR | NR | - | - | - |
| **October 2019** | | | | | | | | | | | | |

| Sl# | Sampling Code | Location | pH | Temperature (0C) | Phosphate | Manganese, Mn | Arsenic, As | Iron, Fe | Fecal Coliform, FC | Sampling Time | Sampling Date | Sample Collector's name With Mobile no. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | GW 1 | Cumilla Railway Station | 6.85 | 28.0 | 0.06 | 0.04 | <0.01 | 0.12 | 0 | 11:25 am | 21.10.2019 | Washim Uddin 01777654488 |
| 2 | EMP | Cumilla Railway Station | 6.97 | 27.0 | 0.56 | 0.09 | 0.001 | 0.18 | 0 | - | - | - |
| 3 | GW 2 | Akhaura Railway Station | 5.90 | 28.1 | 0.10 | 0.02 | <0.01 | 0.07 | 0 | 11:00 am | 23.10.2019 | Washim Uddin 01777654488 |
| 4 | EMP | Akhaura Railway Station | 6.20 | 27.3 | NR | NR | NR | NR | NR | - | - | - |
| **November 2019** | | | | | | | | | | | | |
| 1 | GW 1 | Saldanodi Railway Station | 6.13 | 28.0 | 1.4 | 0.13 | <0.01 | 0.43 | 0 | 11.25 am | 13.11.2019 | Washim Uddin 01777654488 |
| 2 | EMP | Saldanodi Railway Station | 7.10 | 27.1 | NR | NR | NR | NR | NR | - | - | - |
| 3 | GW 2 | Mainamati Railway Station | 6.53 | 27.0 | 1.7 | 0.09 | <0.01 | 0.39 | 0 | 11.00 am | 13.11.2019 | Washim Uddin 01777654488 |
| 4 | EMP | Mainamati Railway Station | 6.72 | 26.0 | 0.46 | 0.61 | 0.003 | <BDL | 11 | - | - | - |
| **December 2019** | | | | | | | | | | | | |
| 1 | GW 1 | Shashidal Railway Station | 6.70 | 24.5 | 0.29 | 0.48 | <0.01 | 0.05 | 0 | 11.05 am | 23.12.2019 | Washim Uddin 01777654488 |
| 2 | EMP | Shashidal Railway Station | 6.90 | 25.0 | NR | NR | NR | NR | NR | - | - | - |
| 3 | GW 2 | Lalmai Railway Station | 5.28 | 25.8 | 1.52 | 0.47 | <0.01 | 0.43 | 0 | 11.50 am | 25.12.2019 | Washim Uddin 01777654488 |
| 4 | EMP | Lalmai Railway Station | 6.20 | 27.0 | 0.18 | 0.09 | 0.001 | 0.05 | 0 | - | - | - |
| **Bangladesh Standard (ECR'97)** | | | **6.5- 8.5** | **-** | **6.0** | **0.1** | **0.05** | **0.3-1** | **0** | **-** | **-** | **-** |

*Note: BDL = Below Detection Limit; LA: Lab Analysis Still Going On; Source: EQMS Field Survey and DPHE Central Laboratory*
*(Source: Laboratory Analysis: DPHE Central Laboratory, Dhaka)*

## 2.4 Air Quality Monitoring

Results of monitoring and Analysis

98. A total of 12 ambient air samples were collected from the railway station areas of the Project rail corridor between Akhaura and Laksam. The ambient status of major air pollutants viz. Particulate Matter (SPM, $PM_{10}$ and $PM_{2.5}$), Sulphur Dioxide ($SO_2$), Oxides of Nitrogen ($NO_x$), and Carbon Monoxide (CO) have been assessed by monitoring air quality at thirteen railway stations of the project.

**Table 4. Air Quality monitoring during July-December 2019**

| Sampling Code | Sampling Location | $PM_{2.5}$ µg/m³ | $PM_{10}$ µg/m³ | SPM µg/m³ | $SO_2$ µg/m³ | NOx µg/m³ | CO ppm |
|---|---|---|---|---|---|---|---|
| **July 2019** | | | | | | | |
| AQ 1 | Lalmai Railway station | 9.79 | 16.62 | 35.86 | 27.16 | 31.77 | <2 |
| EMP | Lalmai Railway station | 13.45 | 29.87 | 53.98 | 3.79 | 11.23 | <2 |
| AQ 2 | Mandabag Railway station | 23.89 | 19.27 | 58.59 | 35.85 | 13.29 | <2 |
| EMP | Mandabag Railway station | 14.43 | 33.93 | 59.18 | 3.11 | 12.83 | <2 |
| **August 2019** | | | | | | | |
| AQ 1 | Alishahar Railway Station | 16.01 | 35.51 | 62.75 | 11.39 | 15.10 | 0.01 |
| EMP | Alishahar Railway Station | 15.29 | 36.65 | 65.82 | 2.56 | 13.59 | <2 |
| AQ 2 | Kasba Railway Station | 13.93 | 28.44 | 56.86 | 10.80 | 14.27 | 0.01 |
| EMP | Kasba Railway Station | 10.95 | 25.56 | 49.52 | 3.73 | 11.46 | <2 |
| **September 2019** | | | | | | | |
| AQ 1 | Sadar Rasalpur Railway Station | 17.69 | 32.43 | 56.79 | 4.22 | 17.68 | <2 |
| EMP | Sadar Rasalpur Railway Station | 11.32 | 27.76 | 48.57 | 2.41 | 12.57 | <2 |
| AQ 2 | Gangasagar Railway Station | 26.53 | 56.21 | 107.59 | 5.18 | 16.25 | <1 |
| EMP | Gangasagar Railway Station | 22.73 | 49.97 | 98.46 | 2.95 | 12.39 | <2 |
| **October 2019** | | | | | | | |
| AQ 1 | Cumilla Railway Station | 51.26 | 84.11 | 131.87 | 11.29 | 27.13 | <2 |
| EMP | Cumilla Railway Station | 24.87 | 56.98 | 96.79 | 4.95 | 14.86 | <2 |
| AQ 2 | Akhaura Railway Station | 35.41 | 72.24 | 113.58 | 8.36 | 31.93 | <2 |
| EMP | Akhaura Railway Station | 26.85 | 61.53 | 105.72 | 5.27 | 17.45 | <2 |
| **November 2019** | | | | | | | |
| AQ 1 | Saldanodi Railway Station | 28.61 | 42.92 | 82.59 | 11.73 | 18.28 | <2 |
| EMP | Saldanodi Railway Station | 7.91 | 19.79 | 34.69 | 2.76 | 9.58 | <2 |
| AQ 2 | Mainamati Railway Station | 39.15 | 71.56 | 115.44 | 9.28 | 19.62 | <2 |
| EMP | Mainamati Railway Station | 18.75 | 42.45 | 78.48 | 3.63 | 14.78 | <2 |
| **December 2019** | | | | | | | |
| AQ 1 | Shashidal Railway Station | 31.60 | 45.78 | 72.12 | 3.35 | 12.94 | <2 |

| Sampling Code | Sampling Location | $PM_{2.5}$ µg/m³ | $PM_{10}$ µg/m³ | SPM µg/m³ | $SO_2$ µg/m³ | NOx µg/m³ | CO ppm |
|---|---|---|---|---|---|---|---|
| EMP | Shashidal Railway Station | 9.59 | 22.12 | 39.34 | 2.37 | 10.37 | <2 |
| AQ 2 | Lalmai Railway Station | 28.65 | 53.11 | 93.24 | 5.26 | 19.12 | <2 |
| EMP | Lalmai Railway Station | 13.45 | 29.87 | 53.98 | 3.79 | 11.23 | <2 |
| **DOE standard (2006)** | | **65** | **150** | **200** | **365** | **100** | **9** |

*Source: Air quality analysis done by EQMS Consulting Limited, 2019*
*Note:*
** CO concentrations and standards are 8-hourly only.*
*** The Bangladesh National Ambient Air Quality Standards have been taken from the Environmental Conservation Rules, 1997 which was amended on 19th July 2005 vide S.R.O. No. 220-Law/2005.*

All parameters shown in ***Table 4*** are within the acceptable limits specified by the DoE.

## 2.5 Noise Level Monitoring

99. Ambient noise levels have been monitored from railway stations of the ALDLP project. Noise data logger (Digital Noise Meter: Model no. GM 1357) has been used to monitor of ambient noise levels. Twenty four (24) noise level sampling locations had been selected from the nearby sensitive receptor of the stations. The Detail list of sampling location has been shown in table 5. Noise level was measured for 1 hour before but at present it is done for 8 hour at every location on different time.

Potential noise impacts vary and are based on the noise amplitude, frequency, distance from receivers, site landscape features, topography, presence of obstacles and meteorological effects. In this project key project related noise source are train traffic, generators, vehicles, construction equipment and people. Noise level found more than EMP and DoE. Noise attenuation measure is suggested for mitigation. During the monitoring phase of the project, field measured value of noise quality is being given in monthly environmental inspection report. Results of noise level monitoring is given in **Table 5**.

**Table 5. Results of noise level monitoring during July - December 2019**

| SL# | Sampling ID | Location | Noise Level dB (A) | EMP | Zone (according to DoE ) | Bangladesh Standard at day Time dB (A) | Remarks |
|---|---|---|---|---|---|---|---|
| **July 2019** | | | | | | | |
| 1. | **NL1** | Lalmai Railway Station | 64.14 | 64.13 | Mixed | 60 | High |
| 2. | **NL2** | Lalmai Railway Station Jame Moaque | 55.83 | 59.12 | Silent | 50 | High |
| 3. | **NL3** | Mandabag Railway Station | 56.36 | 54.64 | Mixed | 60 | Low |
| 4. | **NL4** | Mandabag Railway Station Jame Mosque | 54.93 | 54.74 | Silent | 50 | High |
| **August 2019** | | | | | | | |
| 5. | **NL1** | Alishahar Railway Station | 56.96 | 62.95 | Mixed | 60 | Low |
| 6. | **NL2** | Alishahar Railway Station Jame Moaque | 59.48 | 61.83 | Silent | 50 | High |
| 7. | **NL3** | Kasba Railway Station | 63.59 | 54.65 | Mixed | 60 | High |

| SL# | Sampling ID | Location | Noise Level dB (A) | EMP | Zone (according to DoE ) | Bangladesh Standard at day Time dB (A) | Remarks |
|---|---|---|---|---|---|---|---|
| 8. | **NL4** | Kasba Railway Station Jame Mosque | 53.46 | NR | Silent | 50 | High |
| **September 2019** | | | | | | | |
| 9. | **NL1** | Sadar Rasulpur Railway Station | 58.66 | 60.40 | Mixed | 60 | Low |
| 10. | **NL2** | Sadar Rasulpur Railway Station Jame Moaque | 54.18 | NR | Silent | 50 | High |
| 11. | **NL3** | Gangasagar Railway Station | 59.73 | 62.49 | Mixed | 60 | Low |
| 12. | **NL4** | Gangasagar Railway Station Jame Mosque | 61.48 | 55.82 | Silent | 50 | High |
| **October 2019** | | | | | | | |
| 13. | **NL1** | Cumilla Railway Station | 69.78 | 72.68 | Mixed | 60 | High |
| 14. | **NL2** | Cumilla Railway Station Jame Moaque | 58.04 | 66.10 | Silent | 50 | High |
| 15. | **NL3** | Akhaura Railway Station | 65.15 | 66.23 | Mixed | 60 | High |
| 16. | **NL4** | Akhaura Railway Station Jame Mosque | 65.42 | 55.80 | Silent | 50 | High |
| **November 2019** | | | | | | | |
| 17. | **NL 1** | Saldanodi Railway Station | 58.36 | 62.49 | Mixed | 60 | Low |
| 18. | **NL 2** | Ganganagar Jame Moaque | 48.24 | 55.82 | Silent | 50 | Low |
| 19. | **NL 3** | Mainamati Railway Station | 52.61 | 74.99 | Mixed | 60 | Low |
| 20. | **NL 4** | Mainamati Railway Station Jame Mosque | 57.84 | 65.20 | Silent | 50 | High |
| **December 2019** | | | | | | | |
| 21. | **NL 1** | Shashidal Railway Station | 60.8 | 62.22 | Mixed | 60 | High |
| 22. | **NL 2** | Shashidal Railway Samata Biddya Niketon | 54.6 | NR | Silent | 50 | High |
| 23. | **NL 3** | Lalmai Railway Station | 52.02 | 64.13 | Mixed | 60 | Low |
| 24. | **NL 4** | Lalmai Railway Station Jame Moaque | 55.01 | 59.12 | Silent | 50 | High |

*Source: EQMS Survey Team; EMP: Environmental Management Plan; NR: Not Reported; *Environmental Conservation Rules, 1997 (Schedule 4) (subsequent amendment in 2006)*

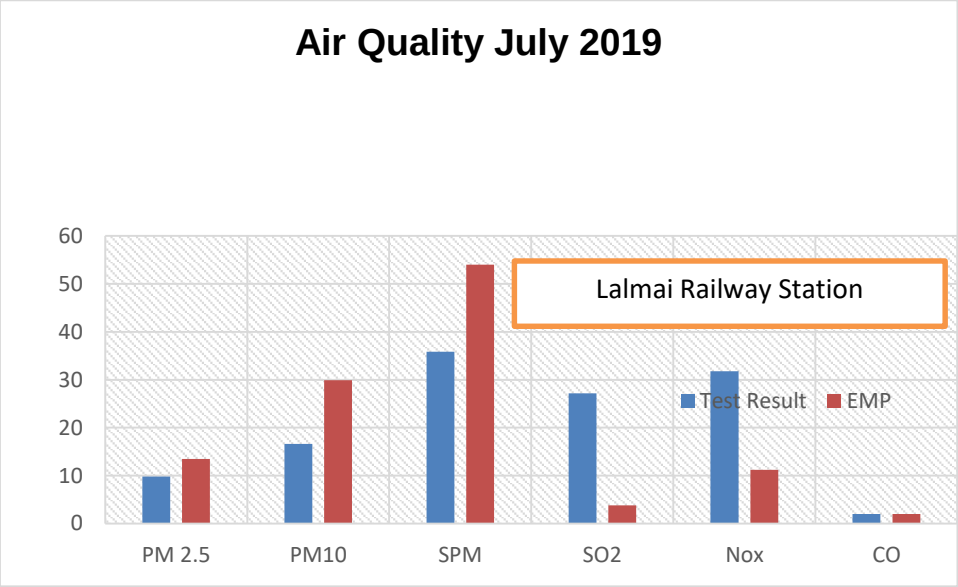



**Figure 3. Air quality (µg/m$^3$) of July 2019 in Lalmai Railway Station**

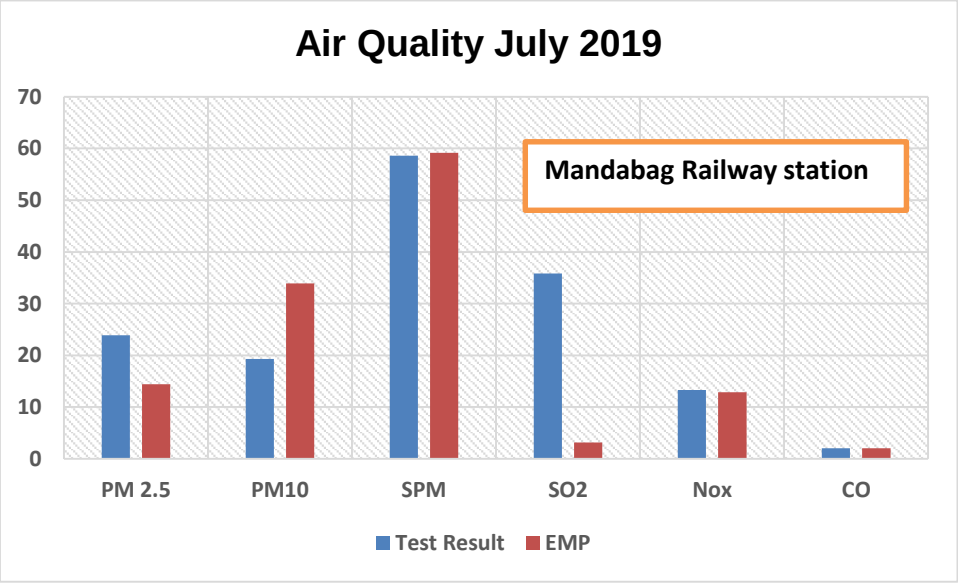



**Figure 4. Air quality (µg/m$^3$) of July 2019 in Mandabag Railway Station**

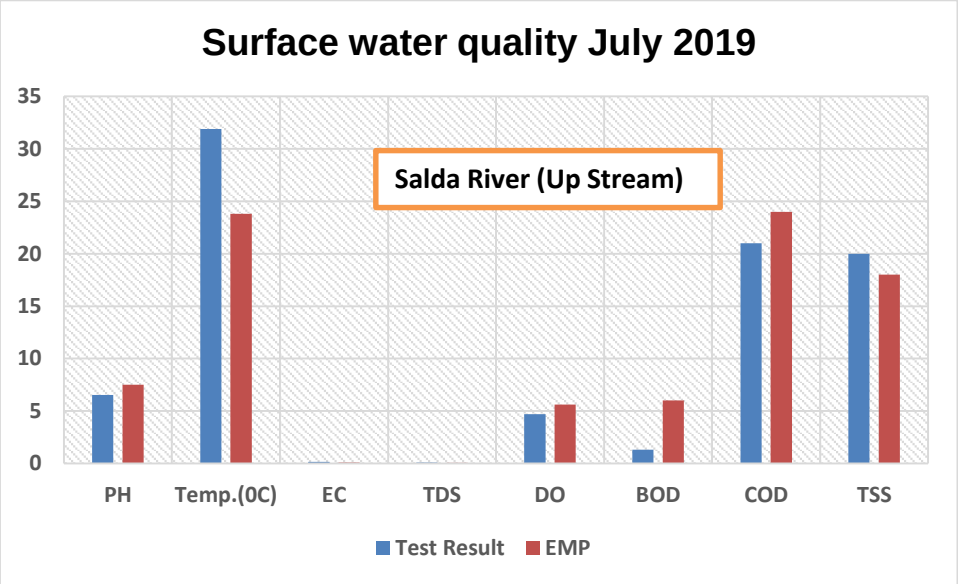



**Figure 5. Surface water quality of July 2019 in Salda River (Upstream)**

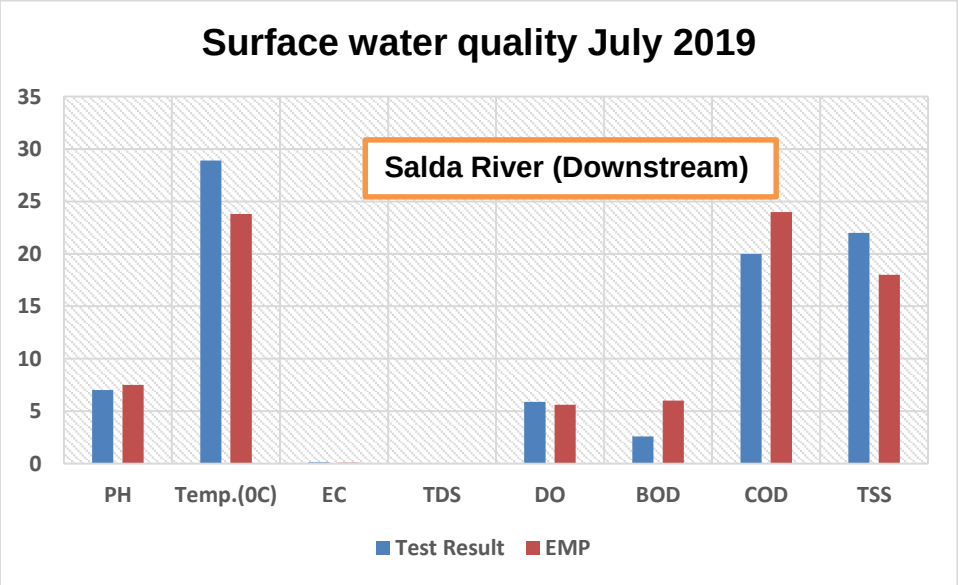



**Figure 6. Surface water quality of July 2019 in Salda River (Downstream)**

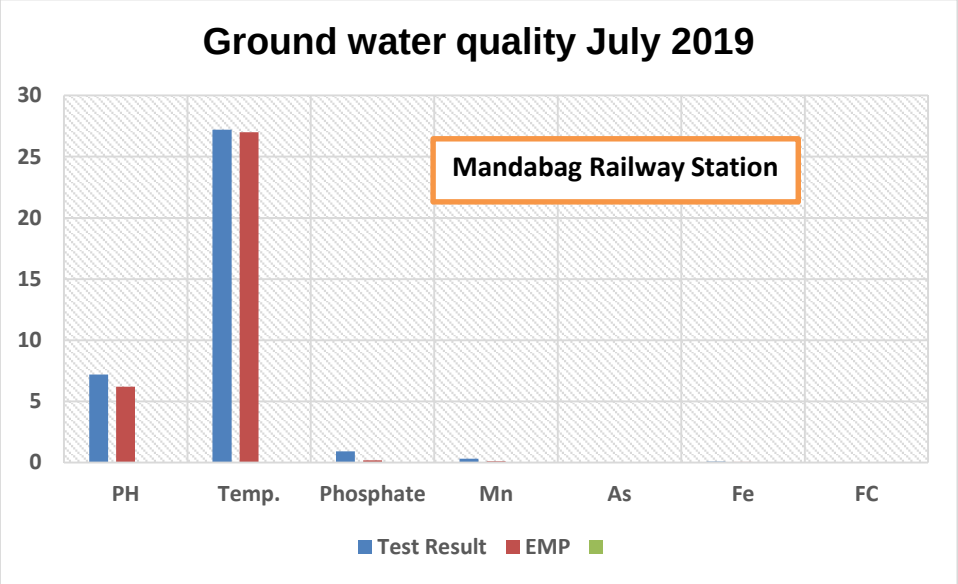



**Figure 7. Ground water quality of July 2019 in Mandabag Railway Station**

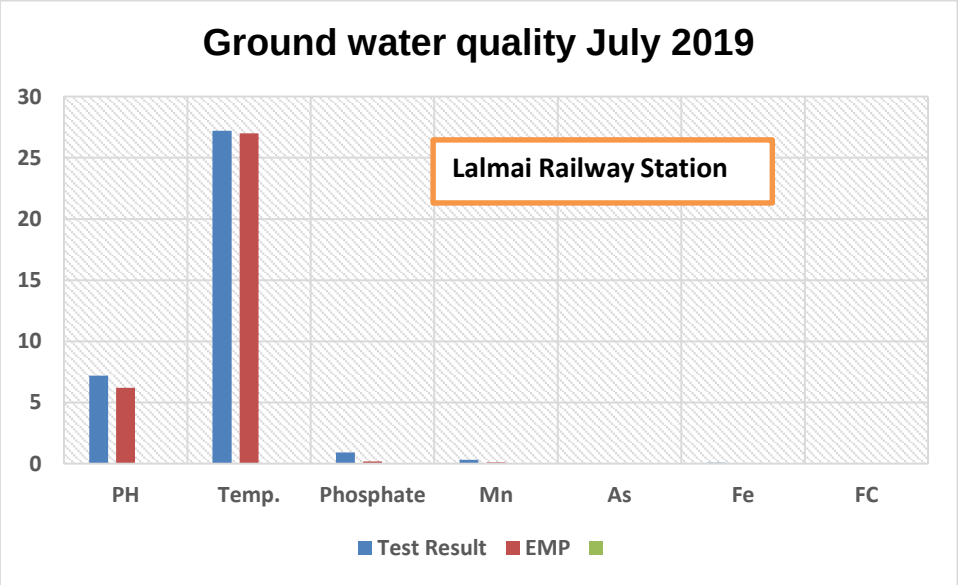



**Figure 8. Ground water quality of July 2019 in Lalmai Railway Station**

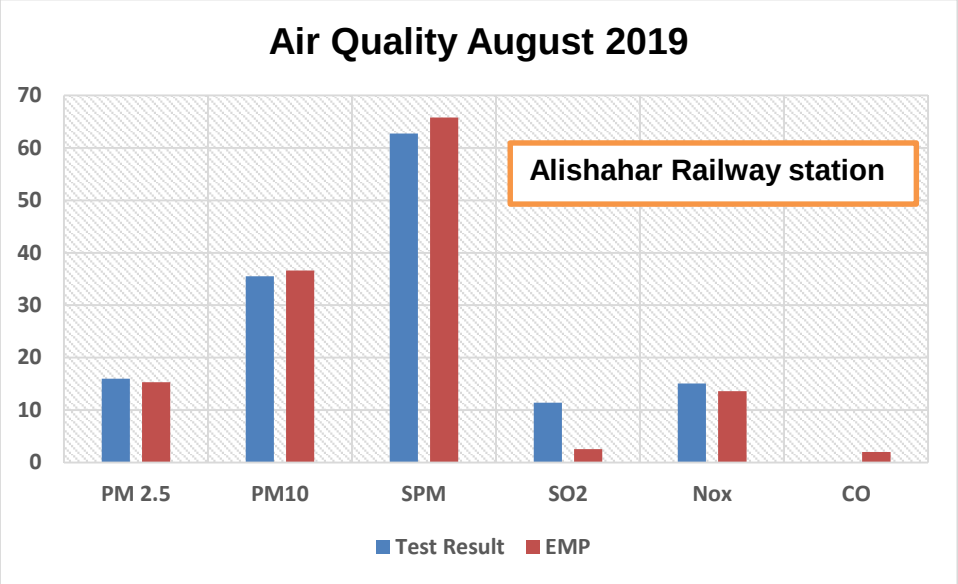



**Figure 9. Air quality of August 2019 in Alishahar Railway station**

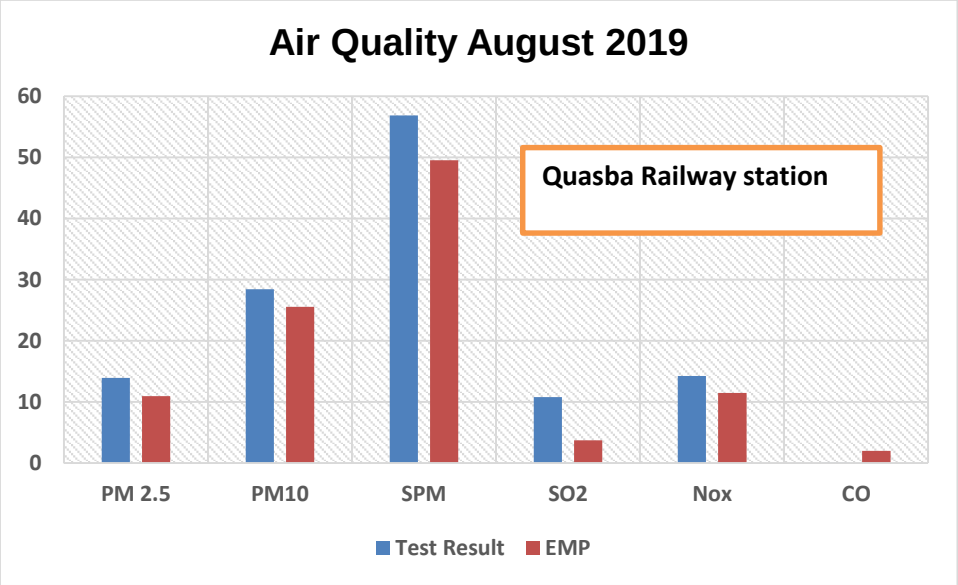



**Figure 10. Air quality of July 2019 in Quasba Railway Station**

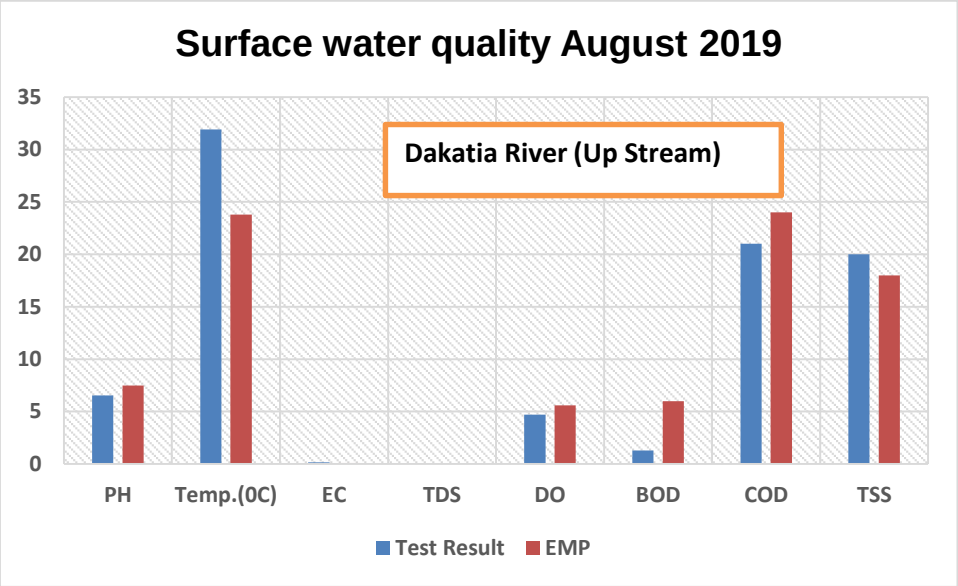



**Figure 11. Surface water quality of August 2019 in Dakatia River (Upstream)**

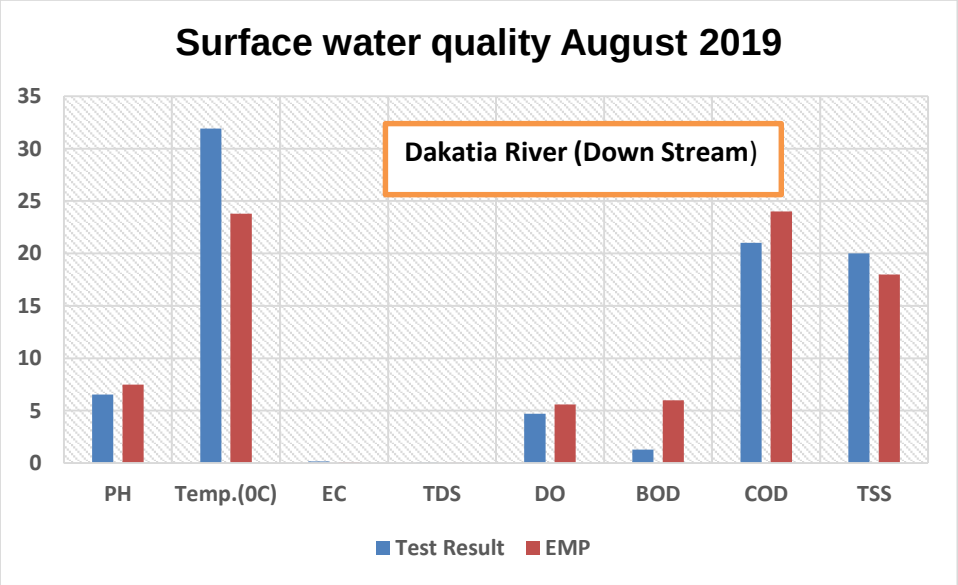



**Figure 12. Surface water quality of August 2019 in Dakatia River Station (Downstream)**

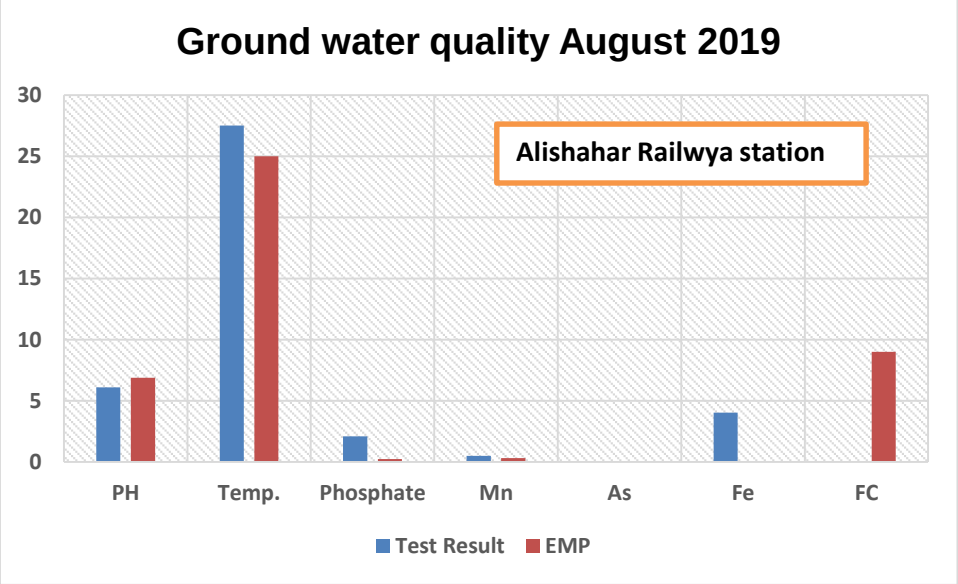



**Figure 13. Ground water quality of August 2019 in Alishahar Railway Station**

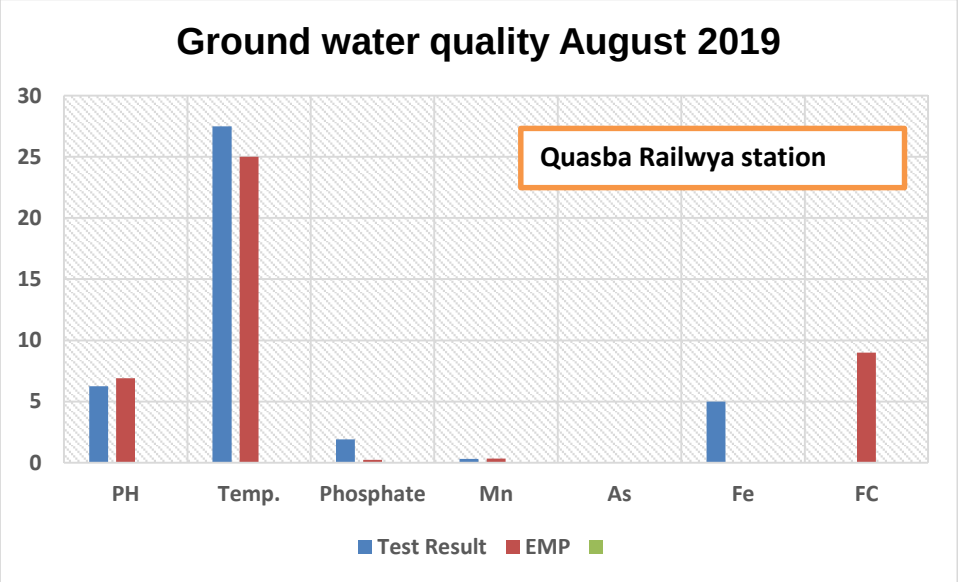



**Figure 14. Ground water quality of August 2019 in Quasba Railway Station**

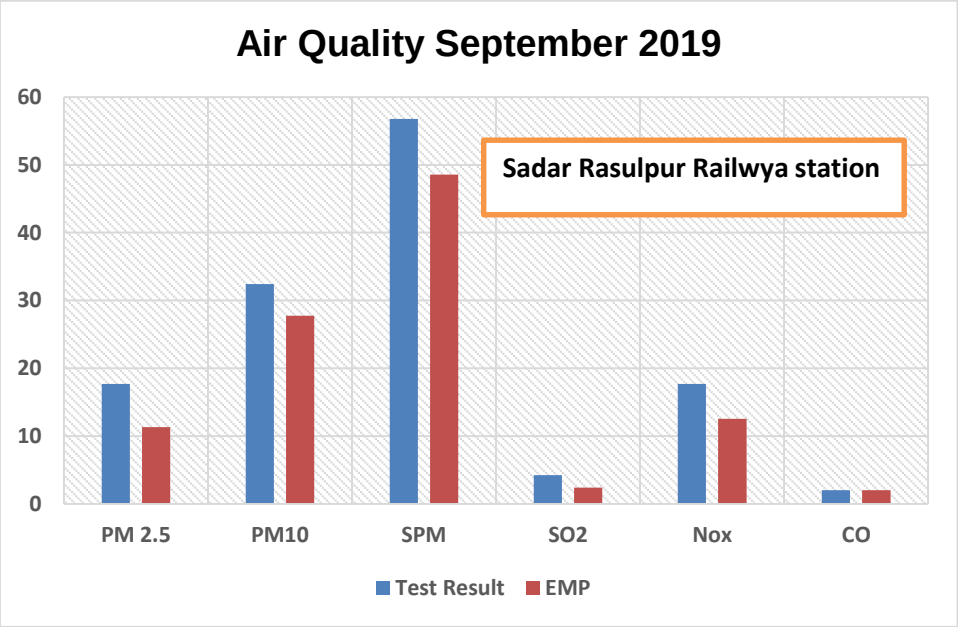



**Figure 15. Air quality of September 2019 in Sadar Rasulpur Railway Station**

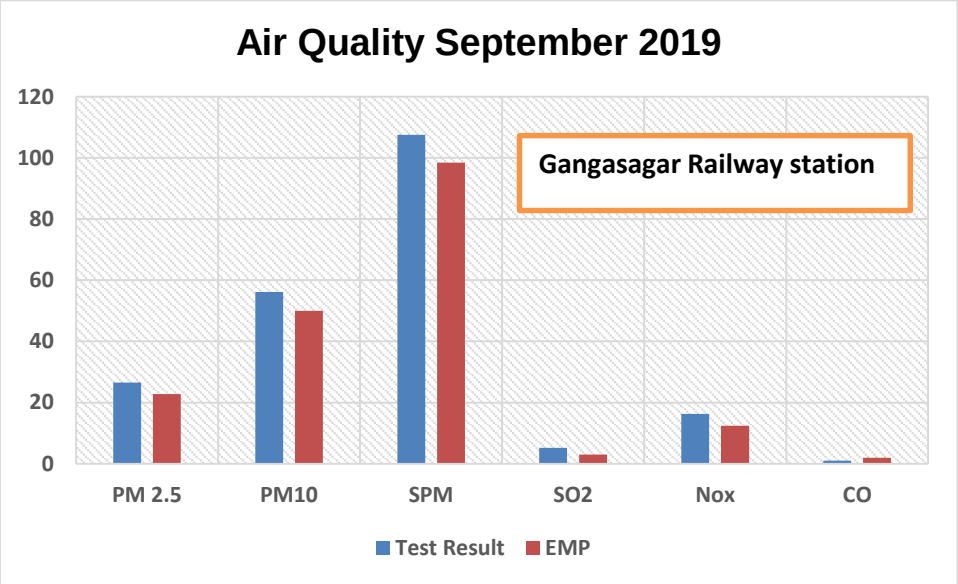



**Figure 16. Air quality of September 2019 in Gangasagar Railway Station**

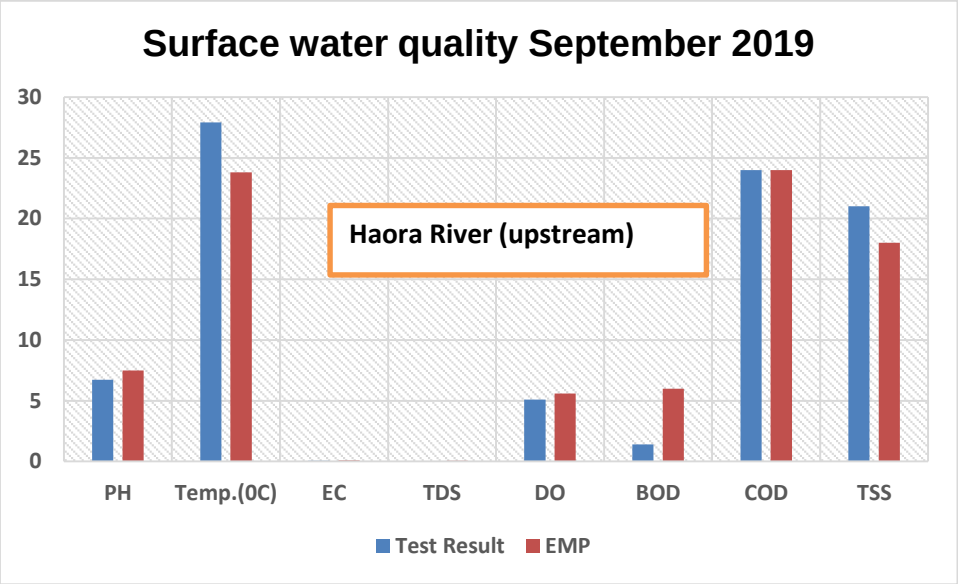



**Figure 17. Surface water quality of September 2019 in Haora River (upstream)**

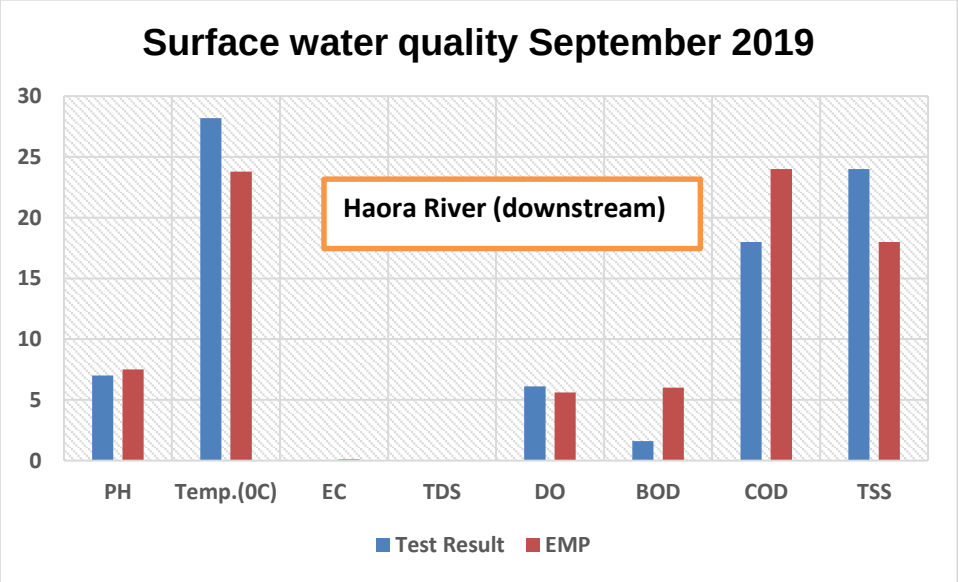



**Figure 18. Surface water quality of September 2019 in Haora River (Downstream)**

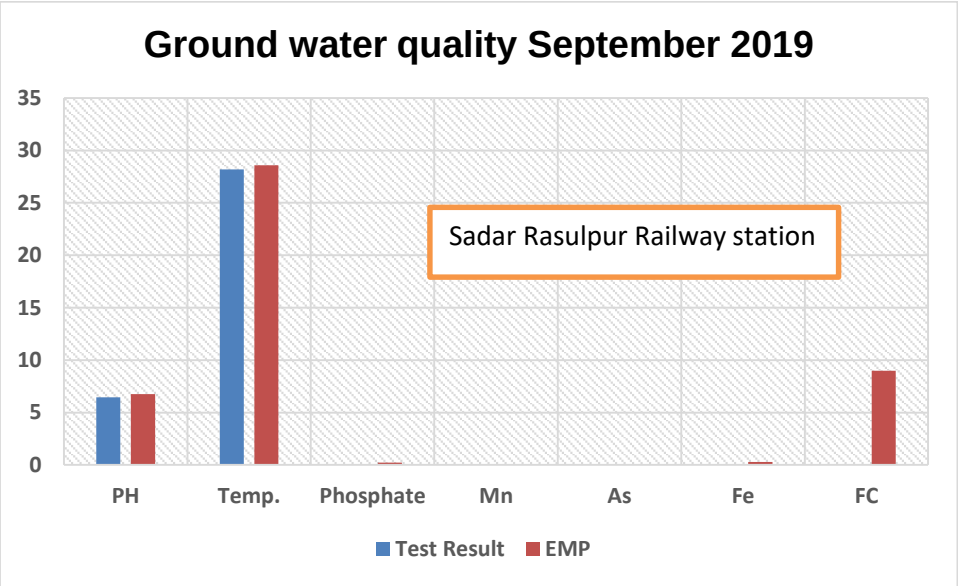



**Figure 19. Ground water quality of September 2019 in Sadar Rasulpur Railway Station**

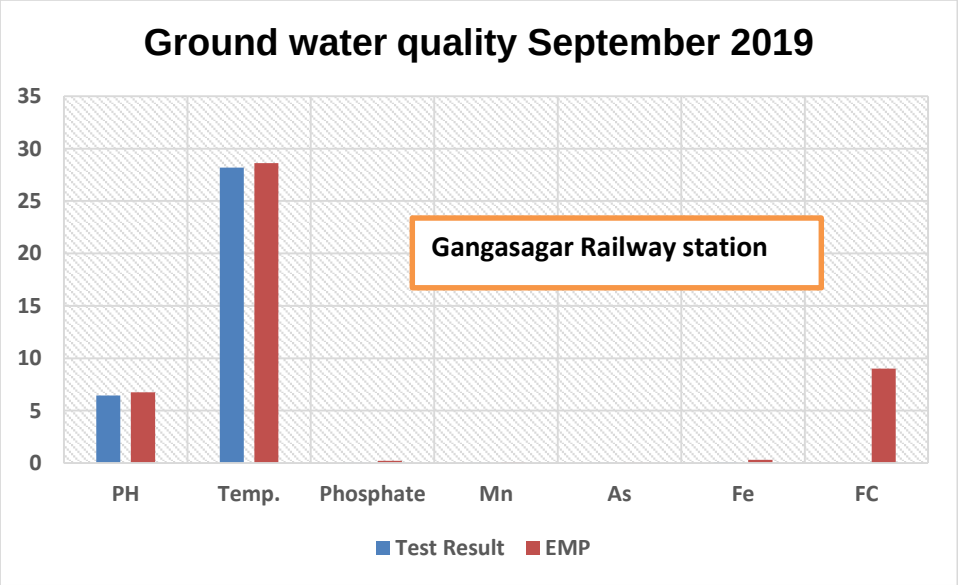



**Figure 20. Ground water quality of September 2019 in Gangasagar Railway Station**

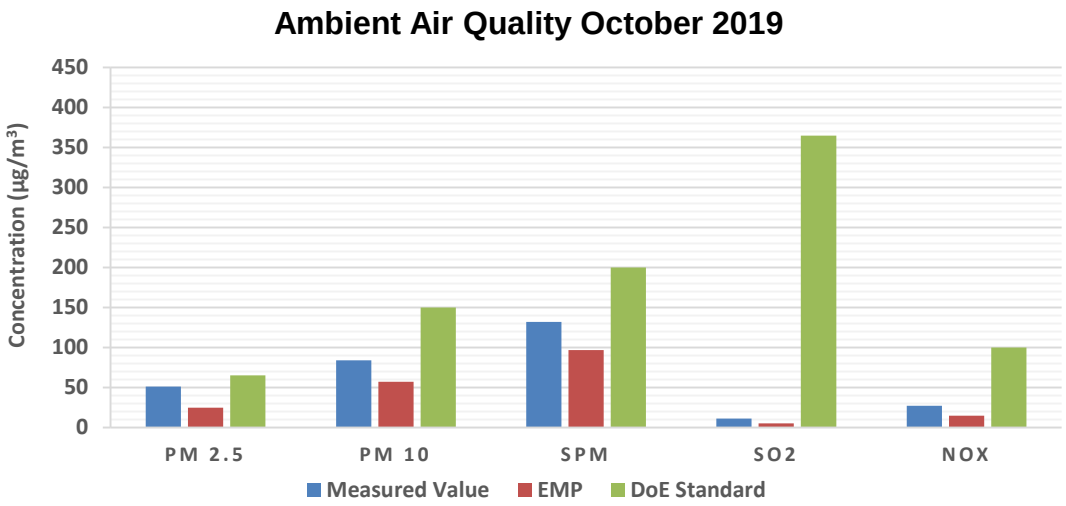



**Figure 21. Ambient Air Quality at Cumilla Railway Station in October 2019**

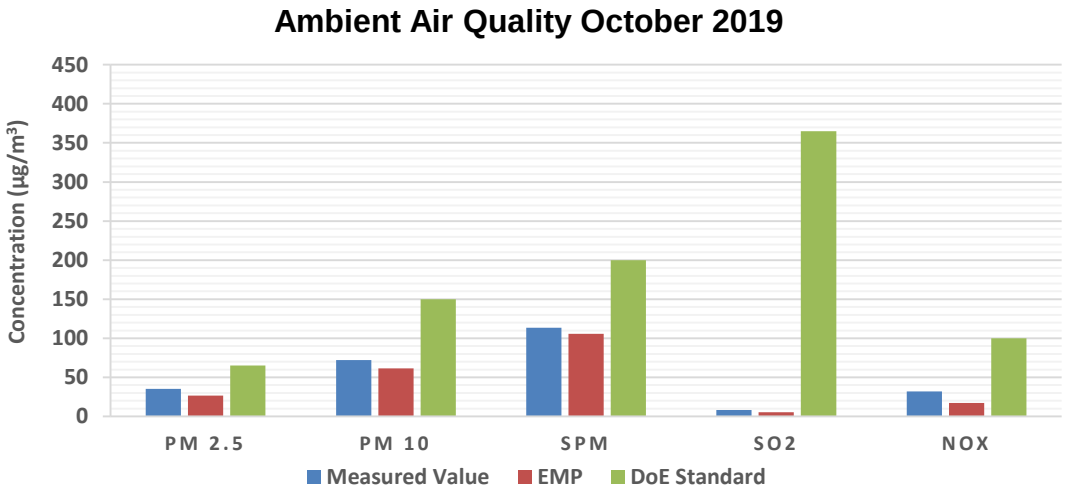



**Figure 22. Ambient Air Quality at Akhaura Railway Station in October 2019**

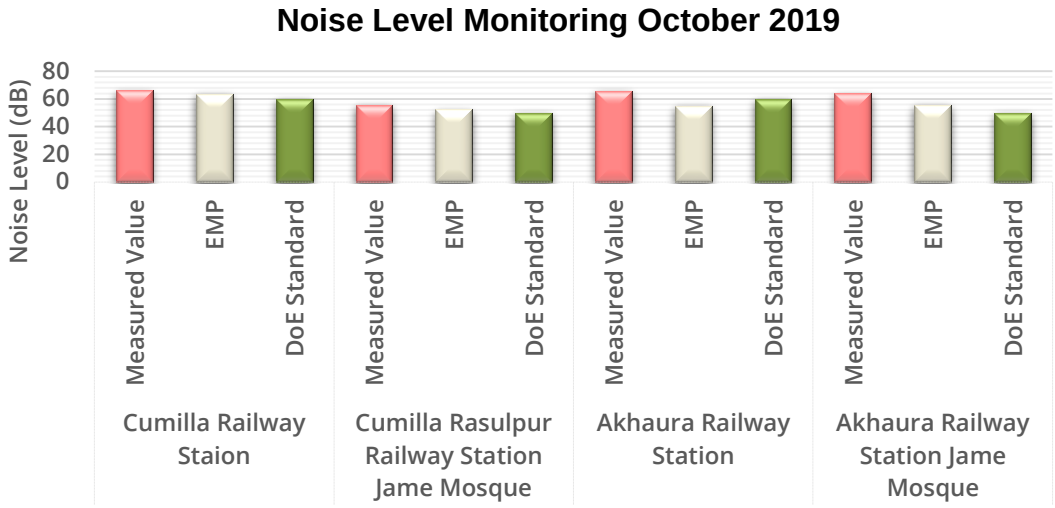



**Figure 23. Noise Level Measurements in October 2019**

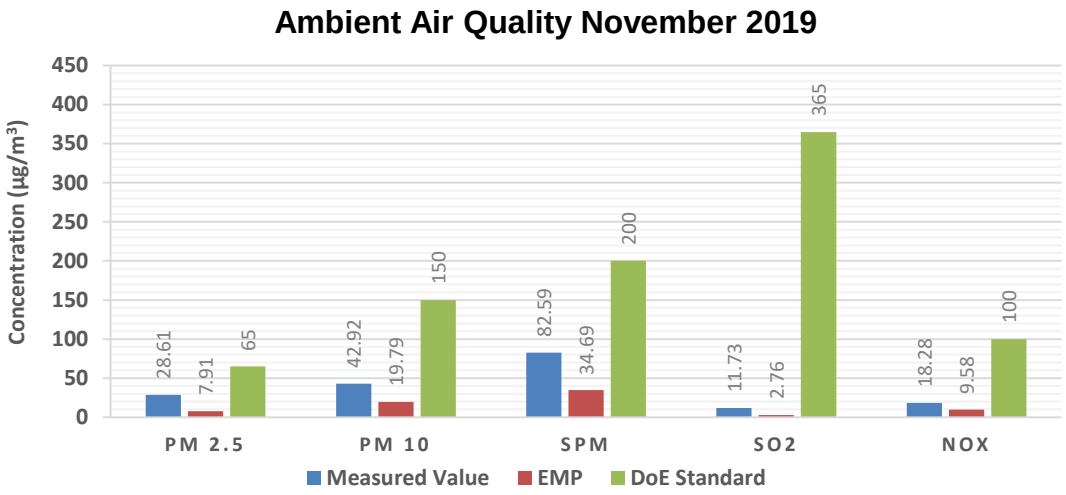



**Figure 24. Ambient Air Quality at Saldanodi Railway Station in November 2019**

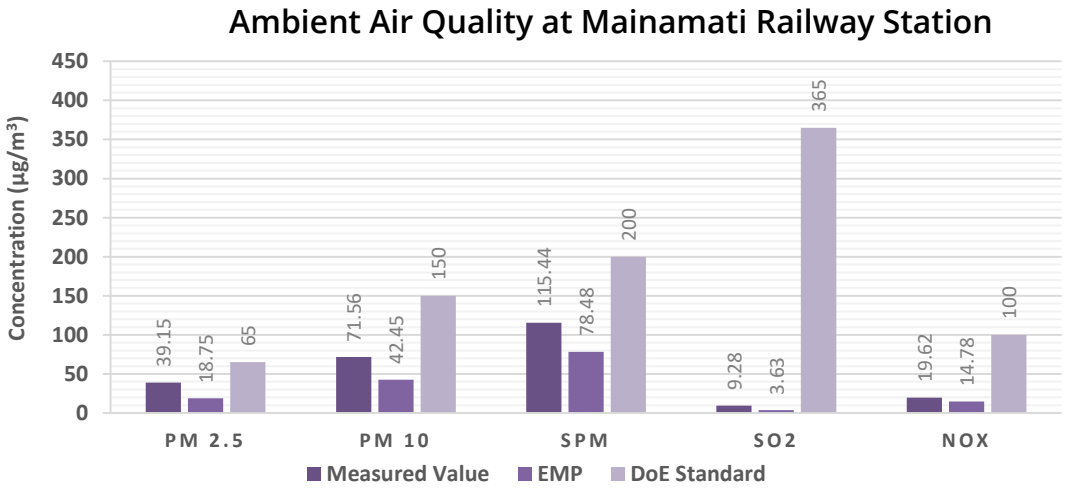



**Figure 25. Ambient Air Quality at Mainamati Railway Station in November 2019**

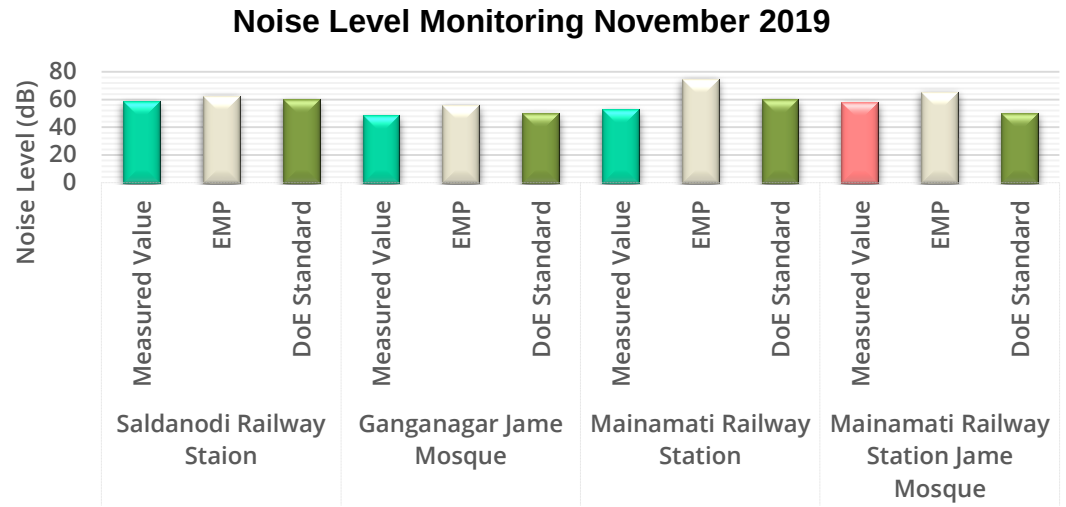



**Figure 26. Noise Level Measurements in November 2019**

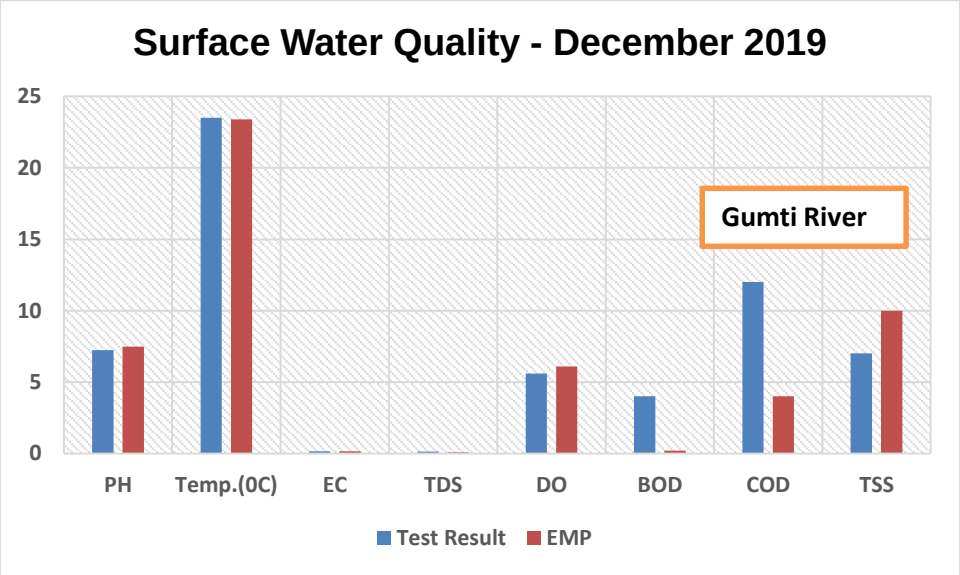



**Figure 27. Surface water quality of December 2019 in Gumti River**

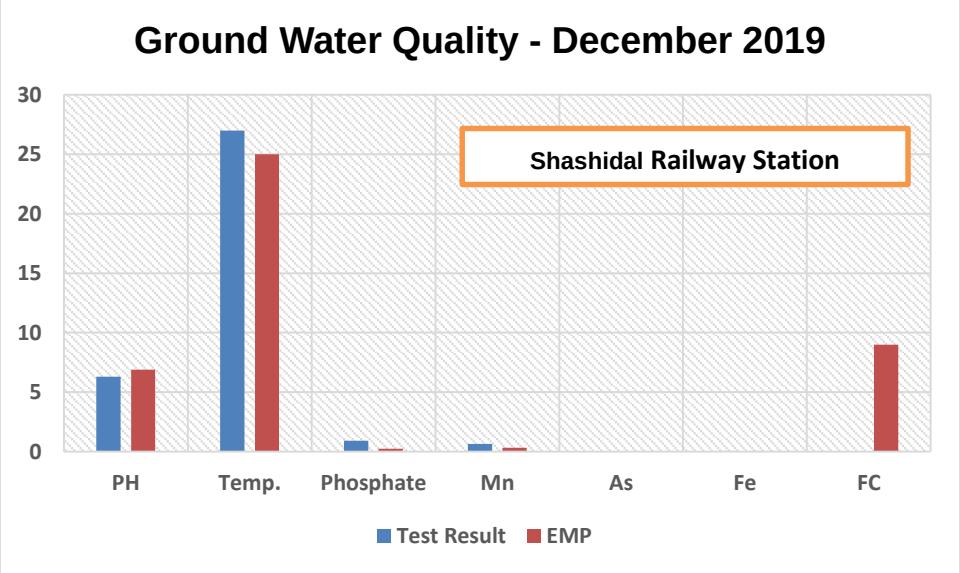



**Figure 28. Ground water quality of December 2019 in Shashidal Railway Station**

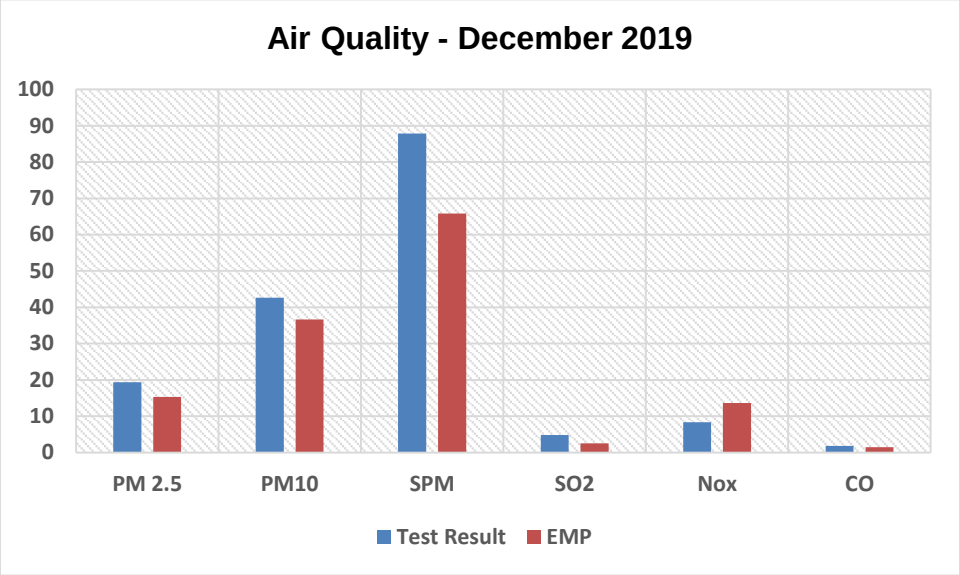



**Figure 29. Air quality (µg/m$^3$) of December 2019 in Shashidal Railway Station**

**Remarks and Recommendation on Environmental Parameters:**

**Noise level** increases due to sudden train pass. This exists for few second. Exposure time for noise level 85 dBA is 8 hours. Vehicle and equipment are not producing noise more than tolerable limit. Sometimes **Air quality** deteriorates due to dust pollution. Old vehicles and equipment also produce emission that causes air pollution. When construction debris and different types of wastes are thrown in water body, it causes **surface water pollution**. Increasing of temperature is project affected due to 55,000 tree cut. It is a climatic change.

**Mitigation Measure suggested:** For noise control vehicle and equipment should be maintain properly. New equipment should be used. Ear muffle and Ear Plugs should be used. For dust control water should be spread in construction site. For surface water pollution control construction debris and waste should not be thrown in water course and should be dumped in designated places. For temperature controlling 1,65,000 trees should be planted as early as possible to keep the project area cool.

### 1) Fisheries Resource.

100. Bridges, culverts and existing railroad cross many waterways. Of them Gumti River is the main river which is crossed this rail line. There is no doubt that fish populations, their habitat and water quality in general are all seriously threatened due to land use changes and chemical pollution. The major rail crossing rivers are Dakatia, Goniajoori, Gumti River, Gumti Spill, Saldanadi, Bajni River, Sidai Khal, and Howrah. During breeding season of fishes, construction activities specially piling of bridge is being avoided.

### 2) Wildlife

101. Within the RoW and the areas where embankment is to be placed is all either paddy, pasture or water ditches specially ponds paralleling the tracks. Some of these ditches may be home to common

amphibians, reptiles and aquatic birds. During the filed inspection no wild mammals have been observed to be affected. Contractor is trying to keep minimum disturbance of these wildlife.

# 3. Compliance with Environment Related Project Covenants

### 1) Compliance with National Environmental Laws

102. The environmental legislation of GOB emphasizes reducing the negative impacts of infrastructure development projects and enhancement of the positive impacts. This conforms to the National Environmental Policy 1992 that was enacted based on the Agenda 21 of Rio Conference and subsequent enactments of the Bangladesh Environmental Conservation Act (ECA) 1995 and Bangladesh Environmental Conservation Rules (ECR) 1997. The DOE documents though do not mention about the provisions for railway tracks and railway bridges specifically.

### 2) Compliance with ADB Guidelines

103. According to the environmental guidelines of ADB the project falls under Category B and hence an IEE was sufficient to meet the environmental requirements. An IEE report was prepared by the Consultant engaged by the ADB during appraisal in 2014. However during the detailed design stage in 2016 an updated Environmental Management Plan (EMP) was prepared. The project is also in conformity with the latest Guideline of ADB i.e. Safeguard Policy Statement 2009.

### 3) Contractor Compliance

a) Environmental Management Plan (EMP)

104. Overall compliance with key actions defined in the EMP, as indicated in the Compliance Monitoring Check List. At present only clearing, earth work for embankment and some station ground preparation are going on.

b) Compliance with Construction Contract Clauses

105. Detailed assessment of compliance by the Contractor with applicable construction contract clauses addressing environmental matters are shown in contract agreement. The Contractor has been complying with more of the contract clauses. Operating period mitigative measures (not the responsibility of the Contract) after the Taking Over of the Works by BR should be implemented properly, e.g. waste management and maintenance of station facilities. For garbage this is partially due to the failure of the Contractor to provide garbage bins as specified in the station specifications. The Engineer will work with BR during the defect period to try and rectify this condition.

c) Environmental Monitoring Reports

106. The contractor began submitting monthly environmental monitoring reports based on the approved template and Table of Contents from November 2016. Based on the environmental reports of July 2019 to December 2019 of contractor this Semiannual Environmental Report has been prepared by CSC of ALDLP. The report contains tables of all monitoring results those are being reported in the respective monthly reports.

d) Landscaping and Site Restoration

107. During site inspection it was found that, aside from the borrow areas which have been turned over to local operators for use as fishponds, landscaping had been very well executed.

With the earthworks for embankment and bridges test piling, the majority of works remaining are located at the stations involving the station buildings, platforms and platform sheds, pedestrian foot over bridges and the signaling system. Cleaning up of surplus materials along the ongoing track and its tidy storage at the stations is required as well as the cleaning up of all the station yard areas and approaches of construction debris. Some clearing of channels and removal of construction debris is also required at some of the bridge sites, but this can only be done after the monsoon season when the river water levels have dropped.

# 4. Adequacy of Mitigation Measures

### 1) Budget and Timeline

108. The original budget allocated for this work is for 4 years for international specialist and for national counterpart. This budget allowed for the completion of two monitoring reports every year, but did not provide enough time for the essential workshop and training at the start of the Contract and the requirement for the international environmental specialist to be on site when the Contractor mobilized. Finally the budget provided should be related to the length/size of the project since larger projects take longer to inspect and longer to report on.

### 2) Capacity Building

109. Bangladesh Railways has recognized the gap in their technical capacity to address safeguard issues and to implement EMPs. BR has committed to establishing an Environmental and Social Safeguards Unit to manage safeguards across the agency.

# 5. Adequacy of Institutional Arrangements for EMP Implementation

110. An annual workshop on EMP implementation and an annual performance review is require, in which ADB should participate. To operate effectively the Engineer should have the direct authority to stop work and fine the contractor for not complying fully with the environmental contract clauses and EMP. The contractor should not be asked to provide presentations on project progress to the lender or BR without the involvement of the Engineer. It only stands to reason the self-reporting will not be impartial and likely miss many important issues, as was the case during at least one ADB mission. This situation led to multiple future problems.

111. The Engineer needs to better enforce the specific deliverables as defined in the EMP, e.g. the construction period EMP completion report and adherence to the reporting table of contents, and field survey requirements.

# 6. Results of Environmental Monitoring and Compliance Measures

### 1) Key Issues Identified

112. The monitoring results revealed that there were some major significant environmental issues that are being raised during the reporting period. But there are a number of working sites where more mitigation action is need to be taken by the contractor to meet up full compliance with the EMP, as many more activities have been started on site already. In respect to location, work type and status of compliance contractor should mention the environmental issues and mention their mitigation measures taken.

# 7. Action Plan of Environmental Mitigation and Monitoring

113. Substantial construction activities will occur after the rainy season when many of the work sites will become accessible. The focus of environmental monitoring will be on the following aspects:

(a) Better implementation of environmental management plan and mitigative measures to minimize the negative environmental impact of the work under construction;

(b) Continue to improve water, air and noise quality sampling and analysis of the project by adhering to specific instructions provided by the Engineer. Pay close attention to the causes of non-compliance and remediation measures to secure safe water supply, air quality and acoustic environment;

(c) Ensure soil erosion protection of the embankment and the bridge sites; and

(d) Strengthen the implementation of the Health and Safety aspects of the EMP for the entire workforce.

114. The Engineer intends to strictly enforce these requirements and with the help of BR be able to demonstrate a substantial improvement by the Contractor over the remaining period 2020.
Of these the Health and Safety issues will need continued and on-going attention with all of the site activities including track laying and signaling works in progress where the safety of works adjacent to the operating line will be paramount, both for worker's safety and for the safe operations of the train services. The action plan is defined in Table 6, and will be expanded by the Contractor.

**Table 6.** **ACTION PLAN AND STATUS OF ENVIRONMENTAL MITIGATION AND MONITORING**

| Environmental Parameter | Action Required | Implemented by | Super-vised by | Status July 2019 | Status Aug. 2019 | Status Sept. 2019 |
|---|---|---|---|---|---|---|
| **Landscape and future visual intrusion** | Cleaning up of various work areas along the site as embankment and bridge works proceed to enable channel and slope protection works and grassing, etc. to be installed and become stabilised and minimise visual intrusion | CTM | CSC | √ | √√ | √√ |
| **Tree Felling** | Ensure trees felled are correctly recorded to enable compensation to be made if required. Initiate planting of trees along lower slope where completed to ensure sufficient time for their establishment. | CTM | CSC | √ | √ | √ |
| **Fisheries, Fish habitat and water courses** | Initiate consultation with relevant government agencies to obtain details relating to fisheries in the major rivers.<br>Make appropriate arrangements for restoration of borrow pits for use as fishponds wherever possible and where requested by local communities. | CTM | CSC/BR | √ | √ | √ |
| **Wildlife** | Initiate consultation with relevant government agencies to obtain relevant details of wildlife in areas affected. | CTM | CSC/BR | N/A | N/A | N/A |
| **Surface Water** | Execute sampling in line with sampling program specified the EMP and BR instructed CTM to undertake; then present results with analysis indicating impacts (if any) and mitigative measures if needed.<br>Sampling should be carried out in the presence of ENGINEER staff with details of locations provided on plans and on the ground and at the times appropriate to ensure meaningful data can be obtained. | CTM | CSC | √ | √ | √ |
| **Ground Water** | | | | √√ | √√ | √√ |
| **Air Pollution** | | | | √√ | √√ | √√ |
| **Noise** | | | | √√ | √√ | √√ |
| **Soil Contamination** | | | | Not sampled-not required by ADB | Not sampled-not required by ADB | Not sampled-not required by ADB |
| | Ensure that once crossing structures are completed all obstructions are removed, natural channel restored | CTM | CSC | √ | √ | √√ |

| Environmental Parameter | Action Required | Implemented by | Super-vised by | Status July 2019 | Status Aug. 2019 | Status Sept. 2019 |
|---|---|---|---|---|---|---|
| **Workforce Camp Conditions** | Ensure adequate waste bins are provided at camps with regular disposal to suitable locations. Initiate regular collections and disposal of garbage from around campsites and ensure the areas remain hygienic. Provide potable water supply at all times (e.g. arsenic found in camp tube-well) | CTM | CSC | √√ | √√ | √√ |
| **Construction Waste Management** | Ensure all solid wastes at works sites and yards are contained and then correctly disposed of; and that oils, grease, etc. from servicing activities is properly collected, contained and recycled. | CTM | CSC | √ | √ | √√ |
| **Personal Health and Safety** | Maintain effective operation and cleaning of sleeping, cooking, washing and toilet facilities in camps. Ensure water supplied is potable and conduct tests for verification. Ensure First Aid Equipment and Medical Facilities are readily available at all times.<br>Initiate further training and awareness sessions on the use of PPE for staff and take steps to ensure these are used correctly | CTM | CSC | √√ | √√ | √√ |
| **Vector Borne Diseases** | Initiate treatment of abandoned borrow pits and clean up areas where water is ponding to reduce risks for breeding of mosquitos. Record of regular inspections provided. | CTM | CSC | Could not be varified | Could not be varified | Could not be varified |

√√= compliant, √= marginally compliant, ✕ = non-compliant

| Environmental Parameter | Action Required | Implemented by | Super-vised by | Status Oct. 2019 | Status Nov. 2019 | Status Dec. 2019 |
|---|---|---|---|---|---|---|
| **Landscape and future visual intrusion** | Cleaning up of various work areas along the site as embankment and bridge works proceed to enable channel and slope protection works and grassing, etc. to be installed and become stabilised and minimise visual intrusion | CTM | CSC | √√ | √√ | √√ |
| **Tree Felling** | Ensure trees felled are correctly recorded to enable compensation to be made if required. Initiate planting of trees along lower slope where completed to ensure sufficient time for their establishment. | CTM | CSC | √ | √ | √√ |
| **[1]Fisheries, Fish habitat and water courses** | Initiate consultation with relevant government agencies to obtain details relating to fisheries in the major rivers.<br>Make appropriate arrangements for restoration of borrow pits for use as fishponds wherever possible and where requested by local communities. | CTM | CSC/BR | √√ | √√ | √√ |
| **Wildlife** | Initiate consultation with relevant government agencies to obtain relevant details of wildlife in areas affected. | CTM | CSC/BR | N/A | N/A | N/A |
| **Surface Water** | Execute sampling in line with sampling program specified the EMP and BR instructed CTM to undertaken; then present results with analysis indicating impacts (if any) and mitigative measures if needed.<br>Sampling should be carried out in the presence of ENGINEER staff with details of locations provided on plans and on the ground and at the times appropriate to ensure meaningful data can be obtained. | CTM | CSC | √ | √ | √ |
| **Ground Water** | | | | √√ | √√ | √√ |
| **Air Pollution** | | | | √ | √ | √ |
| **Noise** | | | | √√ | √√ | √√ |
| **Soil Contamination** | | | | Not sampled-not required by ADB | Not sampled-not required by ADB | Not sampled-not required by ADB |

[1] There are Borrow pit fish pond at chainage: 166+300, 165+200, 190+200, 190+500, 190+875, 191+0, 191+200, Fish pond photographs are attached as appendix:15.6: F

| Environmental Parameter | Action Required | Implemented by | Super-vised by | Status Oct. 2019 | Status Nov. 2019 | Status Dec. 2019 |
|---|---|---|---|---|---|---|
| | Ensure that once crossing structures are completed all obstructions are removed, natural channel restored | CTM | CSC | √ | √ | √ |
| **Workforce Camp Conditions** | Ensure adequate waste bins are provided at camps with regular disposal to suitable locations. Initiate regular collections and disposal of garbage from around campsites and ensure the areas remain hygienic. Provide potable water supply at all times (e.g. arsenic found in camp tube-well) | CTM | CSC | √√ | √√ | √√ |
| **Construction Waste Management** | Ensure all solid wastes at works sites and yards are contained and then correctly disposed of; and that oils, grease, etc. from servicing activities is properly collected, contained and recycled. | CTM | CSC | √√ | √√ | √√ |
| **Personal Health and Safety** | Maintain effective operation and cleaning of sleeping, cooking, washing and toilet facilities in camps. Ensure water supplied is potable and conduct tests for verification. Ensure First Aid Equipment and Medical Facilities are readily available at all times.<br>Initiate further training and awareness sessions on the use of PPE for staff and take steps to ensure these are used correctly | CTM | CSC | √√ | √√ | √√ |
| **Vector Borne Diseases** | Initiate treatment of abandoned borrow pits and clean up areas where water is ponding to reduce risks for breeding of mosquitos. Record of regular inspections provided. | CTM | CSC | Could not be varified | Could not be varified | Could not be varified |

√√= compliant, √= marginally compliant, ✕ = non-compliant

# 8. EMP Implementation Status as of 31 December 2019

## Implementation of Environmental Management Plan during Construction

The Consultant shall manage and check environmental management plan implementation by preparing an appropriate environmental progress schedule in accordance with plans of environmental management during construction.

Contractor shall review EIA (environmental impact assessment) and establish and implement mitigation measures suitable for site conditions according to the EMP.

Contractor shall be well aware of the environmental management plan for its thorough implementation with particular emphasis on critical areas of focused management so as to avoid any problems during inspection.

Contractor shall prepare and keep photos and location maps before and after construction and gain approval from Consultant.

Contractor shall conduct daily inspection and evaluation of environmental management.

Defects identified during the daily inspection shall be collected on a weekly basis, recorded in report of environmental impact assessment and gain approval from Consultant.

When construction of each activity is completed, Contractor shall write down results of consultation and implementation of EMP. Only after obtaining approval from Consultant, Contractor might proceed to perform the next phase of construction.

Contractor shall conduct inspection when the local government authority checks the status of environmental management.

## EMP Implementation Status July- December 2019

### 8.1 Noise and Attention Measures

Clause 3.5 of the EMP defines in detail the noise attenuation measures to be undertaken:

| Item | Status | Comments |
|---|---|---|
| Use of modern plant and equipment with appropriate muffling devices. | Partially Complied | • CTM workers do not use muffling devices |
| All powered mechanical equipment and machinery to be fitted with noise abating gear such as mufflers for effective noise control, in compliance with DoE regulations. | Partially Complied | • CTM did not install mufflers for combating noise generation from the machineries to comply the national regulation |
| Locate rock crushing, concrete mixing and material shipment yards away from residential areas, schools, colleges and hospitals. | Complied | • Crushing and mixing activities are away from institutions. |
| Install temporary noise barriers near sensitive locations such as schools, religious places and hospitals | Complied | • These institutions are far away from construction sites. So no need barriers. |
| Providing the construction workers with suitable hearing protection like ear cap, or earmuffs etc. | Not Complied | • Contractor has not provided the ear cap or earmuffs to the workers who are working near to the noise generating instruments. These devices are not found in |

| Item | Status | Comments |
|---|---|---|
| | | local market. |
| Noise quality monitoring to be carried out as per the schedule in the environmental monitoring plan. | Complied | • Noise monitoring is according to monitoring plan. |

### 8.2 Dust Control

Undertake dust suppression as defined in Clause 3.3 of the EMP:

| Item | Status | Comments |
|---|---|---|
| Vehicles transporting construction material to be covered | Partially Complied | • Materials are being transported covered time to time. |
| Construction equipment to be maintained to a good standard and idling of engines discouraged. | Complied | • Equipment maintains in good standard. |
| Machinery emitting visible smoke to be banned from construction sites. | Partially Complied | • Visible smoke is not fully banned. |
| Contractor to prepare a dust suppression program detailing action to be taken to minimize dust generation (e.g. spraying of roads with water), and the equipment to be used. | Partially Complied | • Toma is spraying water properly in the dust generating area.<br>• Max also spraying water in the dust generating area but insufficient. |
| Dust masks to be provided to workers where dust hazards exist. | Partially Complied | • CTM have been provided all PPE item to the labours but they are not using properly. |
| Air quality monitoring to be carried out as per the schedule in the environmental monitoring plan. | Complied | • CTM is monitoring air quality properly. |
| All roads, permanent or temporary, pukka or katcha, that become dusty and all areas where construction related activities are carried out, shall be subject to necessary suppression measures by watering, sweeping or other measures approved or directed by the Engineer. | Partially Complied | • Contractors are spraying water for dust suppression, but not sufficient. |
| Contractor shall not allow waste oil, lubricant or other petroleum derivatives to be used as dust suppressants and shall take all reasonable precautions to prevent accidental spillage of petroleum products, contact of such materials with soil or water course through discharge, run-off, and or seepage. | Complied | • Waste oil, lubricant etc. are not allowed to suppress dust. Accidental spillage is prevented. |
| Contractor shall take all reasonable measures to minimise dust-blowing from areas under his control by spraying water on stockpile, bare soil, haul road, un-surfaced traffic route and any other source of dust when conditions require dust suppression. If the Engineer considers that the dust suppression measures adopted by Contractor ineffective, Contractor shall in that case take further measure to minimise dust blowing at construction site as per his direction | Complied | • Contractor is spraying water on dust at road and embankment but not on stockpile. |

### 8.3 Watercourse Impacts in Wetlands/Ponds/Rivers/Canals

| Item | Status | Comments |
|---|---|---|
| Adequate mitigation measure shall be undertaken to limit the impact on all water bodies within the Project area | Complied | • Mitigation measure has been taken to limit the impact on all water bodies within project area. |
| Earth moving in the vicinity of watercourses shall be kept to a minimum to avoid sedimentation and contamination from fuel and lubricants. | Complied | • Contractor is using concrete surface for fuel storage. |
| Proper disposal of bricks, cement, and steel reinforcement which will be removed as part of the reconstruction of bridges/ culverts shall be ensured not to block stream flow. | Partially Complied | • CTM is ensuring the sufficient stream flow of the water bodies during the bridge and culvert construction. |
| Temporary erosion and sedimentation control measures during rehabilitation of cross-drainage structures shall be undertaken to ensure that sediment laden run off does not enter the adjoining watercourses. | Complied | • Sediment laden run off does not enter the adjoining watercourses. |
| Construction materials and waste shall not be discharged in watercourse during construction of bridges/culverts by implementing appropriate mitigation measure. | Complied | • Construction materials and waste are not discharged in watercourse. |

## 8.4 Borrow and Dredging Site Impacts

There is no dredging site.

## 8.5 Disposal of Construction Debris and other Waste Materials

| Item | Status | Comments |
|---|---|---|
| Adequate mitigation measure shall be undertaken to limit the impact on pedestrians, local communities and water bodies within the Project area | Complied | • Adequate mitigation measure has been undertaken to limit impact on pedestrians. |
| No burning shall be allowed. | Complied | • Contractor is not burning. |
| No cleared debris shall be left lying on the surface of the ground or buried in any agricultural land | Complied | • Debris are not left on ground. |
| Man-made construction debris shall be disposed of in disposal areas the location and nature of such disposal shall be subject to the approval of the Engineer; and | Complied | • Debris are disposed of in designated areas. |
| All disposal areas shall be finally graded to a uniform and level condition and left such that they create a minimum impact on the surrounding area. | Complied | • Contractor is strongly ensuring the minimum impact on the surrounding area due to waste disposal. |

## 8.6 Servicing and Operating Equipment

| Item | Status | Comments |
|---|---|---|
| Servicing of machines or equipment near rivers, streams or other bodies of water shall be carried out in such a manner as to avoid pollution with gasoline, diesel fuel, oil, grease, or surplus or disposable materials | Complied | • Machines and equipment are being serviced with care to avoid pollution. |

| Item | Status | Comments |
|---|---|---|
| Without limiting the generality of the foregoing, the Contractor shall ensure that all hydraulic systems, fuel systems and lubricating systems are in good condition to avoid leakage of petroleum products; and | Complied | • Sometimes leakage happens. Contractor does not fully maintain these systems properly. |
| Fuel spills will not be condoned and care shall be taken to avoid overfilling machines. | Partially Complied | • Sometimes overfilling machines. Contractor need to be cheeked properly and avoid overfilling machines. |
| The Contractor shall have the proper equipment to transport fuel so that spillage will not occur. Automatic shut-off nozzles shall be installed on all fuel dispensing units. | Complied | • They have proper equipment to transport fuel. |
| The Contractor shall have oil spill abatement equipment on the Site at all times. | Complied | • Contractor has oil spill abatement equipment. |
| The type of equipment shall be subject to the approval of the Engineer, and the equipment shall be maintained in good working condition. Disposal of used oil, lubricants, tires, etc. shall be in accordance with the EMP or as directed by the Engineer. | Complied | • Equipment are being maintained in good working condition. |

### 8.7 Control of Petroleum Products

| Item | Status | Comments |
|---|---|---|
| All petroleum products shall be stored in a designated storage location where any spillage can be safely maintained without contamination of the surrounding area. Storage of petroleum products shall not be permitted in the vicinity of streams rivers or other bodies of water. Impermeable liner shall be placed on subsurface of the storage room to avoid groundwater contamination. | Complied | • Toma should properly maintain and monitor the fuel spillage.<br>• Max fuel storage maintenance properly well. |

### 8.8 Occupational Health and Safety

| Item | Status | Corrective Action Plan |
|---|---|---|
| Supply of appropriate personal protection equipment, such as safety boots, helmets, gloves, protective clothing, goggles and ear protection among the workers and enforce its use. | Complied | • Max and Toma both are compiled except that they are not using ear protecting equipment. |
| Follow the specification on construction safety as defined in civil works | Complied | • Max and Toma both are complied. |
| Construction workers will be required to train in general health and safety matters and on specific hazards of their work. | Complied | • Max and Toma both are complied. |
| Must not hire child labour, age below 14 | Partially Complied | • In some sites sub-contractors of CTM are using child labour |
| Hire, use of benefit from child labour-Child labour (as defined by ILO Conventions 138 and 182) means that no workers under the age of 14 may be hired as general labours, and no workers | Partially Complied | • Max and Toma both are partially complied because sometimes sub- |

| Item | Status | Corrective Action Plan |
|---|---|---|
| under the age of 17 are to be hired for hazardous jobs | | contractor use workers under the age of 17 for hazardous jobs. |
| Equal treatment, equal opportunity. No discrimination based on race, caste, origin, religion, disability, gender, sexual orientation, union or political affiliation, or age; no sexual harassment. Minimum wage- according to minimum wage standards as defined in the Bangladesh Labour Act. | Complied | • Max and Toma both are complied. |

## 8.9 Protection of Topsoil and Soil Erosion

| Item | Status | Corrective Action Plan |
|---|---|---|
| Topsoil storage areas must be protected during the dry season from wind erosion by covering. | Complied | • Topsoil has been protected from erosion. |
| Rapid re-vegetation and use of hydro-seeding and jute erosion protection mats will be applied in areas where erosion is noted during the regular monthly inspections. | Partially Complied | • Sometimes soil erosion is happening from embankment due to heavy rain fall. |
| Embankment site to be planted with trees to promote natural vegetation; as well as fast growing grasses. | Partially Complied | • Tree plantation has not been started but grasses are being planted to protect embankment. |
| The stockpiling and/or disposal of material as aforesaid shall be such that the material is not placed in any area where natural drainage or storm water could pond and become stagnant, or where could erode the material and cause silting of the adjacent area or of any natural or man-made water course. | Complied | • Natural drainage has not been hampered by stockpiling and or disposal of materials. |

# 9. Tree Plantation and Replacement Programme

CTM JV had planned to plant trees to compensate the loss of cutting trees. It will help to keep ecological balance and absorb carbon-dioxide. Sub consultant EQMS is planting tree. Trees are being planted on both side of the rail line. CTM JV had submitted tree plantation and replacement programme to CSC.

## 9.1 Objective of tree plantation

The objective of the tree plantation and replacement program is to compensate for the loss of trees due to the proposed implementation of the Akhaura-Laksam double line railway Project. Other major objectives of the program are

- To protect the affected cultural/sensitive areas (within 50 m from the RoW boundary).
- To enhance the health of the existing ecosystem.
- To reduce the impacts of air pollution and dust as trees are known to be natural sink for air pollutants.
- To arrest soil erosion at the embankment slopes.

## 9.2 Scope of tree plantation

About 31,749 timber trees, 13,546 fruit trees, 188 medicinal trees, 4,166 banana trees, and 5,693 bamboo trees of different sizes will be cut due to the implementation of Project at pre-construction and construction periods. Approximately, 55,000 trees will be removed from the study area. The proposed Tree Plantation and Replacement Program (TPRP) will suggest to plant at least three times of the actual fallen trees. These trees are calculated on both side of the proposed new alignment, proposed station building areas, and new station access road areas (associated facilities). Therefore, a total of 165,000 trees will have been planted completion of this project.

The following areas have been identified for development of plantation sites in the Project areas:

- Both side slopes of the constructed new railway embankment;
- Back side of the constructed new stations; and
- Along the affected cultural/sensitive areas (within 50 m from the ROW boundary).

## 9.3 Provision and purpose of Training

The purpose of training is to orient the members of the BR, who will be responsible for management of the tree plantations, various technical and institutional issues related to protection, maintenance, management and utilization of the plantations.

A training program on tree plantation had been performed on 22 December 2019 at Lalmai Railway Station. Local people participated in this program. The training program was organized by CTM JV. ADB BRM and Bangladesh Railway Officials along with ALDLP Project Director visited during training session. CSC's Acting Team Leader was also present during visit. CSC Environmental Specialists assisted the training program. More training program will be performed next time involving female persons. Below is the training photograph.


### 9.4 Present status of tree plantation

Tree plantation had been started in the month of May 2019. In May about 1700 saplings had been planted. Plantation had been started from Zero point at Laksam end. As of December 2019 it was found that 15% saplings are alive and rest of 85% plants have been died. These saplings will be replaced by fresh ones. During tree plantation in the next year 2020 CTM JV will follow the guidelines of Bangladesh Railway and Social forestry rules of Forest Department. Senior Environment Specialist walked along the embankment in planted site from Chainage 130+700 to 132+300 and counted tree one by one which are stated below:

**Date of Inspection** **: 16 December 2019**
Location : Laksam Zero Point
Chainage : 130+700 to 132+300
Nos. of Saplings : 1,000 Nos. (Through RFI), 700 (without RFI)
**Condition of trees: (Total planted trees 1700)**

Very good condition =23
Good Condition = 112
Not so good =67
Bad condition =16
Very Bad =33
Total live trees =251
Total dead trees = 1449

**Rate of -**

i. **Survival: 15%**
ii. **Mortality: 85%**

**Reasons of tree die-**

i. Improper plantation practices i.e. untrained and/or unskilled workmanship
ii. Lack of care i.e. no watering, no protection for cattle grazing, insufficient manpower
iii. Involvement of local communities was absent in the program
iv. Lack of protection i.e. surround fencing, supports to grow vertically
v. Eaten by cattle and goats
vi. Stakes from plant are stolen by poor people for fuel




**Recommendations –**

i. Deploy skilled manpower for the plantation job
ii. Procure suitable, healthy, strong and steady saplings
iii. Maintain the tree spacing (2m) and ratio of Timber : Fruit : Medicine : Fuel (5:3:1:1)
iv. Comply with proper plantation guidelines for saplings of different species
v. Prepare each point of the plantation area well
vi. Ensure proper care after plantation
vii. Water and manure timely
viii. Ensure protection by fencing
ix. Plant long tree at the bottom row of embankment and bush tree at upper row.

## 10. CSC`s Environmental Safeguard Activities performed recently

- Approval of dumping zone one at Cumilla City Corporation dumping area and one at Quasba Pouroshava dumping area.
- Collection of water sample from test boring of deep tube well at Akhaura overhead water tank on 17/09/2019 and submitted the sample for testing at BUET, Dhaka on 18/09/2019. The test parameters are Total Iron (TI), Chlorides (Cl), Manganese (Mn), Arsenic (As) and pH. We will get the result within 10 days. CSC has instructed Contractor to arrange similar tasks at other stations like: (i.Gangasagar,ii.Imambari,iii.Quasba,iv.Mondobag,v.Saldanodi and vi. Shashidal)

- Monitoring of Monthly Sample collection of Ground water, Surface Water, Air and Noise from construction site for testing is going on.
- Regular Site monitoring by Environmental Specialists is going on. It's a continuous process.
- Inspection of Black Cotton Zone (Hazardous Work site) had been done before. Four safety sign boards are located there. But language of the boards should be changed in to Bangla and quality of sign boards also must be improved. Instruction has been given to Contractor. Currently no work is going on there and so there are no workers at site.
- Bentonite slurry sample collected for toxicity test from Salda Nodi work Site by EQMS with the presence of CSC Environment Team. They have sent it to BUET. Test result is attached as **Appendix: H.**

## 10.1 Findings of Environmental Issues to be complied

- **Tree Plantation and Replacement program**
  55000 trees have been cut down for project work. As a replacement 1, 65,000 trees should be planted by the end of September 2019. But only 1700 trees have been planted till date. No work activity since the first slot of plantation which was on May 2019.

- **Waste management plan regarding Dismantled existing station building**
  CTM was supposed to submit a plan to CSC for review since long but no proper respond was found.

- **PPE`s for work Safety**

  A lot of workers did not wear Personal Protective Equipment's properly, especially it is so hard to find the workers with safety helmets, shoes and gloves. Contractor's initiatives regarding this issue is not satisfactory at all. This issue is persisting since long but no action taken yet.

- **Site Boundaries**
  No barricading is found at most of the construction sites. Contractor is continuously failing to ensure safety barricading. Several reports have been sent to them with photographs.

- **Safety Sign Boards at Worksite**

  Very few Safety Sign boards are provided. Number of Sign boards should be increased. Size of Sign boards are small and should be increased for clear visibility. Language of sign boards should be in Bangla for the clear under standings of workers and local people.

- **Lab Test of test boring water sample of Deep tube Well from Over Head Water tank location of Each Station**
  Only One Station (Akhaura) is done with the task. Other 6 station such as i.Gangasagar, ii. Imambari, iii.Quasba, iv.Mondobag, v.Saldanodi and vi.Shashidal is yet to be done with sample collection and test. Contractor was instructed before to do so. They should take it seriously and arrange sample collection ASAP. With the presence of CSC.

- **Removal of Solid Construction Debris from bridge locations**
  Both Toma and Max have approved dumping zone. But still they make it delay to carry out solid debris to dumping zone. Several time CSC has reminded regarding this issue. No remarkable changes are visible.

- **Safety Sign at Temporary Level Crossing**
  As instructed earlier, Safety signboard with slogan and pictures should be made bigger to create visual impacts. And Signboards should be posted in appropriate places of the level crossings. But most of the board are without pictures. Language of the board also should be in Bangla for clear understanding of the local people.


## 11. Collection of water sample from test boring for deep tube well at Akhaura

Water sample was collected from test boring of overhead tank of Akhaura Station for testing in BUET lab on17/09/2019. The depth of this boring was 688 feet. At the time of sample collection Additional Chief Engineer Md. Abdus Salam and Deputy Director (ways and work) Ms.Tania Mostafa from Bangladesh Railway was present along with CSC`s Environmental Specialists. From CSC`s environment team Senior Environment Specialist Dr. Md. Kabil Hossain and Junior Environment Specialist Md. Redoan Rakib Mugdho were present. All the arrangements were done by Station Building Department of TOMA part (Contractor).

Water sample had been taken and submitted to BRTC, BUET lab for testing on 18/09/2019 by CSC`s Environment team. Test report was collected from BUET on 06/10/2019. BRTC sample number is: **1101-95857/CE/2019-20**. The test parameters are **Total Iron** (TI), **Chlorides** (Cl), **Manganese** (Mn), **Arsenic** (As) and **pH**.

All these activities of sample collection, submission and collection of test report from BUET is done under direct and close supervision of CS C`s Environment team.

Concentrations of test parameters present in the sample were Iron (Fe) = 6.8 mg/l, Chlorides (Cl) = 6 mg/l, Manganese (Mn) = 0.34 mg/l, Arsenic (As) = 0.004 mg/l and pH = 6.4. But this result could not be accepted because some values were not within the safe standard.

As per decision of BR and CTM after 40 days water sample had been collected again for Re-test in BUET on 28/10/2019. The retest result had been provided on 10/11/2019. In this test result concentrations of the parameters were Iron (Fe) = 3.8 mg/l, Chlorides (Cl) = 8 mg/l, Manganese (Mn) = 0.34 mg/l, Arsenic (As) = 0.003 mg/l, pH = 6.82 and Total dissolved Solids (TDS) = 161 mg/l. This result also could not be accepted due to same reason as mentioned before though concentration of Iron value decreased.

Due to getting non-potable water again a meeting was held at Akhaura CSC`s site office with BR,CTM and CSC on 18/12/2019 and decided further testing after washing the pump continuously for 10-15 days. Then new sample of water will be collected again for testing at BUET. It was also decided that if the result fail again, the test boring should be continue up to 1000 feet till getting the potable water.

Photographs: Collection of water sample of test boring of deep tube well for lab test at Akhaura

# 12. Bentonite Slurry Management during construction work

## 12.1 Re-use of Bentonite Slurry

Bentonite slurry can be re-used repeatedly provided its properties are carefully monitored and kept under control. Whatever system of excavation is used, loss of slurry will occur. Some will be excavated with the soil, some will permeate into the strata, and some will become too contaminated for re-use and have to be taken off site. Also, some slurry may be left in the excavation if it is not filled with concrete to ground level. The slurry which is lost is replaced by fresh slurry which is blended with the used slurry to top up the system. Bentonite powder may have to be added to the slurry or admixtures may have to be introduced to adjust its properties. About 94-96% Bentonite is being reused. The quantity of bentonite powder to be added to the mixing water depends on the quality of the bentonite and the required viscosity of the slurry. For most applications, concentrations between 4% and 6% by weight are typical.

## 12.2 Final Disposal of Bentonite Slurry

Usually, the cheapest acceptable method of disposal of bentonite slurry is to place it in an approved landfill tip. However the availability of approved tips is limited, and many tip operators will only accept limited daily quantities (generally related to how much dry solid waste they are handling). Additionally, in wet weather, some tips will not accept bentonite slurry for disposal. The purpose of these forms of treatment is to allow the products to be disposed of as solid waste. Waste disposal regulations have been the subject of significant changes in recent years and users of this guide should always ensure that any transportation or disposal is in compliance with the latest regulations. A part of the dried slurry is being collected and deposited to a designated approved dumping place (Bibirbazar, Jagonnathpur, Cumilla City Corporation dumping yard and Quasba City Corporation dumping yard) which is 2 km far away from the locality. Rest of the slurry is taken by the people who will use the slurry for their landfill site. In December 2019 a test pile boring has been done in bridge No. 1. So bentonite slurry has been produced and this slurry has been dumped to dumping site.

### 12.3 Chemical and Environmental Impact Analysis of Bentonite Slurry

Bentonite Slurry sample was collect by CTM JV from construction site on 4 September 2019 and sent to BUET for testing. CSC had found the test result on 22 December 2019. This study with chemical analysis and phase identification has revealed that there is no harmful chemical component in the supplied Bentonite sample which can be released into the environment during exploitation and processing. According to chemical composition result the most abundant oxides in the bentonite are $SiO_2$ and Al2$O_3$. The total $SiO_2$ present in the clay is around 61.5%. $Fe_2O_3$ is the third most significant component of Bentonite sample. The result of the XRF test on Bentonite clay shows that the supplied bentonite does not contain any harmful toxic metal oxides. Composition of ASH from XRF LAB Centre XRF-1800 are: $SiO_2$=61.74%, $Al_2O_3$=10.16%, $Fe_2O_3$=8.26%, $K_2O$=4.41%, and CaO =1.66. Heavy metals analysis done on the slurries were found to be very low in concentrations and thus bioaccumulation in aquatic organisms from bentonite slurry is insignificant.

## 13. Occupational Health and Safety

### 13.1 Main Objective in Health and Safety

- Identify hazards involved in the work
- Assess the risk of harm to health and safety arising from the hazards identified
- Eliminate or control any foreseeable risks
- Review risk assessment and control measures
- Provide instruction, training and information about safety procedures
- Provide reasonable supervision for employee
- Provide personal protective equipment (PPE) where required
- Provide emergency procedures for the workplace
- Provide and maintain amenities 9such as the facilities for toilets, drinking water
- Provide appropriate First Aid facilities and trained personnel

### 13.2 H&S Management system principles

HSE main principle is “keep safe workplace, keep safe people”. So, if we want ensure this principle, then we must need our employee are to know-what is safety and why it is necessary. So, contractors take a smart way for keep their all type of employee under the same roof.

CTM recognizes the inherent & operational hazards associated with construction projects and clearly belief that a strong, effective & employment driven HSE Management Systems with commitment, support and share responsibility from all project personnel are the basic requisites to achieve the injury & illness free construction work.

### 13.3 Managing Risk in the workplace

CTM persons are using “risk management” approach to address workplace health and safety issues. This involves:

- Identifying the hazards
- Assessment of risks
- Eliminate or control the risk
- Monitoring control measures

These are the elements of a risk management process and is being done in consultation with the people most likely to be affected, such as employees, sub-contractors of contractor, and vendors who may also be working on the same work site.

### 13.4 Providing of Safety Tools

The contractors have provided for their own staff, and the engineer, all appropriate protective clothing, including safety vests, helmets, and steel capped boots, and other equipment for the work to be done, and ensured proper use of the protective clothing. All safety and rescue equipment are always being fully maintained and made available at site.

### 13.5 Training, awareness and supervision

The contractor is taking all reasonable steps for training and promote safety awareness. The training includes the following:

- Training and record keeping
- General health and safety induction training
- Work activity-based health and safety induction training
- Site specific health and safety induction

CTM conducts every week general safety awareness training to their officers, engineers, supervisors and workers. They try to keep update their employees HSE knowledge.

### 13.6 Welfare facilities

Contractor is making available site welfare facilities for his people. Contractor people who shall work on any site shall have access to adequate toilet and washing facilities. The welfare facilities shall be made enough for everybody who is working in the site. Welfare facilities shall be made easily available to people working on the site.

### 13.7 Sanitary conveniences

Adequate numbers of toilets have been provided for people working on site. Toilet shall be flushed by water and connected to a mains drainage system. Men and women shall use the separate toilet. A washbasin with water, soap and towels shall be located close to the toilets.

### 13.8 Washing facilities

Contractor is being provided basins in all sites to allow people to wash their faces, hands and forearms. All basins shall have a supply of clean hot or cold or warm, running water.

### 13.9 Drinking water

Contractor has supplied of safe drinking water for the workers in the site. A tap direct from the mains shall be made available, and also bottles or tanks of water shall be used for storage. If water is stored, it shall be protected from possible contamination and changed often enough to prevent it from becoming stale or contaminated.

### 13.10 Precautions to prevent fires

All types of measures for precaution have been taken to prevent fires. The following precautions have been taken to prevent fires:

- Use less-easily ignited and fewer flammable materials
- Low-solvent adhesives and paint
- Keep the quantity of flammables at the workplace to a minimum
- Always keep and carry flammable liquids in suitable closed containers
- To minimize the risk of gas leaks and fires involving gas-fired plant
- Store flammable solids, liquids and gases safety
- Have an extinguisher to hand when doing hot work such as welding or using a disc cutter that produces sparks

### 13.11 Precaution in case of fire

People shall be able to escape from fire if a fire shall break out. Where hot work is to be conducted in an area surrounding bush land or scrubland, extreme care shall be taken. Control shall be in place to prevent sparks and hot material contacting combustible material prior to the ignition source occurring.

### 13.12 First aid

First aid can save lives, reduce pain and help an injured person make a quicker recovery. First aid box for all sites has been provided with enough equipment to cope with the number of workers on site. An appointed person has taken charge of first-aid arrangements.

### 13.13 Site Security

The contractor is responsible for the security of the site and for maintaining it as a safe-working environment at all sites. The overall site boundary as well as the specific boundaries of the various site facilities is being identified by contractor and be submitted to the Engineer for approval, complete details of the contractor's proposed method or methods for maintaining the security of the various boundaries and for the security of the buildings, personnel, material and equipment contained therein.

### 13.14 Work in the Rail Corridor

The work site protection plan is in place which identifies any pedestrian, commuter, or traffic management issues. There remains watchman. It is the responsibility of the site supervisor to ensure controls documented in the worksite protection plan are implemented.

### 13.15 Safety measures during construction period

On behalf of the contractor a safety officer is supervising the safety arrangement at the site of work. From starting to completion of the embankment, bridge/culvert and track construction work, many safety measures are being taken by contractor. They are providing safety barricade for protect the public. CTM has installed safety caution signboards. They have installed heavy barricade by galvanizing sheets in bridge work site. They also have installed barricade for protect their sensitive works.

### 13.16 Safety Notice Board

The contractor has set up adequate safety notice board located within their workplace. Relevant safety information that has been displayed is:

- Caution of workplace
- Color post demarcation of Rail Track 3m apart
- Toe line demarcation
- Signs of level crossing
- Signs of work on-going
- First aid kit locations
- Emergency contact details
- Evacuation procedures
- Site maps
- Existing hazards in the workplace
- Meeting minutes Name of first aiders and the safety representative

### 13.17 PPE requirements and Training

The relevant mandatory safety equipment shall be issued to all employees. Minimum PPE requirements for projects include:

- Medium impact safety glasses
- Steel capped boots (with lace up ankle supports)
- Long pants
- Long sleeved safety orange shirt

- Safety orange vest
- Safety helmet with brim
- Stay safe booklets
- Water containers

### 13.18 Safety promotional event

Based on the HSE principle CTM organize safety promotional event and carry out other promotional activities. They are giving various HSE training and visual presentation for their employee by this event. The safety promotional events content elements such as –Awareness Training, Fire Fighting Training, Emergency Procedure Training, First Aid Training and Safety related heart touching video presentations. They have also installed many type of safety promotional poster in their workplace.

### 13.19 Orientation session on HIV/AIDS and STI Awareness

**Activities** :

- Presentation of awareness orientation session on HIV/AIDS prevention programme.
- Provision of medical and counseling services.
- Managing, monitoring of HIV/AIDS prevention programme.
- Condom and IEC materials distribution.
- Posters provided for all railway stations and work sites.

**Description**

Many workers are working in the ALDLP and adjacent to project area lot of community people are working. The workers and the community people are not aware of the HIV/AIDS.

Orientation session on HIV/AIDS and STI Awareness/Prevention under ALDLP has been conducted in the construction sites and communities.

**Table 7. Orientation session on HIV/AIDS and STI awareness/prevention July-Dec. 2019**

| Activities for | Date & Time | Venue | Resource persons | Participants | | |
|---|---|---|---|---|---|---|
| | | | | Male | Female | Total |
| Workers | 08/ 07/ 2019 | Bridge No: 231 (Bagmara Bridge) | 12 | 51 | x | 63 |
| Community people | 08/ 07/ 2019 | Near Bridge No: 231 | 07 | 03 | 14 | 24 |

| Activities for | Date & Time | Venue | Resource persons | Participants | | |
|---|---|---|---|---|---|---|
| | | | | Male | Female | Total |
| | | (Bagmara Bridge) | | | | |
| Workers | 09/07/ 2019 | Kosba Mechanical Workshop | 07 | 43 | x | 50 |
| Community people | 09/07/ 2019 | Near Kosba Mechanical Workshop | 08 | 05 | 13 | 26 |
| Workers | 27/ 08/ 2019 | Akhaura Railway Station | 10 | 30 | x | 40 |
| Community people | 27/ 08/ 2019 | Near Akhaura Railway Station | 07 | 11 | 19 | 37 |
| Workers | 28/ 08/ 2019 | Mainamati Railway Station | 10 | 47 | x | 57 |
| Community people | 28/ 08/ 2019 | Near Mainamati Railway Station | 08 | 03 | 16 | 27 |
| Workers | 29/ 09/ 2019 | Bridge No: 231 (Bagmara Bridge) | 08 | 60 | x | 68 |
| Community people | 29/ 09/ 2019 | Near Bridge No: 231 (Bagmara Bridge) | 08 | 02 | 13 | 23 |
| Workers | 30/ 09/ 2019 | New Kosba Railway Station | 06 | 22 | x | 28 |
| Community people | 30/ 09/ 2019 | Near Kosba Railway Station | 04 | 06 | 22 | 28 |
| Workers | 28/ 10/ 2019 | Gangashagor Railway Station | 10 | 30 | x | 40 |
| Community people | 28/ 10/ 2019 | Gangashagor Railway Station | 07 | 02 | 24 | 33 |
| Workers | 29/ 10/ 2019 | Comilla Railway Station | 09 | 40 | x | 49 |
| Community people | 29/ 10/ 2019 | Near Comilla Railway Station | 06 | 01 | 16 | 23 |
| Workers | 17/ 11/ 2019 | Imambari Railway Station | 11 | 23 | x | 34 |
| Community people | 17/ 11/ 2019 | Near Imambari Railway Station | 09 | 02 | 15 | 26 |
| Workers | 18/ 11/ 2019 | Lalmai Railway Station | 06 | 45 | X | 51 |
| Community people | 18/ 11/ 2019 | Near Lalmai Railway Station | 06 | 15 | x | 21 |
| Workers | 22/12/2019 | Comilla Railway Station | 08 | 53 | x | 61 |
| Community people | 22/12/2019 | Near Comilla Railway Station | 05 | 01 | 12 | 18 |

| Activities for | Date & Time | Venue | Resource persons | Participants | | |
|---|---|---|---|---|---|---|
| | | | | Male | Female | Total |
| Workers | 22/12/2019 | Mandabagh Railway Station | 06 | 19 | x | 25 |
| Community people | 22/12/2019 | Near Mandabagh Rail Station | 05 | 14 | x | 19 |

**Orientation Session on HIV/AIDS and STI awareness**


### 13.20 Status of implementation of the safety execution plan

CTM organize safety promotional event based on the safety execution plan and carry out other promotional activities. They are giving various training and visual presentation on safety for their employee by this event. The safety promotional events content elements such as –awareness training, firefighting training, emergency procedure training, first aid training and safety related heart touching video presentations. They have also installed many type of safety promotional poster in their workplace. They are also trying to ensure use of personal protective equipment for workers' safety.

### 13.21 Comments on occupational health and safety

- CTM is not continuously inspecting the sites for identify hazard
- Every month they do not inspect their machinery and equipment
- Every month CSC and CTM have done the Health and Safety joint inspection.
- They inspect for railroad safety including level crossings.
- They are inspecting in all works, and much more for keeping safe workplace
- They are not providing high quality of PPE for their employees
- They are keeping up-to-date PPE checklist and stock properly
- They rarely exchange damage PPE
- They provide PPE for the visitors but not enough
- They are providing general safety awareness training
- Providing individual safety awareness training
- Delivering work basis training and toolbox meeting.
- Group safety induction

### 13.22 Recommendations for health and safety

- All workers should be provided with Personal Protection Equipment (PPE) and wear properly.
- Using of PPE by workers should be ensured.
- Safety guards should be nominated at every unman rail crossing and railway bridge sites

- The cautionary sign boards should be set up at very close to the bridge ends. So people can easily notice the sign board and will be careful of the accident.
- Working sites should be well demarcated to protect the public.
- Potable safe water should be ensured in every site.
- Barricading must be installed during excavation, work at height.
- All the vehicles and plant must be inspected and display the copy of permit.
- More pay attention for the electric cables and equipment in safe use and tagged after inspected.
- Implement fire safety

**Table 8. HSE Statistical report on accident/incident (MAX part)-July-December 2019**

| Sl. No. | Description of report items | Jul-Aug. 2019 | Sep-Oct. 2019 | Nov.-Dec. 2019 | Cumulative Since Jul. |
|---|---|---|---|---|---|
| 1 | Total Manpower (Engaged daily average) | 2760 | 2755 | 2315 | 7830 |
| 2 | Total man-hours worked [(according to pay roll) for that month] | 650370 | 670850 | 565945 | 1887140 |
| 3 | Cumulative Man-hours worked since start | - | - | | 8016256 |
| 4 | Total man-hours worked without Loss Time Accident (LTA) | 650370 | 670850 | 565945 | 1887140 |
| 5 | Total Man-days loss due to Loss-Time Accident (LTA) | 0 | 0 | 0 | 10 |
| 6 | Number of Reportable LTA | 0 | 0 | 1 | 4 |
| 7 | Number of minor injury/first-aid cases | 3 | 5 | 6 | 52 |
| 8 | Number of near miss incidents | 0 | 1 | 2 | 3 |
| 9 | Number of major injuries | 0 | 0 | 0 | 5 |
| 10 | Number of fatal accidents | 0 | 0 | 0 | 0 |
| 11 | Number of dangerous occurrences | 0 | 0 | 0 | 0 |
| 12 | Frequency rate= (Number of reportable LTAx1000000)/Man-hours worked | 0 | 0 | 0 | 0.394 |
| 13 | Severity rate= (Man-days lost due to reportable LTAx100000)/Man-hours worked | 0 | 0 | 0 | 0.919 |
| 14 | Incident rate=Number of reportable LTAx1000)/Average number of persons employed | 0 | 0 | 0 | 3.025 |
| 15 | Cumulative AIR (Accident Incident Rate); AIR= (Number of Reportable Accident x 1000)/Average Daily Manpower. | 0 | 0 | 0 | 5.041 |

**Table 9. Compliance measures (MAX part) during July-December 2019**

| Sl. No. | Description | Jul-Aug. 2019 | Sep-Oct. 2019 | Nov.-Dec. 2019 |
|---|---|---|---|---|
| 1 | % of First-Aid Kit Available complete with necessary medicines | 100% | 100% | 100% |
| 2 | % of Camp Labour covered with periodic medical attention | 100% | 100% | 100% |
| 3 | % of excavated area barricaded | 100% | 100% | 100% |
| 4 | % of welders using necessary PPE | 100% | 100% | 100% |
| 5 | % of Staff & Workmen using required safety gear | 100% | 100% | 100% |
| 6 | % of Staff & Workmen getting portable drinking water | 100% | 100% | 100% |
| 7 | % of area lighting for night work | 100% | 100% | 100% |

**Table 10. Training and awareness programs (MAX part) during July-December 2019**

| Sl No. | Description | Jul-Aug. 2019 | Sep-Oct. 2019 | Nov.-Dec. 2019 |
|---|---|---|---|---|
| 1 | Total Manpower (engaged daily average) | 2790 | 2760 | 2340 |
| 2 | No. of personnel exposed to tool box training | 5880 | 5760 | 4070 |
| 3 | No. of tool box meeting held | 470 | 580 | 550 |
| 4 | No. of safety induction training program conducted | 12 | 10 | 9 |
| 5 | No. of safety training held | 5 | 3 | 2 |
| 6 | No. of safety seminars held | - | - | - |
| 7 | No. of Safety film screened | 98 | 68 | 21 |

**Table 11. HSE Statistical report on accident/incident (TOMA part) July-Dec. 2019**

| Sl. No. | Description of report items | Jul-Aug. 2019 | Sep-Oct. 2019 | Nov.-Dec. 2019 | Cumulative Since Jul. |
|---|---|---|---|---|---|
| 1 | Total Manpower (Engaged daily average) | 1460 | 1560 | 1970 | 4990 |
| 2 | Total man-hours worked [(according to pay roll) for that month] | 311790 | 347240 | 474580 | 1133610 |
| 3 | Cumulative Man-hours worked since start | - | - | | 1133610 |
| 4 | Total man-hours worked without Loss Time Accident (LTA) | 311790 | 347240 | 474580 | 1133610 |

| Sl. No. | Description of report items | Jul-Aug. 2019 | Sep-Oct. 2019 | Nov.-Dec. 2019 | Cumulative Since Jul. |
|---|---|---|---|---|---|
| 5 | Total Man-days loss due to Loss-Time Accident (LTA) | 0 | 0 | 0 | 0 |
| 6 | Number of Reportable LTA | 0 | 0 | 0 | 0 |
| 7 | Number of minor injury/first-aid cases | 0 | 0 | 0 | 0 |
| 8 | Number of near miss incidents | 0 | 0 | 0 | 0 |
| 9 | Number of major injuries | 0 | 0 | 0 | 0 |
| 10 | Number of fatal accidents | 0 | 0 | 0 | 0 |
| 11 | Number of dangerous occurrences | 0 | 0 | 0 | 0 |
| 12 | Frequency rate= (Number of reportable LTAx1000000)/Man-hours worked | 0 | 0 | 0 | 0 |
| 13 | Severity rate= (Man-days lost due to reportable LTAx100000)/Man-hours worked | 0 | 0 | 0 | 0 |
| 14 | Incident rate=Number of reportable LTAx1000)/Average number of persons employed | 0 | 0 | 0 | 0 |
| 15 | Cumulative AIR (Accident Incident Rate); AIR= (Number of Reportable Accident x 1000)/Average Daily Manpower. | 0 | 0 | 0 | 0 |

**Table 12. Compliance measures (TOMA part) during July-December 2019**

| Sl. No. | Description | Jul-Aug. 2019 | Sep-Oct. 2019 | Nov.-Dec. 2019 |
|---|---|---|---|---|
| 1 | % of First-Aid Kit Available complete with necessary medicines | 90% | 92% | 95% |
| 2 | % of Camp Labour covered with periodic medical attention | 60% | 60% | 62% |
| 3 | % of excavated area barricaded | 70% | 73% | 75% |
| 4 | % of welders using necessary PPE | 50% | 50% | 60% |
| 5 | % of Staff & Workmen using required safety gear | 62% | 63% | 64% |
| 6 | % of Staff & Workmen getting portable drinking water | 100% | 100% | 100% |
| 7 | % of area lighting for night work | 90% | 93% | 95% |

**Table 13. Training and awareness programs (TOMA part) during July-December 2019**

| Sl No. | Description | Jul-Aug. 2019 | Sep-Oct. 2019 | Nov.-Dec. 2019 |
|---|---|---|---|---|
| 1 | Total Manpower (engaged daily average) | 2455 | 2044 | 1945 |
| 2 | No. of personnel exposed to tool box training | 5111 | 3166 | 6513 |
| 3 | No. of tool box meeting held | 395 | 280 | 112 |
| 4 | No. of safety induction training program conducted | 7 | 7 | 12 |
| 5 | No. of safety seminars held | 1 | 2 | 2 |
| 6 | No. of Safety film screened | 45 | 66 | 18 |

**Table 14. Key Action Taken in July to December 2019 (MAX + TOMA)**

| Sl No. | Status of Key Actions from previous Health& Safety | Status |
|---|---|---|
| 1 | Installation of reflective road signboard | Continue |
| 2 | Individual safety induction for all type of employee | Done |
| 3 | Installation of safety fence for protecting the public | Continue |
| 4 | Maintained of diversion signboard and supporting board | Continue |
| 5 | PPEs inspection and replacement | Continue |
| 6 | Provide company ID card for employee | Continue |
| 7 | Supervise HIV/AIDS subcontractor's prevention program. | Continue |
| 8 | Safety induction training to 3rd party | Continue |
| 9 | Specific HSE training programs to workers (e.g. Hoist, Lifting act) | Continue |
| 10 | Induction sticker & logo sticking in helmet | Continue |
| 11 | Organize safety management team meeting | Done |
| 12 | Installation of safety WARNING & CAUTION signboard | Done |
| 13 | Group training to employee e.g. First aid, Fire fight, etc. | Done |

# 14. Overall Conclusion and Recommendations

## a. Overall Progress with Implementation of Environmental Safeguard Measures

115. According to the monitoring and supervision by the Engineer of the environmental activities on the ALDLP it is found that the Contractor, CTM is now credibly undertaking most of the environmental mitigative measures specified in the EMP although there are areas where further action and improvement need to be made.

116. The Contractor's compliance with contract clauses and EMP tasks has increased since the mobilization of CTM's environmental engineer, which is a very positive sign.

117. The potential adverse impact of the ongoing works on the major watercourses and overall drainage of the area is being minimized by ensuring the design and construction of the new embankment and structures generally match the embankment and structures of the existing track alignment. The potential adverse impact of dust from the transport of large quantities of embankment materials is being minimized by spraying water to the worksites.

118. The monitoring of water and air quality, and noise levels has generally been fully compliant since July 2019. The implementation of the occupational health and safety issues has been greatly improving with the Contractor and Engineer holding regular briefings related to the various campsites and work sites.

## b. Recmmendations for Improving Contractor's Compliance

119. Based on the site inspection and monitoring of the execution of the Environmental Safeguards program the accomplishments in response to the relevant recommendations are given in the following table.

**Table 15. Recommendations for Improving Contractor Compliance**

| Sl. No. | Recommendation | Timeframe | Implemented by | Supervision by |
|---|---|---|---|---|
| 1 | The Contractor must ensure that the sampling of the critical parameters for water quality, noise and air quality is carried out **fully** in line with the Sampling Program so that meaningful results can be obtained enabling further mitigative measures to be determined and initiated if required. | During project period | CTM | CSC Engineer |
| 2 | The on-site construction supervision and management of the Contractor should be strengthened so that actions taken to improve health and safety issues are maintained and not lost over time. It will be necessary to arrange the training and awareness in the health and safety issues for the construction workers with regular and repeated sessions presented & delivered by specialised personnel. | During project period | CTM | CSC Engineer |

| Sl. No. | Recommendation | Timeframe | Implemented by | Supervision by |
|---|---|---|---|---|
| 3 | The overall management of camps and worksite must be further improved in line with the best practices on occupational health and safety so that these areas of the site can be made fully compliant. | During project period | CTM | CSC Engineer |
| 4 | The staffing provided to address the environmental safeguards program should be enhanced to ensure that all the requirements of the program can be correctly actioned and reports can be provided in a timely manner recognising the importance of these matters to all stakeholders. | During project period | CTM | CSC Engineer |

## c. Overall Environmental Safeguards Compliance

**1) Contractor**

120. The environmental awareness creation, particularly regarding the direct construction impacts and especially for health, pollution and safety issues are important. The need to develop self-regulation of the contractors will have to be emphasized, with the consultant's supervisory role that to be in conformity the relevant Environmental Clauses (Section 6, Subsection H of contract technical specification) incorporated in the construction contracts and national legislation.

**2) Bangladesh Railway**

121. Bangladesh Railway has recognized the need to improve its safeguards technical capacity and to that end in planning to establish an Environmental and Social Safeguards Unit within the agency.

**3) Construction Supervision Consultant (Engineer)**

122. The engineer need addressing all safeguard issues and recognizing the lack of technical capacity of the contractor through preparing and delivering workshop on EMP implementation, field monitoring and reporting, including templates of all required tables and reports.

**4) Asian Development Bank (ADB)**

123. For loan implementation work the ADB's active participation is very important and periodic discussion with BR about the need for the Contractor to comply (based on the Engineer's input) is essential if the EMP actions need to be effective. This action reinforces the seriousness of safeguard implementation with both the Contractor and BR, while underscoring the value of the Engineer's oversight. With the absence of suitable staff engaged from the commencement of the Project by the Contractor this did not happen at the start of the works, but the situation will be resolved after the first year.

## Lessons Learned and Gaps.

The following are major lessons learned during July 2019 to December 2019 implementation period

1) Prequalification of the Contractor

124. Contractor's pre-qualification in environmental and social safeguards needed to specify in the bid documents and then follow through commitments by the contractor to provide safeguard expertise from the start of the construction period need to be constantly enforced.

2) Preparation of Environmental Clauses Section of Contracts

125. Contracts should have environmental sections where all measures are defined, including cross referencing the EMP, prepared as part of the environmental assessment, and with financial effects provided for non-compliance.

3) Prepare Environmental BOQ section

126. In order to effectively hold back payment for safeguard work not completed or inadequately addressed, costs should be linked to each major mitigative task or task group. To address this an environmental safeguards section of the construction contract's Bill of Quantities was prepared, thereby attaching costs to each task. In this way the Engineer can easily link payment hold-backs with incomplete work.

4) Engineer's Environmental Specialist on the Job while the Contractor was mobilizing.

127. Having the Engineer's (CSC) designated environmental specialist on the job when the Contractor mobilized was essential to set the tone and significance of environmental safeguards. Most EMPs have, as an important pre-construction activity, information on EMP implementation and reporting to the Contractor, and assisting with the preparation of the contractor's Environmental Mitigation or Management Work Schedule (EMWS). These contracts should therefore have a provision for the early involvement of the project environmental specialist.

5) Presentation on safeguard by contractor for all of the ADB missions and involvement of CSC

128. Contractor should make presentations on the work being undertaken without the knowledge or oversight of the Engineer is essentially the same as taking away all responsibility and authority of the Engineer to direct the Contractor and to decide on performance. This occurred twice during the constructions stage and resulted in a very significant loss of authority for the Engineer. The Contractor took this to mean that the Engineer and environmental safeguards were items to ignored, with few if any consequences.

129. ADB needs to insist that the Engineer be involved in all matters that require regular the Engineer oversight. This is especially true for safeguard matters, which tend to slip "under the radar". It is important to have both EIB and ADB HQ involved on large and long duration projects and to make sure that the Engineer is kept in the information loop as much as possible.

**Table 16. Present environmental progress status during July-December 2019**

| Sl No. | Environmental Issues | Results of progress level (July-December 2019) in % | | | | | | Remarks |
|---|---|---|---|---|---|---|---|---|
| | | July | Aug. | Sept. | Oct. | Nov. | Dec. | |
| 1 | Noise and attenuation measures | 65 | 67 | 67 | 66 | 68 | 70 | Gradually improving |
| 2 | Dust control | 57 | 60 | 64 | 65 | 67 | 71 | Gradually improving |
| 3 | Water course impacts in wetlands/ponds/rivers/canals | 50 | 50 | 51 | 53 | 52 | 54 | Gradually improving |
| 4 | Disposal of construction debris | 50 | 52 | 54 | 56 | 58 | 60 | Gradually improving |
| 5 | Other waste management | 60 | 62 | 64 | 63 | 67 | 67 | Gradually improving |
| 6 | Servicing and operating equipment | 50 | 53 | 54 | 57 | 59 | 62 | Gradually improving |
| 7 | Control of petroleum products | 52 | 53 | 55 | 57 | 60 | 62 | Gradually improving |
| 8 | Waste oil and lubricants | 60 | 65 | 65 | 67 | 67 | 70 | Gradually improving |
| 9 | Occupational health and safety | 65 | 67 | 67 | 68 | 67 | 70 | Gradually improving |
| 10 | Toilet facility | 75 | 78 | 79 | 80 | 81 | 82 | Gradually improving |
| 11 | House keeping | 72 | 75 | 76 | 77 | 78 | 80 | Gradually improving |
| 12 | Drinking water facility | 74 | 78 | 85 | 88 | 92 | 96 | Good condition |
| 13 | Use of personal protective equipment (PPE) | 76 | 79 | 81 | 85 | 86 | 90 | Gradually improving |
| 14 | Protection of top soil and soil erosion | 25 | 28 | 31 | 32 | 35 | 35 | Gradually improving |
| 15 | Borrow and dredging site impacts | 40 | 45 | 48 | 50 | 51 | 52 | Gradually improving |
| 16 | Disposal of Bentonite slurry | 55 | 60 | 64 | 65 | 66 | 72 | Gradually improving |
| 17 | Tree plantation and replacement | 0 | 0 | 0 | 0 | 0 | 10 | One training performed |

# 15. Appendices

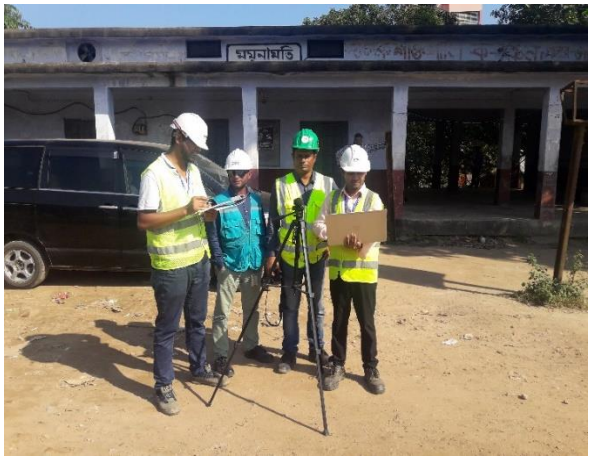
## 15.1 Appendix- A. Quantitative Environmental Monitoring Schedule for Year 2019

| Factor of Monitoring | Stage | Point of Monitoring | Test Parameters | Method for Monitoring | Frequency of Monitoring | Test Month in year 2019 |
|---|---|---|---|---|---|---|
| Air Quality | Construction | All construction locations along the line - 2 locations | PM 10, PM 2.5, SOx, NOx | High Volume Sampler | Once per Month | January, February, March, April, May, June, July, August, September, October, November, December |
| Ambient noise and vibration | Construction | All construction locations along the line - 2 locations | Measurement of noise dB(A) | Filed Level Noise Meter | Once per Month | January, February, March, April, May, June, July, August, September, October, November, December |
| Surface Water Environment | Construction | All construction locations along the line - 2 locations | Temperature, pH, TDS, EC, TSS, DO, COD, BOD5 | In situ and Laboratory analysis | Once per Month | January, February, March, April, May, June, July, August, September, October, November, December |
| Ground Water Environment | Construction | All construction locations along the line - 2 locations | Temperature, pH, Phosphate, Mn, Fe, As, Fecal Coliform | In situ and Laboratory analysis | Once per Month | January, February, March, April, May, June, July, August, September, October, November, December |

## 15.2 Appendix - B. Environmental Sampling Photographs: July-December 2019

**Sampling photo in the month of July –December 2019**


আখাউড়া জংশন


গয়নামতি

## 15.3 Appendix- C. Site Inspection Report during July-December 2019

## Engineer's Recommendation on Present Environmental Site Status and Practices July-December 2019

| ITEMS | OBSERVATIONS | ENGINEER'S RECOMMENDATION | PHOTOGRAPH | REFERENCE |
|---|---|---|---|---|
| **Parameters: Air Quality and Dust Control** | | | | |
| Dust Suppression | Water car spraying water to suppress dust | Good Practice but limited movement. Frequency of movement should be increased.<br>I. Spray water 4 times a day to avoid blowing dust at all the at the places construction of embankment, stations and placement of ballast.<br>II. Also limit the vehicle speed to ≤35 Km/h. |  | [H 6.2 (b) (P-6)]<br>[EMP 2.2 (P-97)]<br>[EMP 2.3.1 (P-97)]<br>[EMP 2.5.2 (P-99)]<br>[EIA VI B (1) 187 (P-50)] |
| Bare Stockpiled Materials | Open Stockpile , which causes air pollution | I. Cover stockpiled sand.<br>II. Spray water 4 times a day to avoid blowing dust at all the places construction of embankment, stations and placement of ballast.<br>III. Also limit the vehicle speed to ≤35 Km/h. |  | [H 6.2 (b) (P-6)]<br>[EMP 2.2 (P-97)]<br>[EMP 2.3.1 (P-97)]<br>[EMP 2.5.2 (P-99)]<br>[EIA VI B (1) 187 (P-50)] |

| ITEMS | OBSERVATIONS | ENGINEER'S RECOMMENDATION | PHOTOGRAPH | REFERENCE |
|---|---|---|---|---|
| Dry Embankment Surface | Dry Embankment surface creates dust and air pollution. | I. Spray water 4 times a day to avoid blowing dust at all the at the places construction of embankment, stations and placement of ballast.<br>II. Also limit the vehicle speed to ≤35 Km/h. |  | [H 6.2 (b) (P-6)]<br>[EMP 2.2 (P-97)]<br>[EMP 2.3.1 (P-97)]<br>[EMP 2.5.2 (P-99)]<br>[EIA VI B (1) 187 (P-50)] |
| **Parameters: Control of Petroleum Products** | | | | |
| Storage of Surplus or Disposable Petroleum Products | Oil filled drums kept open with no spillage protection measures | I. Specify the designated area with impermeable substance not near water body or stream provided with roof at the top and fence surrounding.<br>II. Provide tray during fuelling activities to limit unwanted spillage where needed.<br>III. Maintain at least 500m distance from any housing area during any refuelling activities. |  | [H 6.6 (a) (P-8)]<br>[H 6.6 (b) (P-8)]<br>[H 6.6 (c) (P-8)]<br>[EIA VI B (8) 216 (P-58)]<br>[H 6.7 (a) (P-8)]<br>[EIA VI B (8) 216 (P-58)] |

| ITEMS | OBSERVATIONS | ENGINEER'S RECOMMENDATION | PHOTOGRAPH | REFERENCE |
|---|---|---|---|---|
| Operating Defective Vehicle, Machine, Equipment or Plant at Work Site | Defective machine with no oil spillage measures taken running at camp area | I. Provide problem free machines for any kinds of operation<br>II. Maintain and run in a good place with casting or plane sheet or drum sheet at the bottom of the machine to avoid spillage, and pollution<br>III. Provide tray during fuelling activities to limit unwanted spillage where needed. |  | [H 6.6 (a) (P-8)]<br>[H 6.6 (b) (P-8)]<br>[H 6.6 (c) (P-8)]<br>[EIA VI B (8) 216 (P-58)] |
| Storage of Petroleum Products | Oil pump storage area with concrete casting below to avoid oil spillage | Good Practice |  | [H 6.6 (a) (P-8)]<br>[H 6.6 (b) (P-8)]<br>[H 6.6 (c) (P-8)]<br>[EIA VI B (8) 216 (P-58)]<br>[H 6.7 (a) (P-8)]<br>[EIA VI B (8) 216 (P-58)] |
| **Parameters: Servicing and Operating Equipment** | | | | |

| ITEMS | OBSERVATIONS | ENGINEER'S RECOMMENDATION | PHOTOGRAPH | REFERENCE |
|---|---|---|---|---|
| Servicing of Defective Vehicle, Machine, Equipment or Plant at Workshop | Using Dip pans during servicing activities at workshop | Good Practice |  | [H 6.6 (a) (P-8)]<br>[H 6.6 (b) (P-8)]<br>[H 6.6 (c) (P-8)]<br>[EIA VI B (8) 216 (P-58)] |
| **Parameters: Disposal of construction Debris and others Materials** | | | | |
| Man Made Construction Debris | Broken CIP heads found beside the new embankment for long time. | I. Debris should not be left lying on the ground surface or buried in any agricultural land.<br>II. Recycle, reuse, relocate or remove the wastes to designated dumping yards.<br>III. Break the huge or big into small parts and remove.<br>IV. Implement waste disposal system. |  | [H 6.5 (c) (P-7)]<br>[H 6.5 (d) (P-7)]<br>[EMP 2.5.2 (P-99)]<br>[EIA VI B (8) 215 (P-58)] |

| ITEMS | OBSERVATIONS | ENGINEER'S RECOMMENDATION | PHOTOGRAPH | REFERENCE |
|---|---|---|---|---|
| Construction Waste materials | Haphazard condition. Different construction wastes kept in a scatter manner | I. Wastes like litter or food scraps should not be dumped or burnt anywhere and left lying on the ground surface or buried in any agricultural land.<br>II. Recycle, reuse, relocate or remove the wastes to designated dumping yards.<br>III. Provide bins to segregate the waste.<br>IV. Implement waste disposal system.<br>V. Weekly inspection is must |  | [EMP 2.4.2 (P-98)]<br>[EMP 2.10.1 (P-100)]<br>[EIA VI B (8) 215 (P-58)]<br>[EIA VI B (8) 217 (P-58)] |
| Man Made Construction Debris | Left over tires and empty drums kept in a scatter manner and can cause diseases and others environmental problems. | I. Debris should not be left lying on the ground surface or buried in any agricultural land.<br>II. Recycle, reuse, relocate or remove the wastes to designated dumping yards.<br>III. Break the huge or big into small parts and remove.<br>IV. Implement waste disposal system. |  | [H 6.5 (c) (P-7)]<br>[H 6.5 (d) (P-7)]<br>[EMP 2.5.2 (P-99)]<br>[EIA VI B (8) 215 (P-58)] |

| ITEMS | OBSERVATIONS | ENGINEER'S RECOMMENDATION | PHOTOGRAPH | REFERENCE |
|---|---|---|---|---|
| Dumping Area | An area is selected for dumping solid wastes and also others.<br>But not yet asked for any approval from engineers. | Urgent request for sending a formal letter for engineer's approval. |  | |
| **Parameters: Occupational Health and Safety** | | | | |
| Potable Drinking Water | Safe drinking water facilities available | Good practice but should increase this services<br>I. Clean and disinfect the facility regularly.<br>II. Implement waste disposal system.<br>III. Weekly inspection is must. |  | [EMP 2.4.2 (P-98)]<br>[EMP 2.10.1 (P-100)]<br>[EIA VI B (8) 215 (P-58)]<br>[EIA VI B (8) 217 (P-58)] |

| ITEMS | OBSERVATIONS | ENGINEER'S RECOMMENDATION | PHOTOGRAPH | REFERENCE |
|---|---|---|---|---|
| House Keeping | Waste bin provided for collection of wastes but users are littering | Good practice but users should be groomed and trained.<br>I. Wastes like litter or food scraps should not be dumped or burnt anywhere and left lying on the ground surface or buried in any agricultural land.<br>II. Recycle, reuse, relocate or remove the wastes to designated dumping yards.<br>III. Provide bins to segregate the waste.<br>IV. Implement waste disposal system.<br>V. Weekly inspection is must |  | [EMP 2.4.2 (P-98)]<br>[EMP 2.10.1 (P-100)]<br>[EIA VI B (8) 215 (P-58)]<br>[EIA VI B (8) 217 (P-58)] |
| Sanitary Toilet Facility | Hygienic toilet provided | Good Practice and should be carried on |  | [EMP 2.4.2 (P-98)]<br>[EMP 2.10.1 (P-100)]<br>[EIA VI B (8) 215 (P-58)]<br>[EIA VI B (8) 217 (P-58)] |
| | | | | |

| ITEMS | OBSERVATIONS | ENGINEER'S RECOMMENDATION | PHOTOGRAPH | REFERENCE |
|---|---|---|---|---|
| **Parameters: Protection of top soil and Erosion, Water Course impacts in Wetlands/Canals/Rivers** | | | | |
| Erosion, Sedimentation and Contamination of Superficial or Organic Surplus Adjacent to Natural Drainage | Erosion protection measures not taken | I. Erosion and sedimentation control measures should be taken during cross-drainage work.<br>II. Ensure the continuous stream flow during any construction works. |  | [H 6.3 (c) (P-7)]<br>[H 6.3 (d) (P-7)]<br>[H 6.3 (e) (P-7)]<br>[H 6.3 (f) (P-7)]<br>[H 6.3 (g) (P-7)] |
| Water Congestion or Loss of Navigability Due to Cross Drainage Works | Loss of navigability | I. Erosion and sedimentation control measures should be taken during cross-drainage work.<br>II. Ensure the continuous stream flow during any construction works. |  | [H 6.3 (c) (P-7)]<br>[H 6.3 (d) (P-7)]<br>[H 6.3 (e) (P-7)]<br>[H 6.3 (f) (P-7)]<br>[H 6.3 (g) (P-7)] |

The Project is now at the middle stage and various development activities are in progress. The land development activity of the Project area is ongoing. There are some environmental compliance measures in environmental management plan that should be at place during this construction stage. From the first quarter environmental monitoring of assessment, some recommendations have been made and it is important to consider these measures to properly implement the approved Environmental Management Plan (EMP). CTM are implementing the Environmental Management Plan (EMP) accordingly but sometimes fluctuates and deviates which CSC observes and give instruction to comply the issues.

## 15.4 Appendix-D. Environmental Site monitoring Photographs: July-December 2019

***A picture is worth a thousand words***
***Barnard***


SAFETY
FIRST
সাবধান
রেল ব্রীজের উপর
হাঁটা নিষেধ


20 12 2019


20 12 2019


20 12 2019

## 15.5 Appendix –E. ADB-BRM, BR and CSC Inspection Photographs Jul-Dec. 2019

***A picture is worth a thousand words***
***Barnard***







ADB
Training on Tea Plantation along Railway Track and Thei
Up-Keeping Under Akhaura-Laksam Double Line Project
Organized by: CTM-JV
Participants: Local Residents
22 12 2019


22 12 2019


22 12 2019


CSC


22 12 2019






## 15.6 Appendix-F. Photographs of Borrow pit ponds

## Photographs of Borrow pit ponds excavated during earth work of ALDLP

## 15.7 Appendix-G. Monitoring Checklist July-December 2019

## CONSTRUCTION CAMPS

| Checklist Question | Yes | No | Remarks |
|---|---|---|---|
| 1. Is the camp/yard located in a protected area, next to a community water source or any other ecologically or otherwise sensitive area? | | ✓ | |
| If yes, comment on the adverse impacts on the environment: | | | |
| 2. Is the camp/yard being properly maintained? | ✓ | | Partially |
| If no, list what is not being done properly | | | |
| 3. Is the wastewater being disposed of properly? | ✓ | | |
| If no, comment on how it is being disposed and what are the impacts | | | |
| 4. Have septic tanks been installed? | ✓ | | |
| 5. Are the septic tanks working correctly, that is not overflowing, or emitting smell? | | ✓ | |
| 6. Is the solid waste being disposed of properly? | ✓ | | Partially |
| If no, comment on how it is being disposed and the impacts of such disposal: | | | |
| 7. Is attention being paid to “Good housekeeping”? | ✓ | | |
| If no, comment on what is not being done: | | | |
| 8. Are contractor’s vehicles being maintained at the campsite/yard? | ✓ | | |
| 9. Is the waste from vehicle maintenance being disposed of property? | ✓ | | |
| If no, comment on how it is being disposed: | | | |
| 10. Is the fuel storage area properly surfaced? | | ✓ | Partially |
| If no, comment on how the surrounding area is being affected: | | | Oil can lead to surface and Groundwater pollution |
| 11. Are occupational health and hygiene precautions being taken? | ✓ | | |
| If no, comment on where they are being negiected: | | | |
| 12. Does the community have any issues with the camp? | | ✓ | |
| If yes, what are the issues? | | | |
| 13. Is the detail First Aid is available? | ✓ | | Not in all sites |
| 14. All necessary firefighting equipment is on site and in good working order. | ✓ | | |
| 15. Telephone numbers of emergency services are available on site | ✓ | | |

## EROSION OF SLOPES

| Checklist Question | Yes | No | Remarks |
|---|---|---|---|
| 1. Is there any erosion/Landslides/Instability beside the road?<br>If yes than what is the reason | | ✓ | |
| (a) A combination of some of the reasons above | | | |
| (b) Improper drainage | | | |
| (c) Improper leveling after earth removal | | | |
| (d) Inadequate water channel diversion | | | |
| 2. Is remedial action required? | | ✓ | |
| If yes, comment: | | | |
| 3. Did the erosion/landslide/instability cause any damage? | | ✓ | |
| If yes, what was the nature of the damage? | | | |
| 4. Was the erosion brought to the notice of appropriate authorities by the communities? | ✓ | | |
| If no, was there any action taken? | | | |

## AIR POLLUTION

| Checklist Question | Yes | No | Remarks |
|---|---|---|---|
| 1. What is the nature of air pollution? | | | |
| (a) Dust from road/ rail | ✓ | | |
| (b) Generator emissions | ✓ | | |
| (c) Vehicular emissions | ✓ | | |
| 2. Is the problem significant enough to warrant attention? | | ✓ | |
| If yes, did the contractor take appropriate measure to mitigate the problem? | | | |
| 3. What is/are the measures taken? | | | |
| (a) Periodic water sprays on road surface /borrow pits | ✓ | | |
| (b) Vehicles regularly maintained | ✓ | | |
| (c) Equipment regularly maintained | ✓ | | |
| 4. Is air pollution creating problems for the surrounding communities? | | ✓ | |
| If yes, what type of problems? | | | |

## WATER POLLUTION

| Checklist Question | Yes | No | Remarks |
|---|---|---|---|
| 1. What is the nature of water contamination? | | | |
| 1.1 Surface water (stream, pond etc.) | | | |
| (a) Disposal of out spoil into water body or on slope leading to water body | | ✓ | |
| (b) Discharge of wastewater from camp into fresh water body | | ✓ | |
| 1.2. Groundwater | | | |
| (a) Oil spillage | | ✓ | |
| (b) Any other disposal over soil surface | | ✓ | |
| 2. Is the impact significant enough to warrant mitigatory measures? | | | |
| If yes, provide necessary details: | | | |
| 3. Is the impact long term? | | ✓ | |
| If yes, comment: | | | |
| 4. Can it be ratified by mitigatory measures? | | ✓ | |
| If yes, what type of mitigatory measures should be taken? | | | |
| Any additional comments: | | | |

## CULTURAL HERITAGE

| Checklist Question | Yes | No | Remarks |
|---|---|---|---|
| 1. Does the project area have any cultural heritage, archaeological, historical or religious sites? | | ✓ | |
| 2. If yes, are they affected in any way by the project activities? | | | |
| If yes, how? | | | |
| 3. Did the concerned authorities and the contractor take any appropriate measures to protect the site? | | ✓ | |
| If yes, what are the measures taken? | | | |
| 4. Are the communities satisfied with the measures taken? | ✓ | | |
| 5. Is the community satisfied with the measures taken by the contractor to protect land? | ✓ | | |
| If no, how and with what measures can it be improved? | | | |
| 6. Is the local administration satisfied with the measures taken by the contractor to protect land? | ✓ | | |
| If no, what is being suggested by the local administration? | | | |

## LAND CONTAMINATION (CAMP SITE)

| Checklist Question | Yes | No | Remarks |
|---|---|---|---|
| 1. What are the impacts of project activities on land? | | | |
| (a) Road/ rail run-off oil, grease and fuel contaminating land | | | |
| (b) fuel oil/used oil/grease spill on land in equipment yards/camps sites | ✓ | | |
| (c) indiscriminate discharge of waste on land | | | |
| (d) indiscriminate disposal of solid waste | | | |
| any other project activities resulting in land contamination | | | |
| 2. Is the impact significant enough to warrant mitigatory measures? | | ✓ | |
| If yes, provide necessary details: | | | |
| 3. Is the impact permanent? | | ✓ | |
| 4. If permanent, could it have been avoided by taking appropriate mitigatory measures? | | ✓ | |
| If yes, what type of mitigatory measures should have been taken? | | | |
| 5. Is the impact temporary? | ✓ | | |
| If yes, how could it be corrected? | | | Waste water, fuel oil, used oil, grease will be kept in drums which are properly surfaced. |
| 6. Is the community satisfied with the measures taken by the contractor to protect agricultural activities? | ✓ | | |
| If no, how and with what measures can it be improved? | | | |
| 7. Is the local administration satisfied with the measures taken by the contractor to protect agricultural activities? | ✓ | | |
| If no, what is being suggested by the local administration? | | | |
| 8. Did the community allow the use of their land for borrow pit or any other purpose? | | ✓ | |
| If yes, what was the motivation behind it? | | | |
| If no, did the contractor take permission from the land owner and local administration for the specific use? | | | |

## NOISE POLLUTION

| Checklist Question | Yes | No | Remarks |
|---|---|---|---|
| 1. What is the nature of noise pollution? | | | |
| (a) Vehicles on road/ railway | ✓ | | |
| (b) Generators, construction plant | | | |
| (c) Construction vehicles | | | |
| 2. Is the problem significant enough to warrant attention? | | ✓ | |
| If yes, did the contractor/consultant take appropriate measure to mitigate the problem? | | | |
| 3. What is / are the measures taken? | | | |
| (a) Vehicles regularly maintained and silencers checked | ✓ | | |
| (b) Speed limit enforced on project vehicles | ✓ | | |
| (c) Construction equipment maintained and silenced | ✓ | | |
| (d) Awareness raising of staff over causing nuisance to local communities | ✓ | | |
| 4. Is noise pollution creating problems (health, aesthetic and nuisance) for the surrounding communities? | | ✓ | |
| If yes, what type of problems? | | | |

## DRAINAGE AND FLOODING

| Checklist Question | Yes | No | Remarks |
|---|---|---|---|
| 1. Is the flooding extensive or not? | | ✓ | |
| If yes, give details: | | | |
| 2. Have contractors activities caused flooding or blocked drains? | ✓ | | |
| If yes, give details: | | | Heavy rainfall causes drainage congestion |
| 3. Have cross drainage structures been built in correct location as shown in contract? | ✓ | | Partially |
| If no, give details: | | | |
| 4. Are cross drainage structures “as built” same as in “detailed design”? | ✓ | | Partially |
| If no, give details: | | | |

## CONSTRUCTION CAMPS CLOSURE

| Checklist Question | Yes | No | Remarks |
|---|---|---|---|
| 1. Is the camp/yard located in a protected area, next to a community water source or any other ecologically or otherwise sensitive area? | | ✓ | |
| If yes, comment on the adverse impacts on the environment: | | | |
| 2. Has the camp/yard been properly cleared of all debris and re-vegetated? | ✓ | | |
| If no, list what was not done properly: | | | |
| 3. Was the wastewater disposed of properly? | ✓ | | |
| If no, comment on how it was being disposed and what were the impacts: | | | |
| 4. Are septic tanks installed? Have they been removed? | ✓ | | |
| If no, why not? | | | |
| 5. Was solid waste disposed of properly? | ✓ | | |
| If no, comment on how it was being disposed and the impacts of such disposal: | | | |
| 6. Was attention being paid to housekeeping? | ✓ | | |
| If no, comment on what was not being done: | | | |
| 7. Have all the contractor equipment being removed from the campsite /yard? | | ✓ | |
| 8. Has the scrap metal from vehicle maintenance being disposed of properly? | ✓ | | |
| If no, comment on how it is to be disposed: | | | |
| 9. Has all fuel storage been removed from the site? | ✓ | | |
| If no, comment on how the surrounding area is being affected: | | | |
| 10. Have all general offices and staff dwellings been removed? | ✓ | | |
| If no, comment on if they are to be handed over to new owner or other plans: | | | |
| 11. Does the community have any issues with the camp closure? | | ✓ | |

**FLORA AND FAUNA**

| Checklist Question | Yes | No | Remarks |
|---|---|---|---|
| 1. Is any flora or fauna will be disturbed? | | ✓ | |
| If yes, give details: | | | |
| 2. Have contractor's activities caused any damage to fish habitat? | | ✓ | |
| If yes, give details: | | | |
| 3. Does any Plant species need to be cut down for construction? | √ | | |
| If yes, give details: | | | Some local species needed to cut down |
| 4. Is re-vegetation going on | | ✓ | |
| If not, why | | | Re-vegetation will be started after the construction/ work |

## 15.8 Appendix-H. Toxicity Test Result of Bentonite Slurry from BUET, Dhaka

Ref: CTM JV/TL/ALDLP/BR/19/**3424** December 22, 2019

| P.M. | dP.M. | C.S. | G/E | |
|---|---|---|---|---|
| 23/12/19 | | | | E&V |

The Engineer
Attention: Mr. Md. Khairul Alam
Acting Team Leader
Construction Supervision of
Akhaura – Laksam Double Track Project
House # 9, Road # 14 (First floor)
Baridhara Diplomatic Zone
Dhaka-1212

Sub: Contract No. BR/PD/ALDLP/ADB-EIB/2015/WD1 dated 15.06.2016
Construction of Dual Gauge Double Rail Line and Conversion of Existing Rail Line into Dual Gauge between Akhaura and Laksam
- **Environmental Safeguards: Submission of Bentonite Slurry Test Report**

Ref: 21st Monthly Progress Meeting of 12 December 2019

Dear Sir,

Commensurate with the contract provision and decision of the captioned meeting, attached please find submitted herewith the test report of Bentonite slurry samples of ALDLP.

Test results indicate that there is, inter alia, no harmful chemical component in the supplied bentonite sample, bioaccumulation in aquatic organisms from bentonite slurry is insignificant, bentonite slurries used in construction works may be reconditioned and reused wherever practicable, inhaled bentonite is likely to be less dangerous to humans.

We trust you will find this satisfactory.

Thanking you for your cooperation and assuring you of our best intentions at all times.

Yours faithfully
For **CTM JOINT VENTURE**

GHULAM MOHAMMED
Authorized Representative

DOHWA-KRNA-OCG-BARSA-TK
CONSTRUCTION SUPERVISION
AKHAURA-LAKSAM
IN
22-12-19

**Enclosed:** Bentonite Slurry Test Report from BRTC BUET dated 17 December 2019: 15 pages

**Copy to:** Mr. Md. Arifuzzaman, Project Director, Akhaura – Laksam Dual Gauge Double Line Project, Bangladesh Railway, Rail Bhaban, Dhaka – 1000, Bangladesh.

| | | |
|---|---|---|
| Client | : Mr. Mun Nun Yong<br>Resident Quality Control Engineer (RE/QC)<br>Construction Supervision of Akhaura-Laksam<br>Double Track Project Bangladesh Railway<br>CTM JV<br>Baitul Hossain Building, 6th Floor<br>27, Dilkusha C/A, Dhaka 1000 | 17 December 2019<br>MME 0211/2019-20<br>8vexs2u3tr |
| Client's Reference | : CTM-JV/ALDLP/LAB-1022; Date 04/09/2019 | |
| BRTC Reference | : 1101-95226/MME/2019-20; Date 07/09/2019 | |
| Subject | : Test of Bentonite Slurry | |
| Sample Condition | : Sealed | |

***Please note:*** *The client supplied the sample and the result given herewith corresponds to the sample tested only. The Department of Materials and Metallurgical Engineering of BUET takes no responsibility regarding the misidentification, if any, of the sample.*

# TEST REPORT

The test report is attached herewith.

Fahmida 17.12.19
Dr. Fahmida Gulshan
Professor and Head





Department of MME, Old Academic Building, 1st Floor, BUET, Dhaka 1000
+880 1741 362 504 +880 2 5516 7228-57 Ext 7629 brtcmme@mme.buet.ac.bd

REPORT ON

# CHEMICAL AND ENVIRONMENTAL IMPACT ANALYSIS OF BENTONITE SLURRY

DECEMBER, 2019

Prepared by

Department of Materials and Metallurgical Engineering
Bangladesh University of Engineering and Technology (BUET), Dhaka-1000.

Fahmida

| | |
|---|---|
| Name of the Client: | Mun Nun Yong<br>Resident Quality Control Engineer (RE/QC)<br>Construction Supervision of Akhaura-Laksam Double Track Project of Bangladesh Railway<br>Dhaka Office: House No. 9, Road 14, Baridhara Diplomatic Zone<br>Dhaka-1212. |
| Client's Reference | CTM-JV/ALDLP/LAB-1022; date:04/09/2019 |
| Our Reference: | BRTC No. 1101-95226/MME/2019-20 date: 07/09/2019 |



Fahmida

CONTENTS





Fahmida

## 1. PREAMBLE

CTM JOINT VENTURE requested (Appendix A) the Materials and Metallurgical Engineering (MME) Department, BUET through Bureau of Research, Testing and Consultation (BRTC) to provide an environmental impact report based on chemical analysis of the supplied Bentonite Clay by CTM JV . On September 11, 2019 two faculty members from the MME Department, BUET are selected to collect the relevant data and to perform the detailed analysis of the issue. The overall recommendation of the report is based on the chemical and structural analysis of the supplied Bentonite sample and on the existing scholarly literature regrading Bentonite.

## 2. INTRODUCTION

Among the world's most useful industrial minerals, clay are of great significance. They are widely utilized for agriculture (soils), ceramics, and building materials. With rapid advances in processing and modification of clay minerals, the wide variety of applications of clay include oil refining and absorbents, iron-ore pelletizing, animal feeds, pharmaceuticals, drilling fluids, waste water treatment, fillers in paint and plastic, and coating paper. Clays and clay minerals occur under a fairly limited range of geologic conditions. The cycle of formation of clay and clay-based mineral varies effectively of the environment. Clay and clay-based minerals can be formed by the alteration of pre-existing mineral by weathering: for example, weathering boulders on a hillside, sediments on sea or lake bottoms, deeply buried sediments containing pore water, and rocks in contact with water heated by magma (molten rock) are to form relatively pure clay deposits that are of economic interest known as bentonites and primarily montmorillonite.

Bentonite is usually formed of highly colloidal and plastic clays composed mainly of montmorillonite, a clay mineral of the smectite group, and is produced by in situ devitrification of volcanic ash. In addition to montmorillonite, bentonite may contain crystalline quartz along with some feldspar, and cristobalite. The special properties of bentonite are an ability to form thixotrophic gels with water, an ability to absorb large quantities of water, and a high cation



Fahmida

exchange capacity. The properties of bentonite are derived from the crystal structure of the smectite group, which is an octahedral alumina sheet between two tetrahedral silica sheets. Variations in interstitial water and exchangeable cations in the interlayer space affect the properties of bentonite and thus the commercial uses of the different types of bentonite. By extension, the term bentonite is applied commercially to any clay with similar properties. Fuller's earth is often a bentonite.

# 3 LITERATURE SURVEY

## 3.1 Physical properties of Bentonite

Bentonite feels greasy and soap-like to the touch. Freshly exposed bentonite is white to pale green or blue and, with exposure, darkens in time to yellow, red, or brown. The special properties of bentonite are an ability to absorb large quantities of water with an accompanying increase in volume of as much as 12– 15 times its dry bulk, and a high cation exchange capacity.

Substitutions of silicon by cations produce an excess of negative charges in the lattice, which is balanced by cations ($Na^+$, $K^+$, $Mg^{2+}$, $Ca^{2+}$) in the interlayer space. These cations are exchangeable due to their loose binding and, together with broken bonds (approximately 20% of exchange capacity), give montmorillonite a rather high (about 100 meq/100 g) cation exchange capacity, which is little affected by particle size. Variation in exchangeable cations affects the maximum amount of water uptake and swelling. These are greatest with sodium and least with magnesium.

Interstitial water held in the clay mineral lattice is an additional major factor controlling the plastic, bonding, compaction, suspension, and other properties of Bentonite. Within each crystal, the water layer appears to be an integral number of molecules in thickness. Loss of absorbed water from between the silicate sheets takes place at relatively low temperatures (100–200 °C). Loss of structural water (i.e. the hydroxyls) begins at 450–500 °C and is completed at 600–750 °C. Further heating to 800–900 °C disintegrates the crystal lattice and produces a variety of phases, such as mullite, cristobalite, and cordierite, depending on initial composition and structure. The ability of Bentonite to rapidly take up water and expand is lost after heating to a critical temperature, which



Faluuida

ranges from 105 to 390 °C, depending on the composition of the exchangeable cations. The ability to take up water affects the utilization and commercial value of bentonite.

Bentonite occur as minute particles, which, under electron microscopy, appear as aggregates of irregular or hexagonal flakes or, less commonly, of thin laths. Differences in substitution affect and in some cases control morphology.

### 3.2 Uses of Bentonite

Bentonite has many applications to a broad range of industrial and other activities. Major uses, which include binding foundry sand (i.e. in molds for castings), absorbing grease, oil, and animal wastes, pelletizing taconite iron ore, and improving the properties of many drilling muds. Specialty uses of bentonite include serving as an ingredient for ceramics; waterproofing and sealing in civil engineering projects (e.g., blocking seepage loss from landfill sites, nuclear waste repositories, irrigation ditches, treatment ponds, and the like); serving as a filler, stabilizer, or extender in adhesives, paints, cosmetics, medicines, and other products, as a carrier in pesticides and fertilizers, and as a bonding agent in animal feeds; clarifying wine and vegetable oil; and purifying wastewater. Small amounts of bentonite are also used as a catalyst in the refining of petroleum.

### 3.3 Effects on humans

General population exposure to low concentrations of Bentonite is ubiquitous. There is no information on the possible effects of such low-level exposure. Long-term exposure to moderate or high concentrations of Bentonite dust may affect nose and respiratory tract and chest health. No toxicological effects are expected if respirable dust concentrations are maintained below the occupational exposure standards. Repeated contact with skin may cause dry skin and irritations. Repeated eye contact may generate irritations. No toxicological effects are expected if personal protective equipment is worn. No adverse effects are expected when ingested.

Acute Health Hazards: Eye contact may cause mechanical irritations if exposed to excessive amount of Bentonite. Skin contact may aggravate existing dermatitis. Inhalation from prolonged and continuous exposure may aggravate existing asthmatic or respiratory conditions.

Chronic Health Hazards: Prolonged inhalation of excessive levels of Bentonite dust may cause a simple pneumoconiosis condition, not normally associated with a decrement in lung function. In



Fahmida

cases of long-term exposure to externally high levels of dust, complicated pneumoconiosis with lung function impairment may occur.

Other health adversity to bentonite related exposer are given below.

1. Carcinogenicity: none known
2. Mutagenicity: none known
3. Iatrogenicity: none known
4. Reproductive effect: none known

### 3.4 Ecological Information

Environmental Statement: It was reported that Bentonitè has a low impact on environment. Bentonite is persistent and non-biodegradable but it is unlikely to have any long-term adverse effect on the environment.

Mobility: Solid, non-volatile, insoluble in water.

Degradability: Non-biodegradable. Persistent.

Accumulation: No bioaccumulation or bio-magnification identified.

Ecotoxicity: Non-toxic to aquatic living organisms and animals.
Non-toxic to aquatic plants
Non-toxic to soil organism.
Non-toxic to aerobic and anaerobic plants
Non-toxic to aerobic and anaerobic living organisms and animals.

### 3.5 Disposal Considerations

Bentonite and waste from residue can be disposed as non-toxic and inactive materials in approved landfill sites in accordance with local regulations. Contaminated packaging can be disposed in approved landfill sites in accordance with local regulations.

### 3.6 Transport Information

Bentonite is not classified as dangerous for transportation. Bentonite may be transported in accordance with the standard local authority regulations.



Fahmida

### 3.7 Bentonite Slurry and Its Uses

This is a mixture of bentonite and water. Bentonite has a very high liquid limit. This means that even if a lot of water is added to it, the mixture does not lose its stability or consistency. Bentonite slurry has a very important property which makes it very useful in construction: when a slurry of this type is mixed without there being any variation in water it loses strength, behaving like a fluid. However, it regains this strength when it is left to stand. The main use of bentonite slurry is connected with excavation. When digging a trench (drilling into ground of low consistency with a risk of collapse, normally to build walls or piles), bentonite slurry stops the sides of the trench caving in. While the trench is being dug, it is filled up with slurry: as it is constantly moving, it has little consistency and behaves like a fluid. However, when stirring stops, the viscosity of bentonite slurry increases and it gains the necessary strength to stop the walls of the excavation falling in under pressure. In excavation work it also often serves to remove detritus from the ground. This is done by constantly recirculating the bentonite slurry.

## 4 ANALYSIS OF THE SUPPLIED BENTONITE

The chemical composition of the supplied Bentonite sample was determined by volumetric wet chemical analysis and with Atomic absorption flame spectrometer (AAFS). The chemical composition of the supplied Bentonite sample was also quantified with X-ray Fluorescence spectroscopy (LAB CENTER, SHIMADZU). The phase identification of the samples was carried out using X-Ray Diffraction (Rigaku, Ultima). The Toxicity Characteristic Leaching Procedure (TCLP) of the bentonite was conducted to analysis the presence of toxic elements in the leachates. Deionized water was used as medium and the leaching test was run for 1 hour with a solid to liquid ratio (L/S) of 40 mL/g. After 1 hour under magnetic stirring at 80°C the leachate was filtered and the residue was dried and transferred in a100 mL calibrated flask and diluted with deionized water. The sample was then ready for analysis of anions and cations. Inductive coupled plasma mass spectrometer (ICP-MS) was used to analyze the leachates.

## 5 RESULTS

The chemical analysis through volumetric wet method of the supplied Bentonite clay was performed and the results are shown in Table 1. The chemical analysis was carried out on the three batches of Bentonite to check their composition. The alkali content was dermined by atomic



Fahmida

absorption flame spectrometer (AAFS). According to chemical composition result, the most abundant oxides in the bentonite sample are $SiO_2$ and $Al_2O_3$. The total $SiO_2$ present in the clay is around 61.5%. $Fe_2O_3$ is the third most significant component of Bentonite sample. The next most abundant cmponent is the $K_2O$ which is around 4.2%. According to the chemical analysis the supplied bentonite can be categorized as Potassium Bentonite or K-Bentonite.

Table: 1 Composition of Bentonite clay

| Percentage of compound | Normal clay |
|---|---|
| $SiO_2$ | 61.5 ± 2.6 |
| $Al_2O_3$ | 13.6 ± 1.5 |
| $Fe_2O_3$ | 7.5 ± 0.9 |
| CaO | 1.9 ±0.3 |
| MgO | 0.5 ± 0.2 |
| MnO | 0.1 ± 0.1 |
| $P_2O_5$ | 0.2 ± 0.1 |
| $Na_2O$ | 2.4 ± 0.3 |
| $K_2O$ | 4.2 ± 0.5 |
| Loss on Ignition (LOI) | 8.1± 1.0 |
| Free $SiO_2$ | 6.5 ± 1.5 |

An x-ray fluorescence spectroscopy (XRF) was also used to verify the chemical composition of the supplied Bentonite clay. The results of the XRF test on Bentonite clay are shown in Table 2. The results are in accordance with wet chemical analysis findings. From these findings, it is confirmed that the supplied Bentonite does not contain any harmful toxic metal oxides.



Fahmida

Supplied Bentonite contains less than 10% crystalline silica according to chemical analysis, with a typical value around 6.5%. The International Agency for Research on Cancer (IARC) has classified crystalline silica as a possible carcinogen. However, there is limited evidence for human carcinogenicity of crystalline silica. The most importantly, the possibility of silica exposer to human from the Bentonite slurry is very minimal. It is also assured that the supplied Bentonite does not contain dioxin and can be used in animal feed.

Table 2 Composition of ash from XRF LAB CENTER XRF-1800 (SHIMADZU)

| Parameter | Amount present in % |
|---|---|
| $SiO_2$ | 61.74 |
| $Al_2O_3$ | 10.16 |
| $Fe_2O_3$ | 8.26 |
| $K_2O$ | 4.41 |
| CaO | 1.66 |
| MgO | 1.42 |
| $Na_2O$ | 0.90 |
| $TiO_2$ | 1.33 |
| BaO | 0.07 |
| $P_2O_5$ | 0.20 |
| $SO_3$ | 0.71 |
| MnO | 0.08 |
| $ZrO_2$ | 0.05 |
| $Cr_2O_3$ | 0.04 |
| ZnO | 0.04 |

Next, the concentrations of metal elements in the leachates of the supplied Bentonite were listed in Table 3. The results showed that the leachates contain very less amount of toxic heavy metals which is less than detection limit of the ICP-MS.



Fahmida

Table 3 The metal elements leached by the deionized water of ash and clay in comparison with maximum contaminant levels (MCL).

| Name of metals | Determined value of ions |
|---|---|
| | ppm |
| Cd | <0.0001 |
| Cr | <0.0001 |
| Fe | 0.031 |
| Pb | <0.0001 |

The analysis of the XRD results gives a profound idea about the compounds that are possible to be present in the supplied bentonite sample. Figure 1 shows the mineral phases present in Bentonite through XRD. The presence of montmorillonite structure along with quartz ($SiO_2$) has been detected from the analysis of the peaks generated from the XRD.

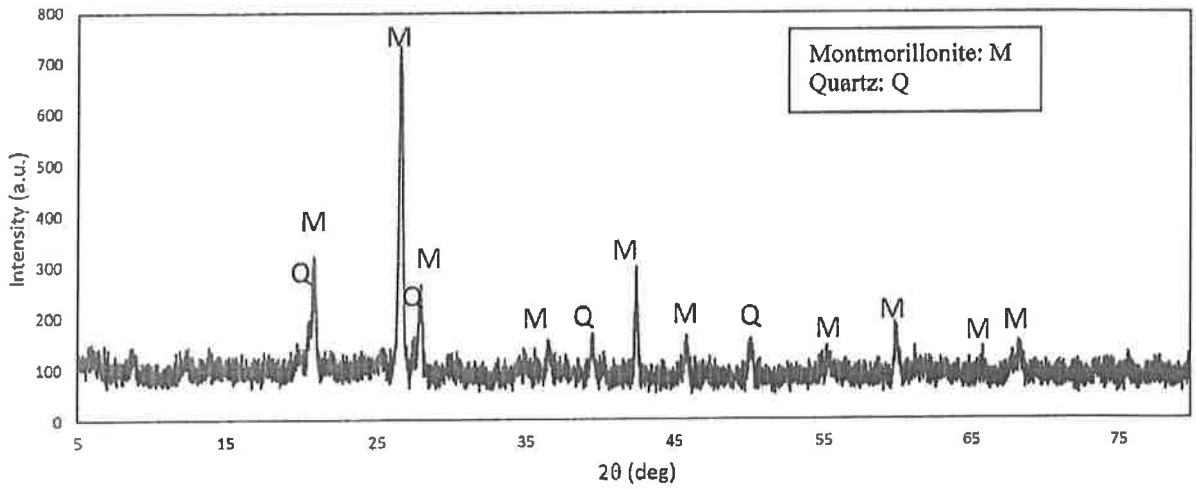



**FIGURE 1.** XRD pattern of the supplied Bentonite.



Fahmida

## 6. CONCLUSIONS AND RECOMMENDATIONS

This study with chemical analysis and phase identification has revealed that there is no harmful chemical component in the supplied Bentonite sample which can be released into the environment during exploitation and processing. Heavy metals analyses done on the slurries were found to be very low in concentrations and thus bioaccumulation in aquatic organisms from bentonite slurry is insignificant.

As the slurry picks up particles of materials in different sizes from the ground, some of its features need to be monitored while it is in use, such as density, viscosity and sand content. Bentonite slurries used in construction works may be reconditioned and reused wherever practicable. Residual used bentonite slurry should be disposed of from the site as soon as possible. Residual used dewatered bentonite slurry can be disposed to a public filling area and liquid bentonite slurry if mixed with inert fill material should be disposed to a public filling area or selected dumping ground.

Based on its surface chemistry, lack of fibrogenicity in experimental systems, and limited human findings, inhaled bentonite is likely to be less dangerous to humans than kaolin. However, during Bentonite slurry preparation some guideline should be maintained.

- set limits for occupational exposure to clay materials, taking into consideration the quartz content;
- enforce and ascertain compliance with the limits by regular exposure monitoring;
- prepare guidelines to ensure good workplace practice;
- disseminate information on the hazards to exposed workers in an appropriate form;

## 8. REFERENCES


1. Pusch, R. (2015). Bentonite clay: environmental properties and applications. CRC Press.
2. Proia, R., Croce, P., & Modoni, G. (2016). Experimental investigation of compacted sand-bentonite mixtures. Procedia Engineering, 158, 51-56.
3. Pusch, R., Ramqvist, G., & Knutsson, S. (2016). Modern method for sealing deep boreholes. Engineering geology, 202, 132-142.




Fahmida

4. McCarty, D. K., Sakharov, B. A., & Drits, V. A. (2009). New insights into smectite illitization: A zoned K-bentonite revisited. American Mineralogist, 94(11-12), 1653-1671.
5. Sun, W. J., Wei, Z. F., Sun, D. A., Liu, S. Q., Fatahi, B., & Wang, X. Q. (2015). Evaluation of the swelling characteristics of bentonite–sand mixtures. Engineering geology, 199, 1-11.
6. Morandini, T. L. C., & Leite, A. L. (2012). Characterization, Hydraulic Conductivity and Compatibility of Mixtures of Tropical Soil and Bentonite for Barrier Usage Purpose. Soils and Rocks, 35(3), 267-278.



Fahmida

# APPENDIX A

Construction of Dual Gauge Double Rail Line and Conversion of existing Rail Line into Dual gauge between Akhaura and Laksam under SASEC Railway Connectivity: Akhaura - Laksam Double Track project of Bangladesh Railway.

Ref: CTM-JV/ALDLP/LAB-1022

1101952226 /NME/2019-20

September 04, 2019

To,
The Director
Bureau of Research, Testing and Consultation (BRTC),
Bangladesh University of Engineering & Technology (BUET).

07 SEP 2019

**Subject: Application for Bentonite Slurry Test.**

Dear Sir,

We are sending herewith the sample of Bentonite Slurry for the Toxicity and Chemical Test.

To perform the above quality tests all fees and charges as per BRTC, BUET rules and regulations shall be paid by CTM – JV.

It is requested to perform the above tests at your earliest convenience.

Thanking you

Best regards

4/9/2019

Mun Nun Yong
Resident Quality Control Engineer (RE/QC)
Construction Supervision of Akhaura-Laksam
Double Track Project Bangladesh Railway.
Dhaka Office: House No. 9 Road 14, Baridhara
Diplomatic Zone, Dhaka-1212, Bangladesh

**Witness: On the Behalf of ALDLP of Bangladesh Railway**

1. Engr. Md. Ibrahim Khalil (Cell:01711-723677)
Senior Quality Control Engineer (CSC)
Construction Supervision of Akhaura-Laksam
Double Track Project Bangladesh Railway.

2. Engr. Md. Abdul Monayem (Cell: 01715-538599)
Senior inspection & testing Specialist (CSC)
Construction Supervision of Akhaura-Laksam
Double Track Project Bangladesh Railway.

3. Engr. Ashis Kumar Bala (Cell: 01719-481190)
QA/QC Manager (Contractor)
CTM-JV.
Akhaura-Laksam Double Track Project.

CTM JOINT VENTURE



Fahmida