

Initial Environmental Examination

Document Stage: Draft
Project Number: 42265-025
August 2017

IND: Assam Urban Infrastructure Investment Program — Tranche 2

**Package Number: AUIIP/PR-2/GUW/WS/03
(Design, Build and Operate of Intake Works, Raw Water Rising Mains, Water Treatment Plant, Clear Water Pumping Station and Allied Works at South East Guwahati)**

Prepared by Guwahati Development Department & Urban Development Department, Government of Assam for the Asian Development Bank.

This draft initial environmental examination report is a document of the borrower. The views expressed herein do not necessarily represent those of ADB's Board of Directors, Management, or staff, and may be preliminary in nature.

In preparing any country program or strategy, financing any project, or by making any designation of or reference to a particular territory or geographic area in this document, the Asian Development Bank does not intend to make any judgments as to the legal or other status of any territory or area.

CURRENCY EQUIVALENTS

(as of 28 August 2017)

Currency unit – Indian rupee (₹)

₹1.00 = \$0.01566

\$1.00 = ₹64. 8615

ABBREVIATIONS

ADB	-	Asian Development Bank
APHED	-	Assam Public Health Engineering Department
AUWSSB	-	Assam Urban Water Supply and Sewerage Board
BRT	-	bus rapid transit
CFE	-	Consent for Establishment
CFO	-	Consent for Operation
CPCB	-	Central Pollution Control Board
DMSC	-	Design, management and supervision consultants
EARF	-	environmental assessment and review framework
EIA	-	environmental impact assessment
EMP	-	environmental management plan
GDD	-	Guwahati Development Department
GRC	-	Grievance Redress Committee
GRM	-	grievance redress mechanism
IEE	-	initial environmental examination
MFF	-	multitranches financing facility
PIU	-	project implementation unit
PHED	-	Public Health Engineering Department
PMU	-	Project Management Unit
SCMU	-	Safeguards Compliance and Monitoring Unit
SPS	-	Safeguard Policy Statement
UDD	-	Urban Development Department
ULB	-	Urban Local Body

WEIGHTS AND MEASURES

cm	-	centimeter
dbA	-	decibels
dia.	-	diameter
ha	-	hectare
kg	-	kilogram
km	-	kilometer
l	-	liter
m	-	meter
m ²	-	square meter
m ³	-	cubic meter
mg/l	-	milligrams per liter
ml	-	milliliter
MLD	-	million liters per day
mm	-	millimeter
sq. km.	-	square kilometers

sq. m. – square meters
 $\mu\text{g}/\text{m}^3$ – micrograms per cubic
 meter

NOTE

In this report, "\$" refers to US dollars.

CONTENTS

	Page
EXECUTIVE SUMMARY	
I. INTRODUCTION	1
A. Overview	1
B. Environmental Compliance Requirements	1
II. DESCRIPTION OF SUB PROJECT	5
A. Need for water supply project for Guwahati	5
B. Description of Subproject	7
III. DESCRIPTION OF ENVIRONMENT	17
A. Physical Features	17
B. Ecological features	25
C. Economic Development Features	28
D. Social and Cultural Features	32
IV. ANTICIPATED IMPACTS AND MITIGATION MEASURES	34
A. Pre-construction: Location and Design	35
B. Construction Impacts	37
C. Operation and Maintenance (O&M) Impacts	46
D. Cumulative Impact Assessment	50
V. INSTITUTIONAL ARRANGEMENTS AND RESPONSIBILITY	51
A. Implementation Arrangements	51
B. Monitoring and Reporting	53
C. Institutional Capacity	54
VI. CONSULTATION, INFORMATION DISCLOSURE, AND GRIEVANCE REDRESS MECHANISM	57
A. Public Consultations Conducted	57
B. Future Consultation and Disclosure	58
C. Grievance Redress Mechanism	58
VII. ENVIRONMENTAL MANAGEMENT PLAN	61
A. Environmental Mitigation Plan	61
B. Environmental Monitoring Program	61
C. Environmental Management Plan Costs	92
VIII. FINDINGS AND RECOMMENDATIONS	94
IX. CONCLUSIONS	95
APPENDIXES	
Appendix 1: Consent to Establish - Water Treatment Plant	96
Appendix 2: Central Pollution Control Board (CPCB) Applicable Environmental Standards	103
Appendix 3: Activities to be performed by DBO contractor - timeline, for the updating of IEE and implementation of EMP	109
Appendix 4: Photo Illustration	110
Appendix 5: Rapid Environmental Assessment (REA) Checklist	111
Appendix 6: Design Considerations as per CPHEEO Manual on Water Supply and	

Treatment	115
Appendix 7: Semi-Annual Environmental Monitoring Report Format	117
Appendix 8: Records of Public Consultation	123
Appendix 9: Sample Grievance Registration Form	131

EXECUTIVE SUMMARY

1. The Assam Urban Infrastructure Investment Program (Program) is a key urban infrastructure initiative of the State Government of Assam, and aims to improve the urban environment and quality of life in the cities of Guwahati and Dibrugarh through the delivery of improved water supply, sanitation, solid waste management (SWM), drainage infrastructure, and a sustainable urban transport system such as a bus rapid transit (BRT) corridor. The Program uses a multitranche financing facility (MFF) modality and is being implemented over a 6-year period from 2012 to 2017. Investments under the MFF will be delivered in two tranches. For Guwahati these included water supply, sewerage, and transportation while for Dibrugarh included drainage and solid waste management.

2. The major outputs of the Program include: (i) for Guwahati, improved water supply, sanitation, and urban transport through a BRT corridor; and ii) for Dibrugarh, improved drainage, and comprehensive Solid Waste Management (SWM).

3. The Government of Assam's Guwahati Development Department (GDD) is the executing agency. A state-level PMU, headed by a Project Director (PD), established as the Implementing Agency which will be in-charge of overall execution and technical supervision, monitoring, and financial control of all activities under the project. Project Implementation Units (PIUs) dedicated exclusively to the project would be set up in Guwahati and Dibrugarh. The PIUs will be headed by a senior technical officer and assisted by qualified and experienced officers seconded from ULBs, finance and other line departments. The PIUs will be responsible for the day-to-day activities of project implementation in the field and will be under the direct administrative control of the PMU.

4. The PMU will have Safeguards Compliance and Monitoring Unit (PMU SCMU) to ensure mitigation of negative environmental and social impacts due to the subproject, if any. The PMU SCMU will have a Safeguards Officer (PMU SO). The PMU will be assisted by the Design, Management and Supervision Consultant (DMSC). As per DBO contract, contractor will be responsible for the revision or updating of initial environmental examination (IEE). An Environment Specialist as part of the DMSC team will advise the contractor for revision or updating of IEE after finalization of the design. Environmental management plan (EMP) will be implemented by contractor with assistance from DMSC and PIU. ADB will review and approve all final IEEs prior to contract award.

5. ADB requires the consideration of environmental issues in all aspects of its operations, and the requirements for environmental assessment are described in ADB's Safeguard Policy Statement (SPS), 2009. According to the SPS, environmental assessment is required for all subprojects under an MFF modality.

6. The overall investments for the proposed subproject in Guwahati will be aimed at providing improved quality and regular 24 hours a day water supply to about 5,10,000 residents in the south-eastern zone of Guwahati by 2030¹. This will involve 1) Expanding water production capacity through water intake works, 98 million liters per day (MLD) water treatment

¹ The Guwahati water supply sub project ensures piped water supply 24 hours a day for nearly 5,10,000 people (by 2030) who presently depend on bore wells and water tankers which would adversely impact the ground water table in the long run and cause negative impacts on the micro-climate of the city. The assured piped water supply to individual houses when the project is completed will reduce wastage of water and transportation of water by tankers and indirectly help climate change in a positive way.

plant, clear water pumping and primary transmission mains, new distribution systems, six service reservoirs, and machinery; and installing bulk and consumer meters.² Installation of 100% new distribution pipes; limiting NRW to 15% as per the Ministry of Urban Development's benchmark of 15% and the move from flat to volumetric rate tariffs will result in effective demand management and water conservation. The infrastructure improvements will be supported by awareness campaigns to promote water conservation, sustainability and cost recovery objectives.

7. Initially under Tranche 1 one of the physical works planned was (i) construction of intake works including intake well, raw water pumping stations, raw water mains and other associated works; and (ii) construction of 98 MLD water treatment plant (WTP), pure water pumping station and associated works. Later it was decided by ADB that the construction of distribution networks to provide water supply to the uncovered areas package for the South Guwahati East Zone would also be included in the same package. It is planned that entire package work will be on DBO contract basis. It was decided later that funding for Intake, WTP, Rising Mains and Pumping stations would be done from Tranche 2 fund allocation not from Tranche 1 and accordingly separate IEE is prepared for "Design, Build and Operate of Intake works, Raw Water Rising Mains, Water Treatment Plant, Clear Water Pumping Station and Allied Works at South East Guwahati".

8. This IEE is prepared for Guwahati Water Supply Subproject "Design, Build and Operate of Intake works, Raw Water Rising Mains, Water Treatment Plant, Clear Water Pumping Station and Allied Works at South East Guwahati". Construction work will be started and to be completed in 36 months. This IEE is presently based on outline design and specification. As per DBO contract, concerned contractor will update this IEE and EMP after the finalization of detailed design. The final detailed implementation schedule will be provided in the updated IEE once the detailed design phase is completed.

9. No subproject components are located within a declared forest and survey indicates that there is no requirement of tree felling under the subproject. However, if, any tree cutting during project execution is required, tree-cutting permit will be obtained from the Assam Environment and Forest Department. As per DBO contract, contractor will be responsible for obtaining all permits like tree cutting permission (if any) after detail design.

10. The process described in this document has assessed the environmental impacts of the said Guwahati Water Supply Project. Potential negative impacts were identified for the construction and operation phases of the improved infrastructure. Location and design impacts are mitigated through proper selection of intake location within Brahmaputra River. Intake structure is selected at comparatively high water depth area (selected after bathymetric survey) and mitigation measures will be applied as per requirement to minimize the impact on ecosystem. Considering the vastness of river Brahmaputra, its flow and the quantity of withdrawal of water from the River (including that of the proposed Intake structure), the impact of construction and operation of the intake structures to the ecosystem is insignificant or unlikely. Mitigation measures have been developed to reduce all negative impacts (if any) to acceptable levels. These were discussed with specialists responsible for the engineering aspects, and as a result, some measures have already been included in the designs of the infrastructure.

² The installation of meters in the project area will facilitate the move from the current flat rate to volumetric tariffs for water supply.

11. Locations and siting of the proposed infrastructures were considered to further reduce impacts. These include, (i) selection of intake location for water intake with consideration of sustainability of abstracting water & quality and upstream water users, (ii) locating all facilities (like intake pump house, WTP) on government-owned land to avoid the need for land acquisition³ (iii) laying of pipe in ROWs alongside main/access roads, to reduce acquisition of land and impacts on livelihoods specifically in densely populated areas of the city.

12. Under design consideration, a course screen of size 12mm X 12mm (ss flat strip with bar spacing of 80mm c/c) shall be provided at each gate to prevent entering of fishes, invertebrates and large aspects into the well. Considering the vastness of River Brahmaputra this is highly unlikely to alteration of natural flow rates due to intake of water. The Brahmaputra River is a 2,900 km long river with an average discharge of about 3,300 to 17,600 cubic meters per second. It is a voluminous river and it has a maximum depth of about 120 m. Riparian vegetation are present adjacent to the mighty Brahmaputra. The riparian vegetation acts as a habitat for the aquatic flora and fauna of the river. Disturbance in the riparian vegetation can alter the ecosystem as a whole. This project deals with pumping of surface water, so the ground water table will not be affected. Water pumping will also not affect the growth of the riparian vegetation. The destruction of the riparian vegetation will be minimum because there will be one approach bridge and only one number of pipe to be installed. Besides, utmost care will be taken during installation. The noise generated during installation will be below the legally notified limit by the Government. The chances of ground compaction by support vehicles is not applicable as the vehicles will be parked far away from the vegetation and the materials will be moved manually without using heavy machinery. Banks of intake site is rocky; therefore, there is no requirement of bank protection. Introduction of alien invasive species is very unlikely as the materials are brought from same geographic zone. Due to this project, the environmental impacts may be observed during construction and operational phases. However the project may not pose any serious environmental threat during operational period.

13. Regardless of these actions, there will still be impacts on the environment when the infrastructure is built and when it is operating. This is mainly because of (i) the invasive nature of trenching and excavation; and (ii) pipeline passing along roads of the city. (ii) construction and operation of intake & WTP.

14. During the construction phase, impacts mainly arise from (i) dredging activities can cause turbidity and sedimentation in nearby waters, degraded water quality and noise, (ii) need to dispose/utilize significant quantities of waste soil (including river sediment) and import a similar amount of sand to support the pipes in the trenches; and (iii) from disturbance of residents, businesses, traffic and important buildings by the construction work. These are common impacts of construction in urban areas, and there are well developed methods for their mitigation. Measures such as conducting work in lean season and minimizing inconvenience by best construction methods will be employed.

15. The subproject will: (i) employ in the workforce to the extent possible, people who live in the vicinity of construction sites to provide them with a short-term economic gain; and (ii) ensure that people employed in the longer term to maintain and operate the new facilities are residents of nearby communities.

16. Once the system is operating, most facilities will operate with routine maintenance,

³ A resettlement plan has been prepared in accordance with Government of India laws and ADB SPS 2009 for lands to be acquired from private owners and temporary relocations during construction

which should not affect the environment. Disposal of sludge from WTP, leaks in the pipelines will need to be repaired from time to time, but environmental impacts will be much less than those of the construction period as the work will be infrequent, affecting small areas only. Under design consideration, a course screen of size 12mm X 12mm (ss flat strip with bar spacing of 80mm c/c) shall be provided at each gate of intake to prevent entering of fishes, invertebrates and large aspects into the well. The findings will be assessed again during detailed design stage.

17. The EMP will form part of the civil work bidding and contract documents. The contractor will be required to (i) update the IEE during detailed design stage; (ii) establish an operational system for managing environmental impacts (iii) carry out all of the monitoring and mitigation measures set forth in the EMP; (iv) implement any corrective or preventative actions set out in safeguards monitoring reports that the PMU/PIU will prepare from time to time to monitor implementation of this IEE and EMP; and (v) allocate a budget for compliance with these EMP measures, requirements and actions.

18. Mitigation will be assured by a program of environmental monitoring to be conducted during construction stages. The environmental monitoring program will ensure that all measures are implemented, and will determine whether the environment is protected as intended. It will include observations on- and off-site, document checks, and interviews with workers and beneficiaries. Any requirements for corrective action will be reported to the ADB.

19. Contractor will do consultation during updating of IEE. Stakeholders are fully engaged in the subproject and have the opportunity to participate in its development and implementation, which is ensured. The stakeholders were involved in developing the IEE through discussions on-site and public consultation after which views expressed were incorporated into the IEE and in the planning and development of the subproject. The IEE will be made available at public locations in the city and will be disclosed to a wider audience via the ADB website. The consultation process will be continued and expanded during project implementation to ensure that stakeholders are fully engaged in the project and have the opportunity to participate in its development and implementation.

20. The most noticeable long-term benefits due to the subproject are: (i) increased access to treated water supply; (ii) reduction in time and cost of collecting water; and (iii) reduction in vulnerability to water borne diseases.

21. From the preliminary design and results of the IEE, the proposed Guwahati Water Supply subproject is unlikely to cause significant adverse impacts. The potential adverse impacts that are associated with design, construction, and operation can be mitigated to standard levels without difficulty through proper engineering design and the incorporation or application of recommended mitigation measures and procedures.

22. Based on the findings of the IEE, the classification of the Project as Category "B" is confirmed, and no further special study or detailed environmental impact assessment (EIA) needs to be undertaken to comply with ADB SPS (2009).

I. INTRODUCTION

A. Overview

1. The Assam Urban Infrastructure Investment Program (AUIIP) is a key urban infrastructure initiative of the State Government of Assam, and aims to improve the urban environment and quality of life in the cities of Guwahati and Dibrugarh through the delivery of improved water supply, sanitation, solid waste management (SWM), drainage infrastructure, and a sustainable urban transport system such as a bus rapid transit (BRT) corridor. The Program uses a multitranche financing facility (MFF) modality and is being implemented over a 6-year period from 2012 to 2017. Investments under the MFF are delivered in two tranches. For Guwahati these included water supply, sewerage, and transportation while for Dibrugarh included drainage, solid waste management and basic services for the poor were identified.

2. One of the major outputs of the Program is improvement of water supply system in Guwahati.

3. ADB requires the consideration of environmental issues in all aspects of the Bank's operations, and the requirements for environmental assessment are described in ADB's Safeguard Policy Statement (SPS), 2009. This states that ADB requires Environmental Assessment of all project loans, program loans, sector loans, sector development program loans, and loans involving financial intermediaries, and private sector loans.

4. ADB classified the Project as environment Category B and accordingly initial environmental examination (IEE) is required for all subprojects. This IEE is prepared for Guwahati Water Supply Subproject "Design, Build and Operate of Intake works, Raw Water Rising Mains, Water Treatment Plant, Clear Water Pumping Station and Allied Works at South East Guwahati". Construction work will be started and to be completed in 36 months. This IEE is presently based on outline design and specification. As per DBO contract, after finalization of all design, concerned contractor will update this IEE and EMP.

B. Environmental Compliance Requirements

5. **ADB Policy.** ADB requires the consideration of environmental issues in all aspects of ADB's operations, and the requirements for Environmental Assessment are described in ADB Safeguard Policy Statement (SPS), 2009. This states that ADB requires environmental assessment of all project loans, program loans, sector loans, sector development program loans, and loans involving financial intermediaries, and private sector loans.

6. **Screening and Categorization.** The nature of the environmental assessment required for a project depends on the significance of its environmental impacts, which are related to the type and location of the project, the sensitivity, scale, nature and magnitude of its potential impacts, and the availability of cost-effective mitigation measures. Projects are screened for their expected environmental impact are assigned to one of the following four categories:

- (i) **Category A.** Projects could have significant adverse environmental impacts. An EIA is required to address significant impacts.
- (ii) **Category B.** Projects could have some adverse environmental impacts, but of lesser degree or significance than those in category A. An IEE is required to determine whether significant environmental impacts

warranting an EIA are likely. If an EIA is not needed, the IEE is regarded as the final environmental assessment report.

- (iii) **Category C.** Projects are unlikely to have adverse environmental impacts. No EIA or IEE is required, although environmental implications are reviewed.
- (iv) **Category FI.** Projects involve a credit line through a financial intermediary or an equity investment in a financial intermediary. The financial intermediary must apply an environmental management system, unless all Projects will result in insignificant impacts.

7. **Environmental Management Plan.** An EMP which addresses the potential impacts and risks identified by the environmental assessment shall be prepared. The level of detail and complexity of the EMP and the priority of the identified measures and actions will be commensurate with the Project's impact and risks.

8. **Public Disclosure.** The IEE will be put in an accessible place (e.g., local government offices, libraries, community centers, etc.), and a summary translated into Assamese for the project-affected people and other stakeholders. ADB will post the following safeguard documents on its website so affected people, other stakeholders, and the general public can provide meaningful inputs into the project design and implementation:

- (i) Final IEE upon receipt; and
- (ii) Environmental Monitoring Reports submitted by PMU/PIU during project Implementation upon receipt.

9. The above is to meet the requirements of ADB's Public Communication Policy 2011.

1. Applicable Legislations

10. The implementation of the subprojects will be governed by Government of India and State of Assam Environmental acts, rules, regulations, and standards. These regulations impose restrictions on the activities to minimize/mitigate likely impacts on the environment. It is the responsibility of the project executing and implementing agencies to ensure subprojects are consistent with the legal framework, whether national, state or municipal/local. In addition, subprojects shall also be consistent with ADB's SPS. The following legislations are applicable to the subproject:

- (i) Environmental (Protection) Act of 1986, its rules and amendments;
- (ii) Water (Prevention and Control of Pollution) Act of 1974, its Rules, and Amendments;
- (iii) Air (Prevention and Control of Pollution) Act of 1981, its Rules and amendments;
- (iv) Municipal Solid Wastes Management Rules, 2016; Central Pollution Control Board (CPCB) Environmental Standards;
- (v) Construction & Demolition Waste Management Rules, 2016;
- (vi) The Environment Impact Assessment (EIA) Notification, 2006 as amended and Notification of Ministry of Environment and Forest No.L-11011/47/2011-IA.II(M) Dated 18.5.12.
- (vii) Forest (Conservation) Act of 1980, its Rules and amendments;
- (viii) Assam Forest Regulation of 1891;
- (ix) Assam Forest Policy of 2004;
- (x) The Assam Ancient Monuments and Records Act 1959; and Rules 1964
- (xi) The Ancient Monuments and Archaeological Sites and Remains Act, 1958

- (xii) The Ancient Monuments And Archaeological Sites Remains (Amendment and Validation) Act,2010
- (xiii) Land Acquisition Act of 1894 and as amended in 1985.
- (xiv) Master Plan Guwahati Metropolitan Area -2025

11. The Government of India laws cover the occupational health and safety of employees working only in factories and mines. However, the Constitution of India has provisions to ensure that the health and well-being of all employees are protected and the State has the duty to ensure protection. For this subproject, the mitigation measures are based on the World Bank Environmental, Health, and Safety (EHS) Guidelines.

2. Environmental Assessment Requirements

12. The Government of India Environmental Impact Assessment (EIA) Notification of 2006, which replaces the EIA Notification of 1994, requires environmental clearance for certain defined activities or projects. This Notification classifies the projects/activities that require EC into 'A' and 'B' categories depending on the impact potential and/or scale of project. For both category projects, prior EC is mandatory before any construction work, or preparation of land except for securing the land, is started. The said subproject components i.e. "Design, Build and Operate of Intake works, Raw Water Rising Mains, Water Treatment Plant, Clear Water Pumping Station and Allied Works at South East Guwahati" is not listed in the EIA Notification of 2006 "Schedule of Projects Requiring Prior Environmental Clearance" thus EC is not required. However, for all the quarry and mining activities environment clearance certificate is necessary. There will be requirement of permission from inland water ways authority for construction of intake in Brahmaputra. Collection of No Objection Certificate from Inland Water Ways Authority of India is under process.

3. National Legal Requirements

13. **Water (Prevention and Control of Pollution) Act of 1974, Rules of 1975, and Amendments.** Any component of the subproject having potential to generate sewage or trade effluent will come under the purview of the Water (Prevention and Control of Pollution) Act of 1974, Rules of 1975, and amendments. Such projects have to obtain Consent for Establishment (CFE) under Section 25 of the Act from Assam Pollution Control Board (APCB) before starting implementation and Consent to Operate (CTO) before commissioning. The Water Act also requires the occupier of such subprojects to take measures for abating the possible pollution of receiving water bodies. The following subprojects require CFE and CFO from APCB:

- (i) Municipal solid waste management facilities;
- (ii) New or augmentation of water treatment plants;
- (iii) New or augmentation of sewage treatment plants

14. **Consent to Establish (CTE)** under Water Prevention and Control of Pollution) Act of 1974, its Rules, and Amendments have been obtained for the **Water Treatment Plant** under the said project (**CTE attached in Appendix 1**). Initially CTE was valid for 2 years. Extension of CTE has already been done (Letter of extension attached in **Appendix 1**).

15. **Air (Prevention and Control of Pollution) Act of 1981**, Rules of 1982 and amendments. The subprojects having potential to emit air pollutants into the atmosphere have

to obtain CFE under Section 21 of the Air (Prevention and Control of Pollution) Act of 1981 read with rules amendments from APCB before starting implementation and CTO before commissioning the project. The occupier of the project/facility has the responsibility to adopt necessary air pollution control measures for abating air pollution. The following require CFE and CTO from APCB.

- (i) All the quarries
- (ii) Diesel generators; and
- (iii) Hot mix plants, wet mix plants, stone crushers, if installed for construction.

16. Emissions and discharges after treatment shall comply with standards notified by the CPCB. **Appendix 2** provides applicable standards for effluents, receiving water bodies, air quality, water quality, and noise levels.

17. **Forest Legislations.** Government of India and State Government of Assam make rules under the Indian Forest Act to regulate activities like (i) cutting of trees and removal of forest produce; (ii) clearing or breaking up of land for cultivation or any other purpose; and (iii) for protection and management of any portion of forest lands⁴. According to the Act, State Government of Assam requires a Forest Clearance from Government of India MoEFCC for use of a forest land for non-forest purposes (means breaking up or clearing of any forest land). The Forest (Conservation) Rules of 2003 issued under this Act, provide specific procedures to be followed for obtaining the Forest Clearance.

18. Compensatory afforestation is one of the most important conditions stipulated for diversion of forest land. For obtaining approval involving 5 hectares (ha), cost of 10 times the number of trees to be removed, subject to maximum of 2500 trees per ha shall be paid. In case of plain areas, the area of the land required for compensatory afforestation, shall be equal to that of the affected forest land. In case of hills, the area of land required for compensatory afforestation shall be twice or double the area of the affected forest land.

19. In addition, the Assam Forest Regulation of 1891 and Assam Forest Policy of 2004, requires a permit for cutting of trees in non-forest land, regardless of land ownership, from the Assam Environment and Forest Department. Afforestation to the extent of two trees per each tree felled is mandatory.

20. No subproject components are located within the forest. Though survey indicates there is no requirement of tree felling but in case of any tree felling during project execution a tree-cutting permit will be obtained from the Assam Environment and Forest Department for trees to be felled on non-forest lands and on ROWs of roads along rising mains alignment.

21. **Ancient Monuments and Archaeological Sites and Remains Act, of 1958 and The Ancient Monuments and Archaeological Sites And Remains (Amendments and Validation) Act, 2010.** The Act designate areas within a radius of 100 meters (m) and 300 m from the “protected property” as “protected area” and “controlled area” respectively. For the subproject, there is no Archaeologically Protected Areas located within project influence zone.

⁴ The term ‘forest land’ mentioned in Section 2 of the Act refers to reserved forest, protected forest or any area recorded as forest in the Government records. Lands which are notified under Section 4 of the India Forest Act would also come within the purview of the Act. (Supreme Court’s Judgment in the National Thermal Power Corporation’s case). It would also include “Forest” as understood in the dictionary sense (Supreme Court order dated 12.12.1996 in WP No. 202/1995-Annexure-I). All proposals for diversions of such areas to any non-forest purpose, irrespective of its ownership, would require the prior approval of the Central Government.

22. **Land Acquisition, Rehabilitation and Resettlement Act, 2013.** The Act shall come into force on January 1, 2014 as notified by the Central Government. The Act will replace the Land Acquisition Act, 1894, a nearly 120-year-old law enacted during British rule and lays emphasis on Rehabilitation & Resettlement in cases of land acquisition. Private land acquisition is guided by the provisions and procedures under this Act. Before the acquisition of any land, the Government is required to consult the concerned Panchayat or Municipal Corporation and carry out a Social Impact Assessment in consultation with them. The Act provides a transparent process for land acquisition for industrialization, development of essential infrastructural facilities and urbanization by giving adequate financial compensation to the affected people.

23. The District Collector or any other officer designated will function as the Land Acquisition Officer on behalf of the Government. There is a provision for consent award to reduce the time for processing if the land owners are willing to agree on the price fixed by the Land Acquisition Officer. The option of acquiring lands through private negotiations is also available.

24. Temporary disruption of household's activity and business may be affected during pipe laying work. A Resettlement Plan has been prepared in accordance with the Land Acquisition Act and ADB's SPS 2009.

4. Applicable International Environmental Agreements

25. In addition, international conventions such as the International Union for Conservation of Nature and Natural Resources (IUCN)⁵, Convention on Migratory Species of Wild Animals (CMS)⁶, and Ramsar Convention on Wetlands of International Importance⁷ are applicable for selection and screening of subprojects under restricted/sensitive areas. India is a party to these conventions.

26. For the said subproject, (i) animals and plant species found in the subproject sites are not included in the IUCN Red List; (ii) will not alter bird migration; and (iii) sites are not within or adjacent to the Deeporbeel, a permanent freshwater lake and a former channel of the Brahmaputra River in Assam listed under the Ramsar Convention in November 2002.

II. DESCRIPTION OF SUB PROJECT

A. Need for water supply project for Guwahati

27. The State Government of Assam has envisaged improvements in the water supply

⁵ The IUCN provides the Red List of Threatened Species (also known as the IUCN Red List or Red Data List) which is a comprehensive inventory of the global conservation status of plant and animal species. The IUCN Red List is set upon precise criteria to evaluate the extinction risk of thousands of species and subspecies. These criteria are relevant to all species and all regions of the world. The aim is to convey the urgency of conservation issues to the public and policy makers, as well as help the international community to try to reduce species extinction.

⁶ CMS, also known as the Bonn Convention, recognizes that states must be the protectors of migratory species that live within or pass through their national jurisdictions, and aims to conserve terrestrial, marine and avian migratory species throughout their ranges. Migratory species threatened with extinction are listed on Appendix I of the Convention. CMS Parties strive towards strictly protecting these species, conserving or restoring the places where they live, mitigating obstacles to migration and controlling other factors that might endanger them.

⁷ The Convention on Wetlands of International Importance (also called as Ramsar Convention) provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. According to the Ramsar list of wetlands of international importance, there are 25 designated wetlands in India which are required to be protected. Activities undertaken in the proximity of Ramsar wetlands shall follow the guidelines of the convention.

sector to provide access to potable water to 100% of the residents of the Guwahati Metropolitan Area (GMA). The City Development Plan (CDP) for Guwahati, prepared under the Jawaharlal Nehru National Urban Renewal Mission (JNNURM), envisions providing safe and sustainable water to its citizens at an appropriate pricing with the ultimate goal of providing 24 hours water across the city. To achieve this objective, the city has been divided into four distribution zones (Figure 1): (i) North Guwahati Zone (ii) South Guwahati West Zone (iii) South Guwahati Central Zone and (iv) South Guwahati East Zone.

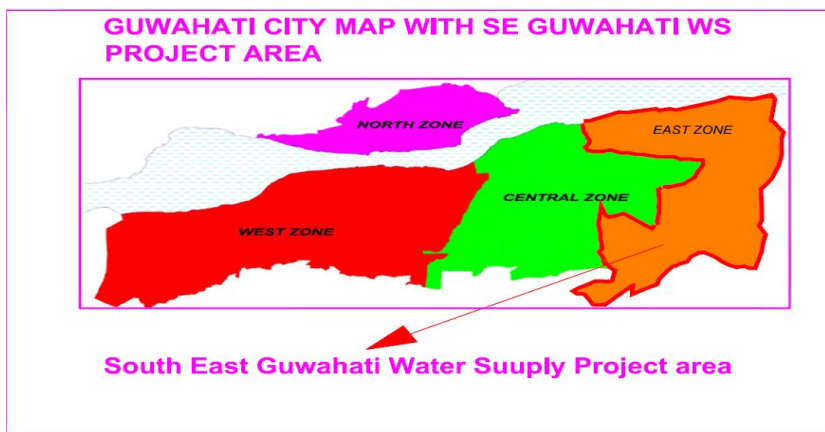


Figure 1: Guwahati Metropolitan Area Water Supply Zones

28. Currently, only 40% of the population has access to central piped water supply system. Lack of adequate water supply is causing inconvenience and hardship in Guwahati. The key issues pertaining to the present systems can be summarized as follows: (i) limited coverage of the system, and dependence on non-potable water sources; (ii) non-uniform distribution, both in terms of quality and quantity of water supplied; (iii) high levels of non revenue water (NRW), and leakages in the distribution system; and (iv) low levels of cost recovery. Currently, only 40% of the population has access to central piped water supply system. Lack of adequate water supply is causing inconvenience and hardship in Guwahati.

29. The present production capacity of 110.85 MLD, actual production of water is 73.4 MLD (66%). Out of around 74 MLD of potable water produced, 72 MLD is drawn from the river Brahmaputra and rest of about 1.5 MLD is pumped from deep tube wells installed at various locations by Guwahati Municipal Corporation (GMC). The present production from all sources (73.4 MLD) is inadequate with respect to present demand of around 150 MLD. Most of the treatment plants are also old and damaged due to which they are running much below their actual capacities. Various components are not functioning and as a result both quantity and quality are not being assured. Intake systems are old and rusted needing immediate repair and replacement. The ADB funded project will add 98 MLD in 2030 and provision for extension up to 147 MLD (2045).

30. The nonrevenue water in the Guwahati production and distribution system is estimated to be over 40%, resulting in a per capita availability of only about 65 liters per day with an average supply hours of 2 to 3 hours within those areas where piped water supply is available. The high NRW is because of uncontrolled leakage from the distribution system and transmission line and free flow of water from the street hydrant points. **Table 1** shows the salient features of the present water supply system.

Table 1: Salient Features of the Guwahati Water Supply System

Particulars	Quantities	Quantities
1.	Present population of Guwahati (2011 estimates)	1,246,082
2.	Present production capacity	110.85 MLD
3.	Present actual production	73.4 MLD
4.	Estimated unaccounted for water	40 %
5.	Overall per capita water availability at households	65 lpcd
6.	Maximum supply hours	2-3 hours a day

Notes: MLD = million per liters; lpcd = liters per capita per day

31. The existing distribution system covers only a part of the GMA and is largely limited to the central part of the city. In most part of the city water supply system is not available. In some of the fringe areas, tube wells are provided although maintenance by the Assam Public Health Engineering Department (APHED), Assam Urban Water Supply and Sewerage Board (AUWSSB) and GMC⁸ is very poor. Lack of proper planning leads to laying of undersized distribution pipes which is main reason of low pressure in the consumer end. Major leakage in the distribution system also leads to heavy contamination of water at the supply end. Consequently water borne diseases like diarrhea, dysentery, typhoid are quite common occurrence. Besides these, provisions for elements namely, chlorinators in the distribution system and bulk and consumer metering will also have to be introduced.

32. The present tariff structure for water supply is based on a flat rate charging system. GMC has tried to introduce water meter in the system but still is not fully operational. Present cost of production of GMC water is around Rs 11 per 1,000 liters. Although collection percentage of GMC is around 80% of water tax but the cost recovery is only up to the mark of 13%. The cost of water is quite high because of the fact that GMC has to incur a huge amount in terms of operations and maintenance (O&M) expenditure and establishment charges.

33. **Specific need of Sub project for South East Guwahati.** There is an urgent need to take up a new water supply project in South East Guwahati as most of the areas of that part of the city are not covered by piped water supply scheme. The quantity of water supplied in the sub project area by piped water supply scheme is only 2.8 MLD against a present water demand of 47 MLD. In project area there is no existing Intake. Only a small part (less than 5%) of area on southern part is served by piped water supply schemes. Existing supply caters mostly institutional area near state secretariat complex. Households in the sub project area depend on tube wells, ring wells, tanker supply etc. For clear water supply to the residents of Guwahati a source of raw water has to be there. Hence, there is a need of Intake at Brahmaputra River and the raw water has to be treated to the desired quality for supply to the residents of Guwahati (24X7) which is only possible with a good water treatment plant.

B. Description of Subproject

34. Initially under Tranche 1 one of the physical works planned was (i) construction of intake works including intake well, raw water pumping stations, raw water mains and other associated works; and (ii) construction of 98 MLD water treatment plant (WTP), pure

⁸ Presently Guwahati Municipal Corporation (GMC), Assam Public Health Engineering Department (APHED) and Assam Urban Water Supply and Sewerage Board (AUWSSB) are responsible for water supply in Guwahati. AUWSSB is mainly supplying water in the central portion of the city. APHED is supplying water to some of the institutional consumers in the South Guwahati eastern zone. GMC has the maximum coverage of residential consumers but not in the eastern zone.

water pumping station and associated works. Later it was decided by ADB that the construction of distribution networks to provide water supply to the uncovered areas package for the South Guwahati East Zone would also be included in the same package. It is planned that entire package work will be on DBO contract basis. Later it was decided that funding for Intake, WTP, Rising Mains and Pumping stations will be done from Tranche 2 fund allocation and accordingly separate IEE is prepared for "Design, Build and Operate of Intake works, Raw Water Rising Mains, Water Treatment Plant, Clear Water Pumping Station and Allied Works at South East Guwahati".

35. Since the contract will be a DBO, the construction contractor will design the project as per required specification. Accordingly, the contractor will update the initial environmental examination (IEE) after the detailed design is finalized. Specific tasks, timeline, for the updating of IEE and implementation of EMP is enclosed in **Appendix 3**.

36. The primary source of water for Guwahati is the Brahmaputra River which has a average flow of about 4,500 cubic meters per second. Raw water is drawn from various intake points along the river and supplied after treatment to the other zones.⁹

37. The proposed water intake wells will be located in the Brahmaputra River near Indian Oil corporation Limited (IOCL) gate at Kharghuli main Road. Two intake wells is being proposed to accommodate required numbers of Vertical Turbine pumps as per design in each well so as to pump 104 MLD during Phase I and additional pumps for 51 MLD during Phase II as mentioned in subsequent section. A surface water based Water Treatment Plant having capacity of 98 MLD (2030) and having design provision for extension up to 147 MLD (2045) is to be constructed at Sunsali for South East Zone of Guwahati under Assam Urban Infrastructure Investment Program. As per design the treatment plant is design in such a way that abstraction 155 MLD water shall be done from intake & production of water at Water treatment plant (WTP) is 147MLD. Difference of water in between abstraction and production water (155-147) =8 MLD is due to losses within abstraction & Production. (Evaporation, Sedimentation, Back wash up etc. i.e. WTP loss @ 5% has been considered in the design).

38. Photo illustration of project locations shown in **Appendix 4**.

39. Proposed location of Intake location, Water Treatment Plant location and Intake to WTP raw water pumping mains shown in **Figure 2** and **3** below.

⁹ Raw water intake of Guwahati Refinery is situated at Sector-1. The capacity of raw water Intake from river Brahmaputra is 14 MLD for supplying to the refinery and the refinery township. The total discharge of river Brahmaputra is estimated as 3300 M³/Sec & 16700M³/Sec at Pandu for lean period and during flood respectively, therefore, abstraction of 155 MLD raw water i.e., abstraction of 1.79 M³/Sec water from river Brahmaputra would be very minimal at a variable flow during the leanest period from the River Brahmaputra, this ensures availability and sustainability of water.



Figure 2: Proposed Location of Intake in Guwahati

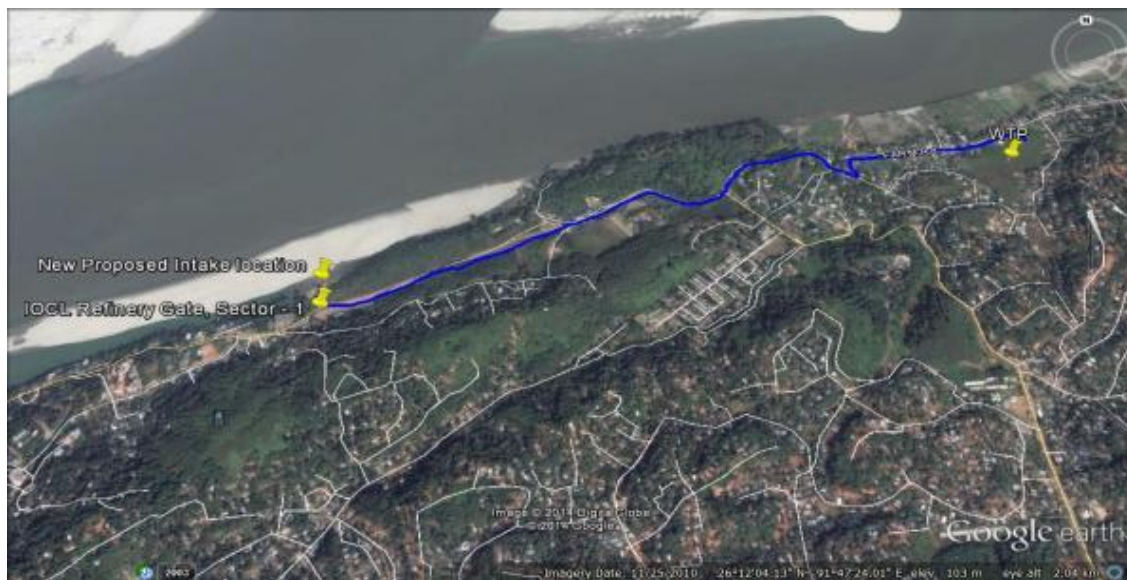


Figure 3: Proposed Location of WTP and Raw Water Main Alignment from Intake to WTP

40. Based on evaluation of the various locations, the site near IOCL gate is found to be most suitable. The site is suitable due to the following reasons:

- (i) The site is easily approachable by road;
- (ii) Minimum depth of water at the location at the leanest period 4-12 m, while maximum depth at the site is 25.00 m. Water availability will be perennial at the location;

- (iii) It will be feasible to construct an approach bridge from the river bank to location of proposed intake wells. Approach Bridge of 50 m length having each span of 25m should be provided to connect the Intake well to the proposed approach road which will be further connected to the existing road; and
- (iv) No bank protection is required. At intake location river bank is rocky. Quality of river water at the location is suitable for the conventional treatment.

41. Tentative Design feature of intake structure is shown in table below.

Table 2: Design Criteria for the South East Intake Structure

S. No.	Component	Units	Values
i.	Design Flow	MLD	155
ii.	Design Year	Yr.	2045 (Phase II)
iii.	Operation	Hrs/d	23
iv.	Inflow of River Water (Year 2007)	Cumec	3647 (winter)
v.	Approx. High Flood Level (HFL)	M MSL	53.0
vi.	Approx. High Water Level (HWL)	M MSL	49.75 ^a
vii.	Approx. Low Water Level (LWL)	M MSL	41.00 ^a
viii.	Approx. Max. Sour Level*	M MSL	32.00 ^a
ix.	Max. Wave Velocity or Force	m/s or kg	TBD ^a
x.	Number of Intake Wells	Nos.	2
xi.	Nominal Well Inside Diameter	mm	10000 ^b
xii.	Approx. Bottom Elevation of Well	M MSL	24.00
xiii.	Top of RCC Cap. Elevation	M MSL	54.20 ^b
xiv.	Highest water level	m	52.50
	Deck slab level	m	54.20
	Corbel level	m	61.80
	Roof slab(Excluding dome)	m	64.80
xv.	Gate Openings		
	• Intake Level	Nos.	3
	• Gates at each Level	Nos.	2
	• Gate Dimensions (w×h) each	mm	2200 × 2200
	• Approx. Invert EL of Upper Gate	M MSL	44.80 m
	• Approx. Invert EL of Intermediate Gate	M MSL	39.00 m
	• Approx. Invert EL of Lower Gate	M MSL	35.30 m
xvi	Coarse Screens (for protection of fish & other aquatic animal)		
	• SS Flats Strip	mm	12×12
	• Bar Spacing	mm	80

Notes:

- a. To be established verified or revised by further hydrological study
- b. To be determined by the contractor's design calculation

42. **Sustainable water availability at Intake point along with back up data.** Brahmaputra River within Assam is almost 700 km long with more than 100 tributaries. It has a total length of 28.67 km, total area of 49 sq km and a major natural feature in Guwahati. Assam Pollution Control Board (APCB) is carrying out continuous water quality monitoring under the National Water Quality Monitoring Program and Monitoring of Indian National Aquatic Resources. The flow data of the river is given below.

Table 3: Flow of Brahmaputra in Guwahati City

S. No.	Year	River Flow in Guwahati in Season (Cumec)		
		<i>Flood</i>	<i>Winter</i>	<i>Summer</i>
1	2003	31265	9360	6080
2	2004	28657	5659	8196
3	2005	26890	7854	3662
4	2006	21178	3869	4641
5	2007	18723	3647	6554
6	2008	25657	4520	3752
7	2009	20461	4725	11378

Source: Central Water Commission (CWC)

43. Lowest observed flow in the river at Guwahati is 3647 cumec in winter season in the year 2007. The total proposed river abstraction is 0.65 cumec which is less than 0.02 percent of the minimum flow.

44. The Bathymetric survey of the new Intake well site (IOCL Refinery gate sector – 1) indicates that the depth varies between 4 and 12 m at this leanest period. Hence availability of water at this Intake location will be there.

45. As per preliminary design for intake within Brahmaputra River: (i) location is not a spawning and migration area for fishes and/or their prey; (ii) location will not disrupt on-going activities, i.e., boat navigation, fishing activities, etc.; (iii) location will not impact existing aquatic vegetation, volume and depth of the water body, amount and timing of fresh water inflow, presence of upland rearing and spawning habitats, and the water quality of the river.

46. A surface water based Water Treatment Plant having capacity of 98Mld (2030) and having design provision for extension up to 147Mld (2045) is to be constructed for South East Zone of Guwahati at village Sunsali under Assam Urban Infrastructure Investment Program (funded by ADB). The Intake works, raw water rising mains and Water Treatment Plant is to be designed to create infrastructures that would have capacities for supply of uninterrupted 24x7 treated water {98 MLD (2030) & 147MLD (2045)} throughout entire design period of 30 years for south East Zone of Guwahati.

47. The basis of the design of the system shall be as per guide lines mentioned in CPHEEO manual on water supply and treatment and as per specification of Intake works:

- (i) Construction of intake structure consisting of intake wells with a raw water pump station above the wells, Supply and Installation of Pumping machineries, electrical Equipments, Instrumentation Equipments and Equipments for control system of raw water pumping station.
- (ii) Supply, fabricate and lying of MS pipes with accessories of raw water rising mains.
- (iii) Construction of Approach Bridge from raw water pumping station to riverbank.
- (iv) Construction of electrical substation including supply and installation of electrical Equipments, transformers cables etc. for supply of power to raw water pumping station and Intake work site.

- (v) Construction of administrative building, staff quarters, workshop cum store, internal roads, landscaping and arboriculture, boundary wall including gate and guard room at Intake work site.
- (vi) Construction of pre-settling tanks within WTP.
- (vii) Construction of approach road from Intake work site to WTP and from Noonmati - Kharghuli road to WTP at Sunsali village.

48. Major components under Water Treatment Plant:

- (i) Rapid sand filter technology will be used for treatment of river water.
- (ii) Construction of Cascade Aerator, Raw water inlet channel, Flash mixers, Flocculation unit, Plate settler (Clarifier), Rapid sand filters, Back wash reservoir, Chemical House and dosing system, Chlorination unit, Sludge handling and disposal unit and clear water reservoir and clear water pumping station.
- (iii) Supply and Installation of Pumping machineries, electrical Equipments, Instrumentation Equipments and Equipments for SCADA system for clear water pumping station.
- (iv) Construction of Electrical sub-station including supply and installation of electrical Equipments, transformers cables etc. for supply of power to clear water pumping station and other units of the WTP.

49. As per bid condition DBO contractor will finalize the design and they will collect sludge from the treatment plant and dispose / use after due permission from PMU/ PIU. Land is not yet selected. It is preliminarily estimated that 10 ha of land will be required for disposal. Sludge handling and disposal is discussed in more detail in Section IV.

50. **Raw Water Pumping Main.** The scope of work regarding the raw water pumping main includes supplying and laying mild steel pipe line of length approx. 2300 m (of internal diameter 1400mm) and associated civil works.

51. **Table 4** shows the components of the subproject based on the present proposals which are expected to be substantially correct, although certain details may change as per final design under DBO contract. **Figure 4 to 6** indicates proposed layout for Intake and pumping mains, water treatment plant and pre settling tank within water treatment plant.

Table 4: Description of the Proposed Water Supply Subproject Part for South East Guwahati City

Component	Function	Description	Location
Construction of 2 water Intake wells	Intake of Raw River Water for supply of treated water at South east Guwahati, Assam	➤ Two intake wells has been proposed to accommodate required numbers of Vertical Turbine pumps as per design in each well so as to pump 104 MLD during Phase I and additional pumps for 51 MLD during Phase II	Located in the Brahmaputra River near Indian Oil corporation Limited (IOCL) gate at Kharghuli main Road.
Construction of approach Bridge	For movement of man and machine & Laying of raw water pumping main	➤ Approach Bridge of 50 m length having each span of 25m should be provided to connect the Intake well to the proposed approach road which will be further connected to the existing road	Near IOCL gate-1 at Kharguli

Component	Function	Description	Location
Raw water Pumping Mains	Transfer of Raw water from intake to Water Treatment Plant	➤ Approx 2300 m MS pipeline 1422mm (O.D), 10mm thick plate	Pumping main from intake to WTP via Primary settling tank to Water Treatment Plant
Water Treatment plan including pre settling tank	Treatment of Raw water	A surface water based Water Treatment Plant having capacity of 98Mld (2030) and having design provision for extension up to 147Mld (2045) is to be constructed for South East Zone of Guwahati at Sunsali village. Pre settling tank with retention capacity of about 1 hr. within water treatment plant. The Pre settling tank shall be of reinforced cement concrete structure. As a part of WTP - construction of Cascade Aerator, Raw water inlet channel, Flash mixers, Flocculation unit, Plate settler (Clarifier), Rapid sand filters, Back wash reservoir, Chemical House and dosing system, Chlorination unit, Sludge handling and disposal unit and clear water reservoir and clear water pumping station.	WTP will be constructed for South East Zone of Guwahati at Sunsali village. Pre settling tank will be constructed within WTP
Clear water storage tank with installation of pumping machinery	Storage of treated water for pumping to Master Balancing Reservoir at Gopal Nagar	➤ RCC reservoir for storage of treated water for supply	• Located within water treatment plant at Sunsali village

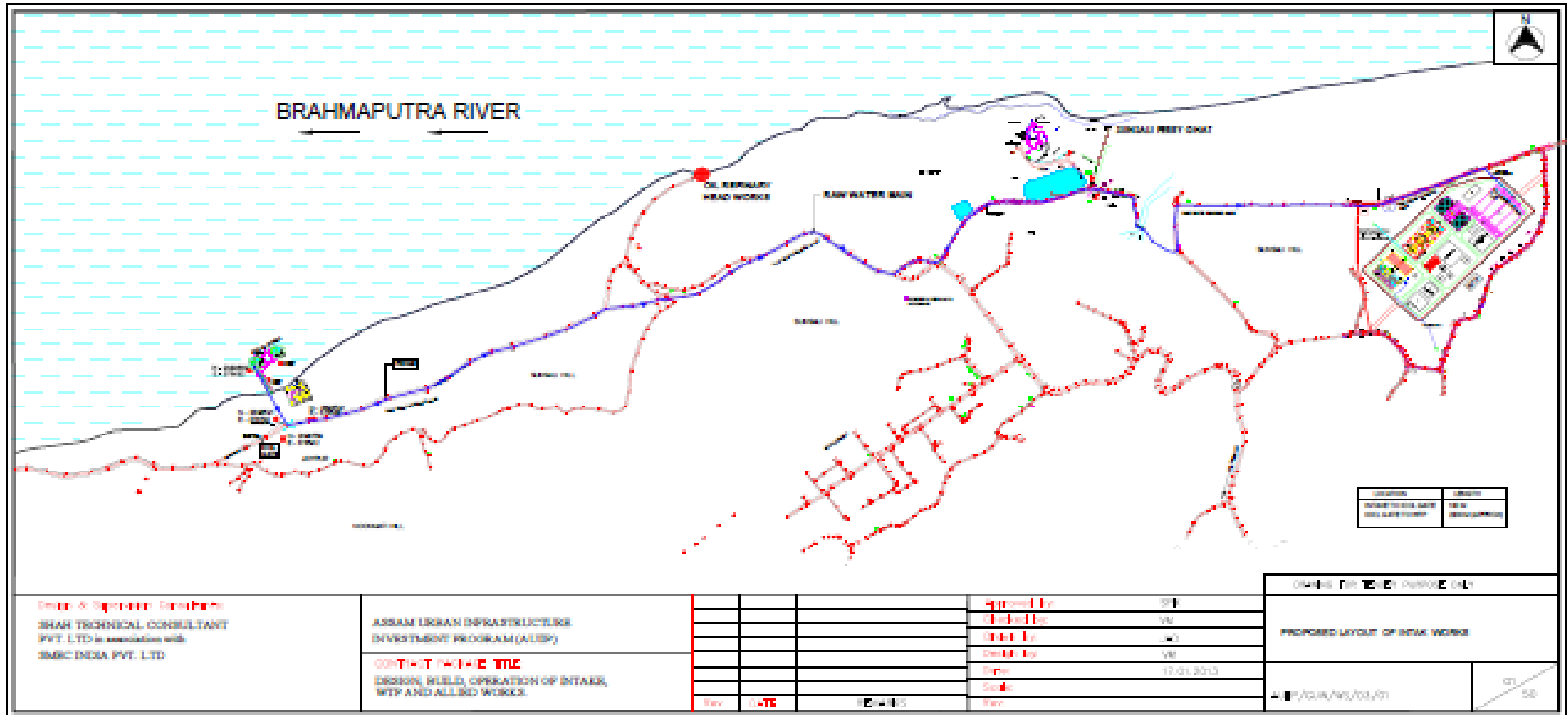


Figure 4: Layout Plan for Intake and Pumping Mains

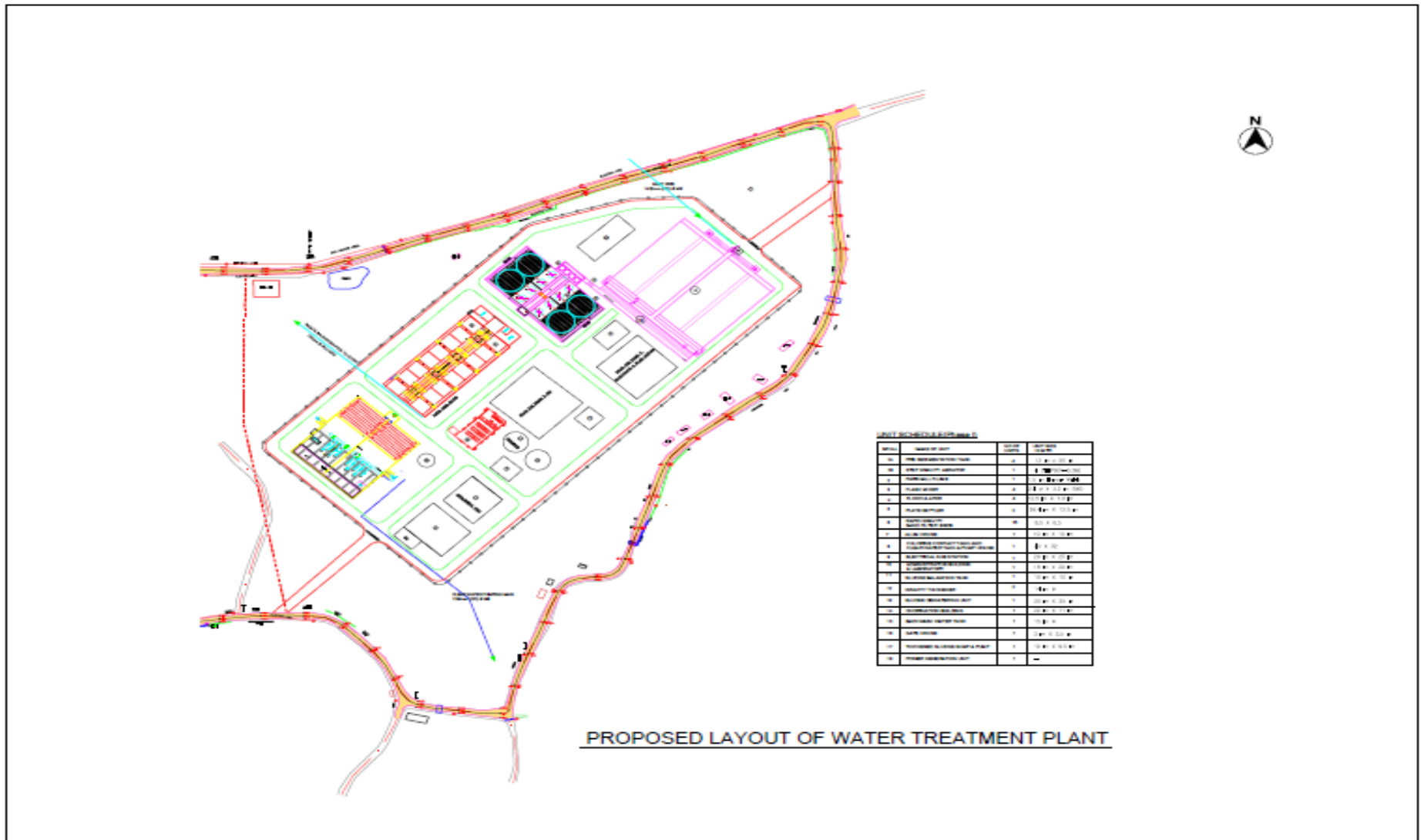


Figure 5: Proposed Layout of WTP

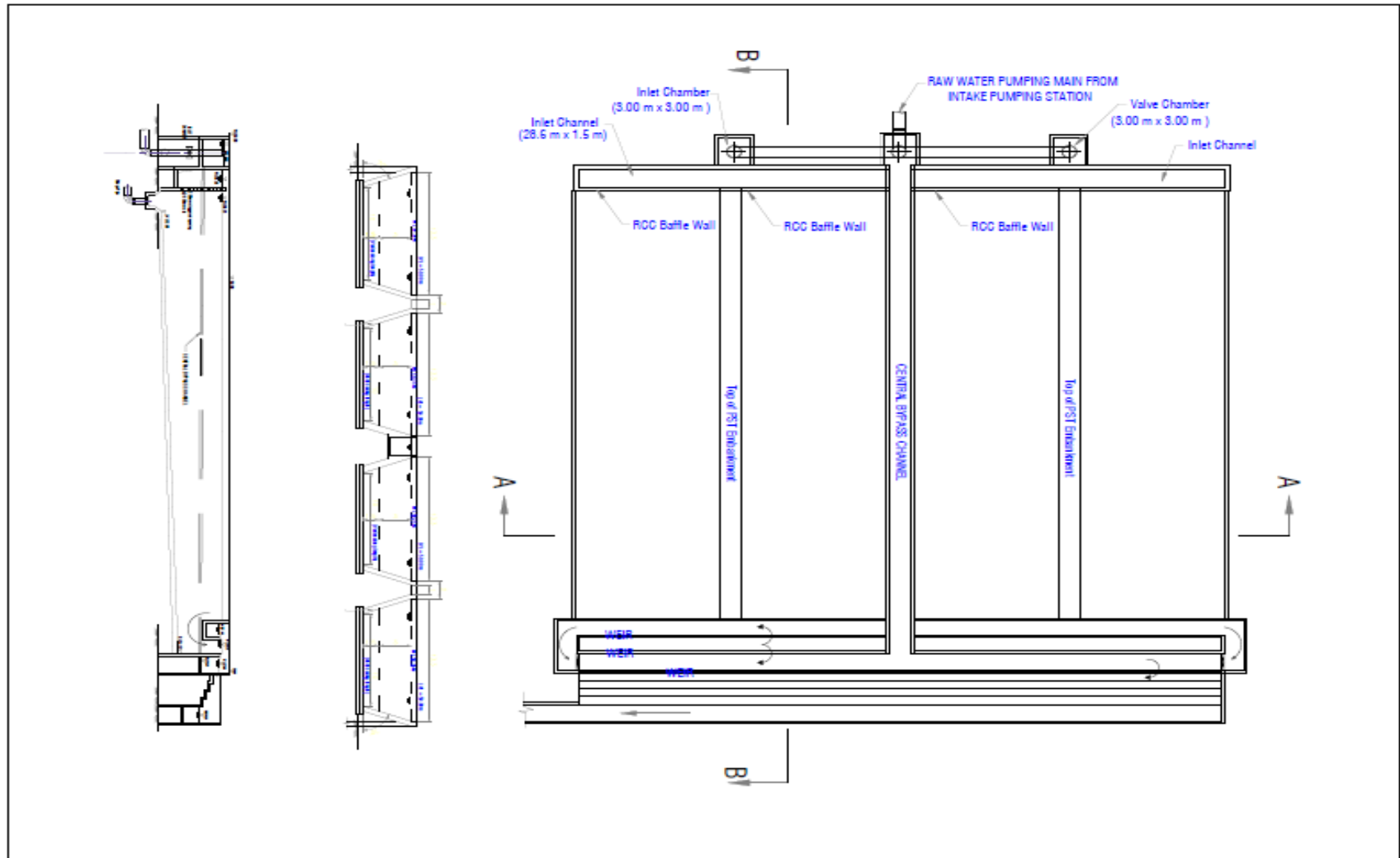


Figure 6: Proposed Layout for Pre-settling Tank

III. DESCRIPTION OF ENVIRONMENT

A. Physical Features

1. Location

52. Guwahati district is the capital of State of Assam and is located on the southern bank of Brahmaputra River. The Guwahati Municipal Area (GMA), with a total area of 262 square kilometer (sq km) is located on both banks of Brahmaputra River dividing it into two parts - North Guwahati and South Guwahati. The State Government of Assam has proposed the Southeastern zone for assistance under the Project, which covers 71 sq km and a total of 11 wards and some parts of 6 other wards. Map of the Guwahati city and location of wards are shown in **Figure 7 and 8** respectively.



Figure 7: Map of Subproject Area – Guwahati City

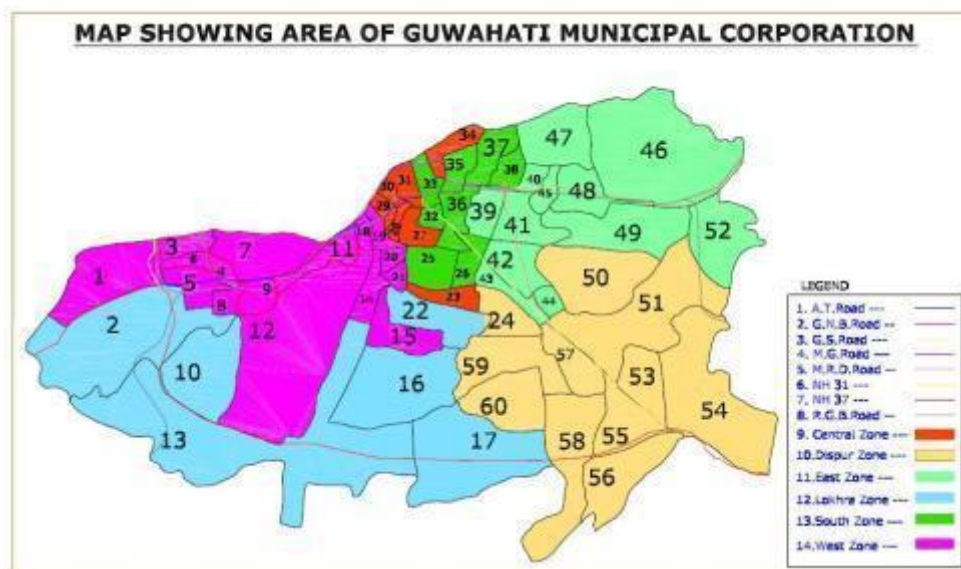


Figure 8: Guwahati Municipal Corporation Area Showing Distribution of Wards

2. Topography

53. Guwahati is located at $26^{\circ}10'$ N latitude and $91^{\circ}45'$ E longitude with an altitude varying between 49.5 m to 293 m above mean sea level. The average slope varies from zero degree to 18 degrees. The natural topography of the city guides the flow of rain water towards the Bharalu and Basistha Rivers.

54. The physical configuration of Guwahati exhibits a peculiar structure being located within a crescent-shaped basin, surrounded by a number of hillocks. As a result, swamps and low-lying areas in between the hillocks have emerged in the landscape. These low-lying areas are often inundated during heavy rainfall.

55. The Intake will be constructed at IOCL Refinery gate, Sector-1, at Kharghuli main Road, Guwahati, on the bank of the Brahmaputra River. From the existing road, the distance of the river bank is about 100m and two intake wells are to be constructed at a distance of 30 m from the river bank and shall be connected by approach bridges. Approach Bridge of 50 m length having each span of 25m should be provided to connect the Intake well to the proposed approach road which will be further connected to the existing road. WTP will be constructed for the South East Zone of Guwahati at Sunshali village. Pre-settling tank will be constructed within WTP. Raw water transmission will be laid along the road from Kharghuli to Sunshali.

3. Geology and Seismicity

56. Guwahati is characterized by mostly Precambrian granite gneisses, quartzite forming residual hills and occupying a major part of the landscape. Small-elongated inter-montane valleys with varying thicknesses of sediment fill and alluvium form the rest of the areas. There is the presence of a number of paleo-channels that are perceived to be old channels linked to the Brahmaputra River towards the north.

57. The Brahmaputra valley and its adjoining highlands constitute a highly active seismic zone. Guwahati falls in the Seismic Zone V, where earthquakes of magnitude 8 or more can

occur i.e., the zone with highest intensity. Guwahati and its surrounding area are situated on the fringe of hard rock formation. Its vulnerability to the seismic activity¹⁰ is exacerbated due to congestion brought on by topography, with poorly built housing and narrow streets.

4. Climate

58. Three seasons are witnessed in Guwahati. From February to May, the weather is dry. In the month of March, the northeast wind carries the dry sand from the Brahmaputra River and makes the whole atmosphere dusty. In April and May, local rain along with thunderstorms is a common feature. The maximum and minimum temperature varies from 12° to 31°C during this period. From June to October is the southwest monsoon season with heavy rainfall. The temperature varies from 22° to 32°C in this period. November to January is the cold weather season. The average annual rainfall in Guwahati is 1637.3 mm with 87 average rainy days. About 90% of this rain occurs between April and September and July and August being the maximum rainy months.

5. Drainage

59. The whole GMA area is divided into six drainage basins, which are ultimately drained into the Brahmaputra River either directly or through various drainage channels and reservoirs. These six basins are Bharalu Basin, Dipar Basin, Silsako Basin, Foreshore Basin, North Guwahati Basin, and Kalmoni Basin.

6. Surface Waters

60. **Brahmaputra River.** Brahmaputra River within Assam is almost 700 km long with more than 100 tributaries. It has a total length of 28.67 km, total area of 49 sq km and a major natural feature in Guwahati. Assam Pollution Control Board (APCB) is carrying out continuous water quality monitoring under the National Water Quality Monitoring Program and Monitoring of Indian National Aquatic Resources. Results of monitoring conducted by APCB show coliforms exceed the prescribed Government of India limits. All other parameters are within the prescribed limit. The flow data of the river is given below.

Table 6: Flow Data of Brahmaputra River in Guwahati City

S. No.	Year	River Flow in Guwahati in Season (Cumec)		
		Flood	Winter	Summer
1	2003	31265	9360	6080
2	2004	28657	5659	8196
3	2005	26890	7854	3662
4	2006	21178	3869	4641
5	2007	18723	3647	6554
6	2008	25657	4520	3752
7	2009	20461	4725	11378

Source: Central Water Commission, 2011

61. Brahmaputra River water quality data is shown below. Samples were collected 1km up

¹⁰ Earthquakes measuring up to 8.7 on the Richter scale occurred here in 1897 and 1950. Between 1920 and 1980 as many as 455 earthquakes of magnitude 5 on the Richter scale were recorded in the region an average of 8 per year

stream & 3 km downstream for Intake location. There is no as such contaminated discharge (waste water) near proposed Intake location.

Table 7: Water Quality of Brahmaputra River

Parameters	W1	W2	Tolerance Limits for Inland Surface Water
Temperature (°C)	25	25	-
pH	7.2	6.9	8.0
Conductivity (µmhos/cm)	107	158	-
Turbidity (NTU)	16	14	-
Dissolved Oxygen (mg/l)	7.20	7.20	Min 4.0
Alkalinity as CaCO ₃ (mg/l)	66.00	56.0	-
Total Hardness as CaCO ₃ (mg/l)	68.00	68.0	-
Calcium as Ca ²⁺ (mg/l)	20.00	36.0	-
Magnesium as Mg ²⁺ (mg/l)	4.30	12.0	-
Chloride as Cl (mg/l)	12.00	10.00	600.0
Sulphate as SO ₄ ²⁻ (mg/l)	16.80	4.8	400.0
Nitrate as NO ₃ ⁻ (mg/l)	0.14	0.62	50.0
Residual Chlorine (mg/l)	BDL	BDL	-
Phenolic Compound (mg/l)	BDL	BDL	0.005
Total Iron as Fe (mg/l)	0.50	0.16	50.0
Fluoride As F (mg/l)	0.33	0.50	1.5
Total Dissolved Solids (mg/l)	72.00	-	1500.0
Arsenic as As (µg/l)	1.18	BDL	200.00
Chromium as Cr (VI) (mg/l)	BDL	-	0.05
Lead as Pb (mg/l)	BDL	-	0.1
Zinc as Zn (mg/l)	0.024	-	15.0
Copper as Cu (mg/l)	0.059	-	1.5
Cadmium as Cd (mg/l)	0.005	-	0.01
Mercury as Hg (mg/l)	BDL	-	-
Bacteriological Parameters			
Total Coliform (MPN/100 ml)	300	860	5000.0
Faecal Coliform (MPN/100 ml)	Nil	290	

BDL: Below Detection Limit (Source: W1: Assam Pollution Control Board for AUJIP, Date of collection of sample: 08/10/2012 & W2: Collected from JICA funded project, Intake point of JICA funded Guwahati Water supply project at Kharghuli)

62. Before starting of the construction work base line monitoring will be conducted and Oil and Grease will be considered as a monitoring parameter.

63. **Bharalu River.** The Bharalu River originates as a small stream from the southern range of Khashi Hills and flows through the city gaining momentum in width and depth and ultimately joining Brahmaputra River. Most of the drains directly or indirectly fall into Bharalu River which is an important channel for the drainage of the city. But due to siltation, the bed level of the river has considerably risen. Results of monitoring conducted by APCB show dissolved oxygen, biological oxygen demand, and coliforms exceed the prescribed Government of India limits. All other parameters are within the prescribed limit.

Table 8: Water Quality of Bharalu at Bharalumukh Before Confluence with Brahmaputra River (During the Period from 2009 to 2013)

Parameters	Month & Year of collection					Tolerance Limits for Inland Surface Water
	April, 09	April, 10	April, 11	April, 12	April, 13	
a. Physical Parameters:						
pH	6.9	7.4	6.8	6.8	6.8	8.0
Turbidity (NTU)	7.2	6.9	21	18.2	19.4	-
Conductance ($\mu\text{mho/cm}$)	533	697	734	799	836	-
b. Organic Parameters:						
DO (mg/L)	nil	nil	nil	0.5	nil	Min 4.0
COD (mg/L)	56.4	54.4	160	81.2	85.7	-
BOD (mg/L)	6.5	30	32	15	48	3.0
Major Mineral Parameters:						
Chloride as Cl (mg/L)	92	36	14	156	68	600.0
PO ₄ as P (mg/L)	9.3	10	3.1	10	14.2	-
Sulphate as SO ₄ (mg/L)	52.6	29.4	11.8	23.2	5.6	400.0
Other Inorganic parameters:						
T. ALKALINITY (mg/L)	204	82	540	260	252	-
T. Hardness as CaCO ₃	224	92	56	156	150	-
Calcium as CaCO ₃ (mg/L)	168	60	38	104	110	-
Magnesium as CaCO ₃ (mg/L)	56 0.11	32	18 0.029	52 0.1	40 0.1	-
Nitrate -N (mg/L)	0.10	0.73	0.38	2.4	3.4	50.0
Total Dissolved Solid (TDS)	393	432	448	562	548	1500.0
Total Fixed Solid (TFS)	102	112	206	128	115	-
Total Suspended Solid	38	28	37	33	38	-
Sodium (mg/L)	4.5	31.7	41	22.8	50.5	-
Potassium (mg/L)	2	10.1	3.1	6.4	18.4	-
Fluoride (mg/L)	0.68	0.71	0.56	0.49	0.52	1.5
c. Trace Metals:						
Zinc as Zn ($\mu\text{g/L}$)	144	232	101	142	130	15000
Copper as Cu ($\mu\text{g/L}$)	10	105	80	61	9	1500
Lead as Pb ($\mu\text{g/L}$)	BDL	285	10	10	13	100
Cadmium as Cd ($\mu\text{g/L}$)	3	2	2	3	4	10.0
Nickel as Ni ($\mu\text{g/L}$)	5.9	45	20	20	BDL	-
Chromium as Cr (T) ($\mu\text{g/L}$)	3	46	42	33	57	50.0
Arsenic as As ($\mu\text{g/L}$)	BDL	1.13	1.4	2.2	2.2	200.0
Mercury as Hg ($\mu\text{g/L}$)	BDL	BDL	BDL	BDL	BDL	-
Total Iron ($\mu\text{g/L}$)	80	80	320	120	730	50000
d. Bacteriological						

Total Coliform (MPN/100m1)	2100	1500	2000	2300	21000	5000.0
Faecal Coliform (MPN/100l)	730	720	Nil	910	2000	-
BDL : BELOW DETECTABLE LIMIT						

64. Treated water quality at Guwahati is shown in **Table 9**.

Table 9: Gouwahati Municipal Corporation Supply Water (Place of Collection - Panbazar Water Treatment Plant, Guwahati)

Physical Parameters	Value	Acceptable limit {(BIS)10500,2012}	Standard {(BIS)10500,2012}- Permissible limit in absence of alternative source
Appearance	Almost clear	Agreeable	Agreeable
Colour	Almost clear	Colouless	Agreeable
Odour	Odourless	Agreeable	Agreeable
pH Value	7.98	6.5 – 8.5	6.5 – 8.5
Turbidity (NTU)	<5.0	1.0	Less than 5
Chemical Parameters (mg/L)			
Total Dissolved Solids	158.0	500.0	2000.0
Total Hardness (as CaCO ₃)	60.0	200.0	600.0
Total Alkalinity (as CaCO ₃)	48.0	200.0	600.0
Total Iron (as Fe)	0.02	0.3	0.3
Chloride (as Cl)	4.0	250.0	1000.0
Residual free chlorine	0.20	0.20	1.0
Fluoride (as F)	0.3	1.0	1.5
Nitrate (as NO ₃)	BDL	45.0	45.0

BDL: Below Detection Limit (Source: Guwahati Municipal Corporation,
Date of collection of sample: 15/09/2012)

7. Groundwater

65. Owing to the inadequacies of piped water supply, Guwahati depends on groundwater from ring/dug wells and tube wells for drinking purposes. Groundwater quality in Guwahati has been studied with special reference to the presence of fluoride. The Brahmaputra River in the north, hills to the east and south, and alluvial soil to the west surround the city. Fluoride, above the guideline values of World Health Organization, has been found in groundwater of the eastern and southern plains of the city. The sources of fluoride and nitrate are suspected to be minerals from the Precambrian granite, which forms the basement of the city and outcrops at several places in the city.

66. Ground water quality data was collected from secondary published source. Samples were collected near the sub project locations at Khanapara (residential), Ruckmini Gaon (residential), Noonmati (near KV Noonmati) and Chunsali (residential). The maximum and minimum values as noted during monitoring are given below.

Table 10: Ground Water Quality In and Around Guwahati

S. No	Parameters	Minimum	Maximum
1	Odour	NS	WS
2	Temperature(°C)	22	22.1

S. No	Parameters	Minimum	Maximum
3	Turbidity (NTU)	6.2	8.4
4	pH	7.03	8.41
5	Conductance ms/cm	0.65	7.98
6	Total dissolved solid mg/L	145	225
7	Total suspended solid mg/L	11	20
8	Chloride (mg/L)	34.8	161.88
9	Sulphate (mg/L) as SO ₄	5.75	8.1
10	Phosphate (mg/L)	0.31	0.65
11	Fluoride (mg/L)	0.8	1.6
12	Cyanide (mg/L)	BDL	BDL
13	Calcium(mg/L)	44.8	105.8
14	Nitrate (mg/L)	0.41	0.5
15	Magnesium (mg/L)	6.81	11.68
16	Sodium(mg/L)	7.1	7.3
17	Potassium (mg/L)	2.8	3.8
18	Manganese (mg/L)	0.03	0.87
19	Zinc (mg/L)	BDL	0
20	Iron (mg/L)	0.11	0.63
21	Copper (mg/L)	BDL	BDL
22	Lead (Pd) (mg/L)	BDL	BDL
23	Chromium + ⁶ (mg/L)	BDL	BDL
24	Chromium (Total) (mg/L)	BDL	BDL
25	Cadmium(mg/L)	BDL	0.001
26	Arsenic (µg/L)	BDL	0.01
27	Cobalt (mg/L)	0.006	0.22
28	Nickel (mg/L)	BDL	0.01
29	Phenol (mg/L)	BDL	BDL
30	Total Cali farm (MPN/100 ml)	-	-
31	Faecal Califon (MPN/100ml)	-	-

BDL: Below Detection Limit, (Source: EIA Report INDAdept⁶ Project- Guwahati Refinery)

8. Air Quality

67. Air pollution in Guwahati has increased in recent years due to growth of traffic and other urban activities. The ambient air quality data is collected from secondary source in respect to particulate matter (PM 2.5 & PM 10), sulfur dioxide (SO₂) and nitrogen oxides (NO_x), shown in **Table 11**. At all the locations sulfur dioxide and nitrogen oxides are within the limit.

Table 11: Air Quality Monitoring Result

Locations	Parameters ($\mu\text{g}/\text{m}^3$) (Min- Max)/ Mean			
	SO ₂	NO ₂	PM ₁₀	PM _{2.5}
Guwahati Refinery Guest House*	BDL-6.10 (2.40)	BDL-13.6 (5.40)	24.8 – 78.2 (56.8)	24.2-56.2 (40.6)
Guwahati Refinery Township*	BDL-5.4 (2.3)	BDL-14.6 (2.3)	51.7-131.5 (80)	32.2-71.4 (48.4)
Near WTP site at Chunsali*	BDL-6.1 (2. 6)	BDL-6.4 (2,80)	21.1-76.4 (57.3)	21.7-51.3 (34.8)
Near Proposed Intake Site Kharghuli Area**	6.0	11.0	25.0	12.0
CPCB Standard	80	80	100	60

(Source: *EIA Report INDAdapt⁶ Project- Guwahati Refinery, Date of sampling: 17-11-2011, 20-11-2011 , 24-11-2011 , 27-11-2011 , 30-11-2011 , 02-11-2011 , 05-12-2011 , 08-12-2011 , 11-12-2011 , 15-12-2011 , 18-12-2011 , 21-12-2011 , 24-12-2011 , 27-12-2011 . **: Baseline monitoring near intake site at Kharguli of JICA funded WSSP, Date of sampling: 23-06-13 and 19-10-13)

68. Results show that the maximum PM₁₀ value cross the standard limit 100 $\mu\text{g}/\text{m}^3$ at Refinery Township. The maximum values of PM_{2.5} cross the standard limit of 60 $\mu\text{g}/\text{m}^3$ at Guwahati refinery township area. But the average concentrations of PM₁₀ and PM_{2.5} at all the locations are within the standard limit.

9. Noise Level

69. Secondary data for ambient noise in and around the project locations are collected. **Table 12** shows noise level data of the project area.

Table 12: Noise Levels (dBA) in the Project area (Day time 6AM to 10 PM; Nighttime from 10 PM to 6 AM)

Sr. No.	Noise Monitoring Station	Day time SPL(dBA)		Night time SPL (dBA)	
		Leq	Range	Leq	Range
1	Noonmati* (Guwahati Refinery main gate)	72	61-86	64	40-73
2	Noonmati* (Sector-III)	74	51-79	56	44-68
3	Noonmati Public School*(Chunsali)- nearby WTP site	64	54-81	42	36-66
4	Near APBN Barrack**	44.5	-	41.5	-
5	Right Side Hill**	40.2	-	39.8	-
6	Centre of the Hill**	42.0	-	40.2	-
7	Near Raj Bhawan**	40.2	-	38.6	-

(Source: *EIA Report INDAdapt⁶ Project- Guwahati Refinery, Date of sampling: 17-11-2011, 20-11-2011 , 24-11-2011 , 27-11-2011 , 30-11-2011 , 02-11-2011 , 05-12-2011 , 08-12-2011 , 11-12-2011 , 15-12-2011 , 18-12-2011 , 21-12-2011 , 24-12-2011 , 27-12-2011 . **: Baseline monitoring near intake site at Kharguli of JICA funded WSSP, Date of sampling: 23-06-13 and 19-10-13)

70. Results show that noise level is maximum at township area and above the standard.

71. After commencement of work baseline monitoring in respect to air and noise will be

conducted at specific project sites.

B. Ecological features

1. Protected Areas and Reserve Forest

72. There are 9 reserve forests within GMA with a total area of 17,673.93 sq km apart from the Deeporbeel (Ramsar wetland) having an area of 4.14 sq km. **Table 13** presents the names of the reserve forests along with their extents.

73. No project locations are within the forest area.

Table 13: Reserve Forests in Guwahati Metropolitan Area

S. No.	Name of Reserve Forest	Area (sq km)
1	Garbhanga	11,460.95
2	Gotanagar	171.00
3	Fatasil	670.44
4	Hengrabari	498.00
5	Jalukbari	97.70
6	Maliata	325.46
7	Rani	4,372.38
8	Sarania Hills	8.00
9	South Kalapahar	70.00
	Total Area	17,673.93

Source: Directorate of Forests, 2007

2. Wetlands

74. Guwahati has a large number of low lying areas and some of them have developed into lakes and water bodies. These wetlands help in mitigating the problems of flash flood, which is a common occurrence during the monsoon season. Larger water bodies are popularly known as *beels*. Those mostly serve as backyard fishing ponds to the residents particularly in rural areas. There are around 7 wetlands in and around Guwahati namely: (i) Deeparbeel; (ii) Borsolabeel; (iii) Sarusolabeel; (iv) Silsakubeel; (v) Zentiabeel; (vi) Kamrangabeel; and (vii) wetlands of Dimoria block. Deeparbeel (Ramsar wetland), Kamrangabeel, and Zentiabeel are favorite sites for the migratory birds while Deeporbeel is the storehouse of more than 170 varieties of fishes and act as the main storm water storage basin of the city. There is no wetland located within the subproject area.

75. Deeporbeel is a former channel of Brahmaputra River located 9 km to the southwest of the city. It is a permanent fresh water lake with abundant aquatic vegetation. The lake and its surrounding swamps, comprising an area of 4.14 sq km, have been (i) declared as a bird sanctuary on 1st January 1989; (ii) included in the Directory of Asian Wetlands; and (iii) included as a Ramsar Site. There are about 170 species of birds, 2 critically endangered, 1 endangered, 5 vulnerable and 4 near threatened recorded in Deeparbeel. No project components is within or adjacent to this protected wetland.

3. Flora and Fauna

76. Flora and fauna in the subproject alignment are those commonly found in urban and built-up areas. There are no recorded endangered or critical species in the project area.

However the common flora and fauna found in Guwahati are given in **Tables 14 & 15** below.

Table 14: Common Flora of Guwahati

S. No.	Plant Species	Family
1.	<i>Artocarpus chaplasha</i>	Moraceae
2.	<i>Alphonsea ventricosa</i>	Annoanceae
3.	<i>Castanopsis indica</i>	Fagaceae
4.	<i>Canarium spp.</i>	Burseraceae
5.	<i>Dillenia indica</i>	Dilleniaceae
6.	<i>Dysoxylum procerum</i>	Meliaceae
7.	<i>Magnolia spp.</i>	Magnoliaceae
8.	<i>Mesua</i>	Clusiaceae
9.	<i>Stereospermum personatum</i>	Bignoniaceae
10.	<i>Tetrameles spp.</i>	Tetramelaceae
11.	<i>Actinodaphne obovata</i>	Lauraceae
12.	<i>Aesculus spp.</i>	Sapindaceae
13.	<i>Artocarpus chama</i>	Moraceae
14.	<i>Albizia spp.</i>	Fabaceae
15.	<i>Anthocephalus chinensis</i>	Ruhiaceae
16.	<i>Duabanga grandiflora</i>	Lythraceae
17.	<i>Bauhinia purpurea</i>	Fabaceae
18.	<i>Michelia champaca</i>	Maguoliaceae
19.	<i>Schima wallichii</i>	Theaceae
20.	<i>Trewianudi flora</i>	Euphorbiaceae
21.	<i>Lageraroemia spp</i>	Lythraceae

(Source: EIA Report – Environment Information Center, New Delhi, 2011)

77. Final construction designing will be done judiciously so that no trees need to be cut. In case of requirement of tree felling during implementation of the project permission will be taken from concerned authority.

Table 15: Common Fauna of Guwahati

S. No.	Scientific Name	Common Name	Name of the Family
1.	<i>Macacamulatta</i>	Rhesus macaque	Cercopithecidae
2.	<i>M. assamensis</i>	Assamese macaque	Cercopithecidae
3.	<i>Tardigraduscougang</i>	Slow Loris	Lorisidae
4.	<i>Viverrazibetha</i>	Large Indian civet	Viverridae
5.	<i>A. binturong</i>	Binturong	Viverridae
6.	<i>H. urva</i>	Crab eating mongo	Herpestidae
7.	<i>Melogalemoschata</i>	Ferret badger	Mustelidae
8.	<i>Arctonyxcollaris</i>	Hog badger	Mustelidae
9.	<i>Rhizomyspruinosis</i>	Hoary bamboo rat	Cricetidae
10.	<i>Cannomysbadius</i>	Bay bamboo rat	Spalacidae
11.	<i>Leptoptilosdubius</i>	Greater Adjutant Stork	Ciconiidae

(Source: EIA Report – Environment Information Center, New Delhi, 2011)

78. Common bird species as recorded within the Guwahati city is given in **Table 16**.

Table 16: Common bird species of Guwahati

Common Names	Scientific Name
Birds (Aves)	
Ruddy Shelduck	<i>Tadorna ferruginea</i>
Gadwall	<i>Anas streapera</i>
Mallard	<i>Anas platyrhynchos</i>
Northern pintail	<i>Anus acuta</i>
White pelican	<i>Pelecanus erythrorhychos</i>
Brown Pelican	<i>Pelecanus occidentalis</i>
Lesser adjutant stork	<i>Leptoptilos javanicus</i>
Greater adjutant stork	<i>Leptoptilos dubius</i>
Indian river tern	<i>Sterna aurantia</i>

79. Common aquatic flora and fishes as recorded in Brahmaputra is shown in Table below. Considering the totality of the river as well as its discharge it can be confirm that intake location is not a spawning and migration area for fishes and/or their prey. This will be re-assessed during detailed design phase.

Table 17: Aquatic flora and fishes of Guwahati

Common Names	Scientific Name
Flora- Aquatic	
Lotus	<i>Nelumbo nucifera</i>
Water hyacinth	<i>Eichhornia crassipes</i>
Fishes (Pisces)	
Rahu	<i>Labeo rohita</i>
Chital	<i>Chitala chitala</i>
Barali	<i>Wallago attu</i>
Sal	<i>Channa marulius</i>

80. There is very less riparian vegetation at the Intake site. In fact at the well point there is no underwater vegetation. Some of the riparian vegetation commonly found along the Brahmaputra river bank shown in **Table 18**.

Table 18: Some of the Riparian Vegetation Commonly Found Along the Brahmaputra River Bank

Common Name	Scientific Name
Dubari bon, Bermuda grass	<i>Cynodon dactylon</i>
Hardy Sugar Cane(meghela kuhiyaar)	<i>Saccharum arundinaceum</i>
Kans grass (Wild Sugarcane)	<i>Saccharum spontaneum</i>
Vetivergrass (Kuss kuss grass)	<i>Vetiveria zizanoides</i>
Ekara	<i>Phragmites karka</i>
Kasidora	<i>Lindernia Crustacea</i>
Creeping water primerose	<i>Ludwigia parviflora</i>
diamond flower	<i>Oldenlendia corymbosa</i>
Snake-Needle Grass	<i>Oldenlendia diffusa</i>
creoing rungia(Kharmor)	<i>Rungia repens</i>

Indian Laurel, Silver Grey Wood	<i>Terminalia Tomentosa</i>
Birina	<i>Themeda Villosa</i>

Source: Guwahati University

C. Economic Development Features

1. Land Use

81. Built up areas in Guwahati accounts for about 50% of the land. Lands categorized as unusable lands and vacant lands are presently categorized as green belt and water bodies/beels which accounts for about 30% of the area. Rest of the area is under public/semipublic use, special category lands and open spaces/parks.

82. All areas in the GMA have been designated as one of the 9 use-zones, which are residential, commercial, industrial, public- and semi-public, recreational, transportation, eco-sensitive zone, composite Use I and composite Use II. The Composite Use I includes residential, commercial, and public- and semi-public uses, whereas Composite Use II includes residential, commercial, public- and semi-public and industrial (existing) uses. Proposed land use break up in GMA is shown in **Table 19** and in **Figure 9**. Other than the forest part and vacant hill area distribution pipeline will be laid all along the road within urban residential and commercial set up of Guwahati city.

Table 19: Proposed Land Use Break-up in GMA

S. No.	Land Use Categories	Area in Ha. (excluding New Towns)	% of Developed area	Area in Ha. (including New Towns)	% of Developed area
1	Residential	8,646	31.92%	10,383	31.65%
2	Retail Commercial	360	1.33%	447	1.36%
3	Wholesale Commercial	81	0.30%	417	1.27%
4	Industrial	518	1.91%	918	2.80%
5	Public and Semi-Public	3,270	12.07%	3,606	10.99%
6	Composite Use I	814	3.01%	814	2.48%
7	Composite Use II	300	1.11%	841	2.56%
8	Recreation & Open Space	3,324	12.3%	3,728	11.0%
9	Transportation	2,853	10.53%	3,407	10.39%
10	Eco-Sensitive / Eco Friendly Zone	6,919	25.5%	8,245	26.0%
	Total	27,085	100%	32,806	100%

(Source: Master Plan for Guwahati, 2009)

83. As per the design plan, intake and WTP will be constructed within available Govt. land. At present for construction of intake pump house 0.14 ha of land and for WTP about 2.9 ha land is available at Kharguli and Sunshali respectively. Resettlement Plan will indicate land transfer issues.

84. Land use along the proposed pumping mains from intake to WTP is shown in **Table 20** below.

Table 20: Land use from Intake to WTP

S. No.	Item	Land Use	Length in (meter)
1	Intake Well	River	60
2	Raw water pumping	Green belt	52
3	Raw water pumping	Hill	590
4	Raw water pumping	Residential	1300
4	Raw water pumping	Hill	298
			2300

2. Trade and Commerce

85. Guwahati has the largest wholesale and retail market in the North Eastern region. The city has over 57,000 trade establishments (based on 2002 to 2003 data). All the trade establishments are registered by GMC.

3. Major Markets

86. Fancy Bazaar and Paltan Bazaar are the major market centers in the city. Fancy Bazaar is the largest wholesale and retail market in the entire North Eastern Region. All types of commodities from food grains, vegetables, fruits, household grocery items, hardware, and retail goods like clothes and stationeries are sold in this market. Paltan bazaar is the second largest market in Guwahati dealing mainly in automobile parts, tools and machineries, hardware. Besides, it is also the largest transport hub in the North Eastern region, where the Inter State Bus Terminus is located.

4. Industry

87. Guwahati is one of the major industrial centers of Assam and the North Eastern Region. The location of the Northern Frontier Railway Headquarters, Guwahati Oil Refinery at Noonmati and other heavy- and medium-size petrochemical industries have added industrial impetus to the city. Ancillary industries to the refinery like the Assam Carbon and India Carbon have also developed. There are 507 industrial units located in and around Guwahati in the industrial estates. The industrial estates are managed by the Directorate of Industries. The Assam Industrial Development Corporation is located at Banda, Bamunimaidan, North Guwahati, Rani -South and Amingaon areas.

88. Since 1971, Guwahati has also become a tea auction center, the second of its kind in India next to Kolkata.

89. There is no houses nearby/ impact zone of the intake and WTP. The existing system will maintain in all respect as well as due to Construction of Intake as well as WTP. Socio economic condition of the area will be improved and entire population will get fresh potable water under any circumstances. Considering the Boating, fishing & other existing users both upstream & downstream will not be affected or obstructed.

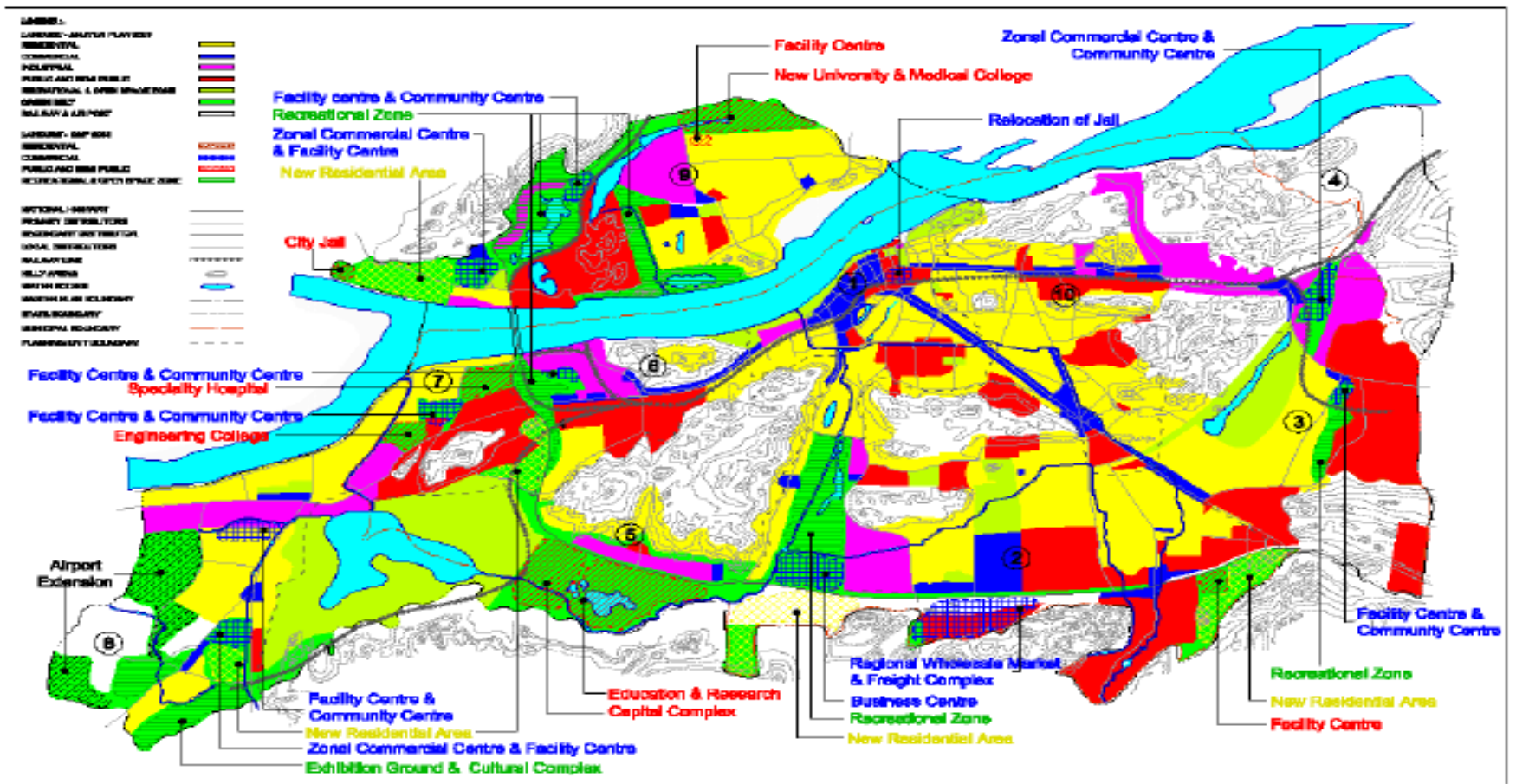


Figure 9: Proposed Land Use Plan of Guwahati

5. Physical Infrastructure

90. **Water Supply.** The primary source of water for Guwahati is the Brahmaputra River, which has flow of about 4,500 cubic meters per second. River Brahmaputra can provide as much as 78.1 billion cubic meters (or 78,100 billion liters/day) of water during monsoon and 56.12 billion cubic meters (or 56,120 billion liters/day) in non-monsoon days. The level of water remains at 48.17 meters above mean sea level for 50% of the monsoon season which lasts around 150 days. The capacity of the proposed Southeast Guwahati water intakes from the river is about 104 MLD while the proposed WTP capacity under the sub project is 98 MLD. The water supply to the city is provided by the three independent organizations namely the GMC, the APHED and the AUWSSB through their respective systems. Collectively, these systems provide potable water to only 30% of the city population. The total installed capacity water generation under GMC area is around 98 MLD considering the capacities of the treatment plants at Panbazar, Patpabhri and Hengrabari. However, the total water produced is only 79 MLD. The level of service, in terms of per capita water availability varies with 113 lpcd in the eastern part of the city and 60 lpcd in the western part. The remaining parts of GMA are dependent on tube wells, which have reported increase in iron and fluoride concentrations.

91. **Sewerage and Sanitation.** GMA does not have an integrated sewerage system except for certain establishments having their own independent systems such as colonies managed by the railway and defense authorities and the Indian Oil Corporation. In the absence of an organized system, septic tanks with or without soak pits are the most prevalent mode. Given the high subsoil water table in all but the hilly portions of the GMA, the soak pits are non-functional, thereby polluting the groundwater. In the low income areas, specifically in the 26 designated slum areas, most of the wastewater is discharged into the Bharalu River which finally drains into the Brahmaputra River. A drainage canal leading to River Brahmaputra has been noted upstream of the water intake however site inspections conducted in March and May 2011 show that the flow from this drainage is low and insignificant as compared to the flow of the river.

92. **Storm Water Drainage.** GMA can be divided into six drainage basins. The wetlands and other water bodies in GMA collectively act as the receptors of storm water during the monsoons. The natural drainage system in the GMA has been impaired due to unplanned development, encroachment onto natural wetlands and low-lying areas, blocking of the water courses and drainage channels, and compounded by disposal of solid wastes into these systems. Further, during monsoon, the water level of the Brahmaputra River sometimes, is higher than the ground level of the city areas, thereby inhibiting the natural flow of the city storm water into the river, further complicating the drainage problem in the city. The frequent water logging has been attributed to several reasons cited as under: (i) undulating topography;(ii) inadequacy of natural and artificial drains in carrying the storm water due to their narrowness and a rise in their bed level; (iii) encroachments over the low lying areas by new settlers on either side of the natural drains which has blocked the natural flow of the flood water to the drains; (iv) construction of buildings and roads over the manmade drains; (v) indiscriminate cutting and quarrying of hill slopes for filling up of low lying areas results in sheet wash and blockage of channels; (vi) most of the original swamps and natural water reservoirs are filled up for residential, industrial or institutional purposes. Consequently, the rain water spread over the built up areas causes flash flood; and (vii) rising of the ground water table with the rising of the Brahmaputra reduces the rate of percolation.

93. **Solid Waste Management:** Guwahati generates Solid Waste of 550 to 600 tons per day @ 436 to 478 gms per capita/day. Guwahati waste Management Company (P) Ltd at present manages to collect process & dispose as per Govt. of India Municipal Solid Waste Handling rules (MSWHR, 2000) drawn 90% of the waste generated, are collected. Segregation at source is not done properly. The collected waste include domestic (55%), commercial (18%), street sweeping and drain cleaning (15%) & rest are other dykes of wastes. Street cleaning is done by 800 sweepers covering a total road length of 639 km and 270 workers for drain cleaning. The organic waste processing capacity for the MSW facility is only 50 tons/day which much less than the actually needed i.e. between 150 to 200 ton per day. The number of various equipment used for the facility for collection are, 27 nos., dumper placers, 4 nos. open trucks, 3 nos compactor, 58 auto tripper, 2 nos. JCB, 1 no small JCB, 1 no bulldozer, 2 nos EX70, 1 no EX70, 350-Tricycles, and 370 nos. of metal bins and around 1000 sweepers are used for door to door collection.

94. **Transport.** The total road length of Guwahati is 1145.9 km. GMC takes up development of about 20 km of roads every year. This works out to a road density of 43 km/sq.km. There are two major roads within the city with a length of 60 km and has an average width of 20 m. off street parking is found to be inadequate in the city. Pedestrian facilities are found to be poor and there are street vendors blocking the traffic causing congestion. Movement of goods vehicles and non-motorized transport also add to the congestion. Condition of roads for both major and minor are classified to be poor as per ULB and Line Department Survey.

95. Guwahati has public transport system run by private operators since 1961. At present, it operates on 17 routes covering almost the entire city. Eight new routes would be opened shortly. The Assam State Transport Corporation also operates city bus service in Guwahati but it covers the main routes and has limited frequency.

96. While the demand for transportation services in Guwahati has increased rapidly, supply is lagging. The GMA is constrained in terms of road space and alternative routes and as a result, severe traffic congestion problems have developed. Other issues include existence of choke points on the arteries, poor geometry of intersections, overflow of on-street parking onto ROW, presence of bus and truck terminals in densely traveled areas and inadequate attention to traffic management. Public transport system is poor, and there is a lack of mass public transport systems. Absence of a comprehensive traffic and transport plan to identify the sectoral priorities and vision for the sector, that shall enable phasing of the investments required is identified as a major gap.

D. Social and Cultural Features

1. Area and Population

97. The total area of Guwahati under the jurisdiction of GMC boundary is 216 sq km and that of Guwahati Metropolitan Development Authority (GMDA) is 262 sq km. **Table 21** gives the population of Guwahati within and outside the municipal area.

Table 21: Guwahati: Population, 2011

Urban Unit	Details
Within Municipal Limits	1037011
Outside Municipal Limits	216927
Total Master Plan Area	1253938

Source "Census of India 2011 Assam"

2. Population Growth

98. **Table 22** gives the population growth rate in Guwahati. The growth rate after a steep decline in 1981-91 has again shown a rapid increase in 1991-2001. The growth rate of population outside the municipal area has shown a consistent trend.

Table 22: Guwahati: Annual Average Growth Rate of Population (%)

Urban Unit	1971-81	1981-91	1991-01	2001-11
Within Municipal Limits	16.1	0.6	3.3	28.33
Outside Municipal Limits	2.4	3.9	3.2	

Source: Census of India, Rural-Urban Distribution of Population, and Provisional Population Totals of Respective States, 2011

99. A very high proportion of population (24%) in Guwahati is migrants. Being a regional center, all major facilities are housed in this city. It serves as a hinterland to the whole of the North Eastern Region. The literacy rate in Guwahati has shown an improvement from 70.6% in 1991 to 77.8% in 2001. The share of scheduled tribes is comparatively lower as compared to other project cities. The share of Schedule caste (SC) population to total population is 6.3% and of ST is 4.1% as per census.

3. Health

100. With the lack of sanitation facilities, poor coverage of the drinking water supply and stagnant water there are a large number of water borne health risks in Guwahati. Records from the Assam Department of Health illustrate these concerns very well. Often diarrheal diseases go unreported and only the more serious cases merit attention. Even then the patterns identified show the presence of these diseases throughout the year. This could be attributed to the consumption of contaminated water, poor hygiene and unsanitary living conditions as all these reported cases in 2006 shows very high incidence of enteric fevers in June, the period when the monsoon is present in its full fury in the city. This perhaps may also be due to contamination of the drinking water sources with sewage and waste. This is possible in areas where water logging would be leading to contamination of potable water in vulnerable sections of the water supply network. The classification 'enteric fever' would include typhoid cases. Contamination of domestic water supplies occurs through many routes. The lack of a proper sewerage system has implications on water quality.

101. According to a study on the North East, of the 16 genera of mosquitoes found in the region 15 are found in Assam. While not all of them may find suitable habitats in Guwahati or be carriers of disease, the present unsanitary conditions can make an appropriate habitat for some of them. Malaria and Japanese encephalitis are the 2 water vector diseases the city authorities are monitoring. There have been a few deaths reported due to malaria.

4. Tourism

102. Guwahati has a number of temples, which are important tourist destinations. Some of these are the (i) Kamakhya temple on top of the Nilachal hills that is an important center for tantric form of Hinduism and Saktism; (ii) Umananda on the peacock island, in the middle of the Brahmaputra; and (iii) Nabagraha and Sukleshwar are notable places of Hindu pilgrimage. Other places of tourist importance in Guwahati are Bhuvaneshwari Temple, Vasistha Ashram, Balaji temple, Planetarium, the State Museum, Science Museum, State Zoological Park cum Botanical Garden, and Srimanta Sanakardeva Kalashetra. The number of domestic tourists has increased considerably while foreign tourist inflow has remained constant in the past three years.

5. Slums

103. There are nine slums in the GMC area, all of which are notified. Four slums are on private lands, and five are on Government lands. All the slums occupy 77,300 sq. meters of lands. About 2% of the city's population resides in slums.

6. Sensitive Receptors

104. There are number of sensitive receptors mostly educational institutes are located nearby the proposed pumping mains (approx 2230 m). **Table 23** shows the list of sensitive receptors along the pipeline zones. During construction, safety arrangement needs to be maintained at those locations.

Table 23: Sensitive Receptors Nearby the Project Site

Sl. No.	Sensitive Area	Location
1	Kendra Vidyalaya	Approximately 1.0 km from IOCL refinery gate, Sector - 1(Intake site)
2	Chunsali High School	Approximately 1.2 km from IOCL refinery gate, Sector - 1
3	Noonmati Public school & Chunsali Sonalipur Namghar sector – 1	Approximately 1.5 km from IOCL refinery gate, Sector - 1
4	Chunsali Ramsa hill (Prathamc Parishad Kendra adjacent to Janta hindi school)	Approximately 2.1 km from IOCL refinery gate, Sector - 1
5	Anganbari Kendra	Approximately 2.2 Km from IOCL refinery gate, Sector - 1

IV. ANTICIPATED IMPACTS AND MITIGATION MEASURES

105. This section of the IEE reviews possible subproject-related impacts, in order to identify issues requiring further attention and screen out issues of no relevance. ADB SPS (2009) require that impacts and risks will be analyzed during pre-construction, construction, and operational stages in the context of the subproject's area of influence. As defined previously, the primary impact areas are (i) Intake, WTP sites and along the raw water pumping mains; (ii) main routes/intersections which will be traversed by construction vehicles; and (iii) quarries and borrow pits as sources of construction materials. The secondary impact areas are: (i) entire Guwahati area outside of the delineated primary impact area; and (ii) entire Guwahati district in terms of over-all environmental improvement.

106. The ADB Rapid Environmental Assessment Checklist for Water Supply was used to screen the subproject for environmental impacts and to determine the scope of the IEE investigation. The completed Checklist is enclosed in **Appendix 5**. The proposed subproject component will interact physically with the environment. Contractor to reassess findings of the REA upon completion of detailed design.

107. In the case of this subproject (i) most of the individual elements are relatively small and involve straightforward construction and operation, so impacts will be mainly localized; (ii) most of the predicted impacts are associated with the construction process, and are produced because that process is invasive, construction of intake through well sinking, involving excavation and earth movements etc; and (iii) mostly being located in the built-up areas of Guwahati city (except intake location), will not cause direct impact on biodiversity values. The subproject will be in properties held by the local government and access to the sub projects locations is thru public ROW and existing roads.

A. Pre-construction: Location and Design

108. **Design of the Proposed Components.** The Central Public Health and Environment Engineering Organization (CPHEEO) manual suggests a design period of 15/30 years. The water supply components were designed following the recommendations of the CPHEEO Manual for Water and Water Supply. Design consideration as per CPHEEO Manual on water supply and treatment is included in **Appendix 6**.

109. Impacts arise from the design of the project including the technology used and scale of operation.

110. Impacts associated with the planning mainly depend on the site selection. Location impacts include on-site biophysical array and encroachment / impact either directly or indirectly on adjacent environments. It also includes the impacts on the people who might lose their livelihoods due to the development of the proposed site.

111. Design considerations with point wise conditions stipulated in the CTE in the form of compliance attached as **Appendix 1**.

112. **Encroachment into private properties, forestland and cutting of trees and damage to vegetation.** Construction works in the Guwahati city area, the raw water rising main pipelines are to be laid on or along the roads in the un-used vacant land adjacent to the roads within the ROW (plane or hill). In narrow roads where there is no vacant land adjoining road, pipeline will be buried within the roadway. However, considering the narrow and busy lanes, temporary impacts are likely during construction stage.

113. No private land acquisition is required for construction of intake structure allied components and Water Treatment Plant.

114. The construction of water treatment plant, intake, pumping mains will not fall within the forest area. Forest Clearance from the Assam Environment and Forest Department will not be required However, the following measures are to be implemented to minimize any impacts:

- (i) Identify and assess the livelihood and resettlement impacts, including temporary impacts, through resettlement planning process. Implement measures as recommended by the resettlement plan;
- (ii) Materials required for the work should be stored in proper area and transported to the site as and when required manually; and
- (iii) No equipment generating excessive noise shall be used for construction.

115. As per preliminary design tree cutting is not required for the project. Location and design impacts are mitigated in design through selection of intake location within Brahmaputra River. Intake structure is selected at comparatively high water depth area (selected after bathymetric survey) and mitigation measures will be applied as per requirement to minimize the impact on ecosystem. Considering the vastness of river Brahmaputra, its flow and the quantity of drawl of water from the River including the Intake structure, this interference/ disruption of ecosystem functions are unlikely. Mitigation measures have been developed to reduce all negative impacts (if any) to acceptable levels. These were discussed with specialists responsible for the engineering aspects, and as a result some measures have already been included in the designs of the infrastructure.

116. **Site selection of sources of materials.** Extraction of materials can disrupt natural land contours and vegetation resulting in accelerated erosion, disturbance in natural drainage patterns, ponding and water logging, and water pollution. To mitigate the potential environmental impacts, locations of quarry site/s and borrow pit/s (for loose material other than stones) would be included in the design specifications and on plan drawings. Priority would be, sites already permitted by Mining Department. If other sites are necessary, these would be located away from population centers, drinking water intakes and streams, cultivable lands, and natural drainage systems; and in structurally stable areas even if some distance from construction activities. It will be the construction contractor's responsibility to verify the suitability of all material sources and to obtain the approval of the DMSC/ GMC. If additional quarries will be required after construction is started, then the Construction Contractor shall use the mentioned criteria to select new quarry sites, with written approval of GMC. Selected quarry areas are listed below.

Table 23: Selected Quarry Areas

Name of Quarry	Material	Road	Distance in km		Total Distance (in km)	
			Surfaced	Unsurfaced	Surfaced	Unsurfaced
Barpathar Quarry	Boulder, Stone Aggregate & stone dust	Quarry to Basistha Temple	Surfaced	2.00	Surfaced	22.00
			Unsurfaced	0.00		
			Katcha	0.00		
		Basistha Temple To Site	Surfaced	20.00	Unsurfaced	0.00
			Unsurfaced	0.00		
			Katcha	0.00		
TOTAL LEAD (km) =					22.00	
Name of Quarry	Material	Road	Distance in km		Total Distance (in km)	
Nineth Mile Earth Quarry	Soil for roadworks	Quarry to Khanapara	Surfaced	5.00	Surfaced	20.00
			Unsurfaced	0.00		
			Katcha	0.00		
		Khanapara	Surfaced	15.00	Unsurfaced	0.00

Name of Quarry	Material	Road	Distance in km		Total Distance (in km)	
			Unsurfaced	0.00		
		to Site	Katcha	0.00		
TOTAL LEAD (km) =					20.00	
Name of Quarry	Material	Road	Distance in km		Total Distance (in km)	
Saygaon , kukurmara river bank of Bramhaputra	Sand	Kukurmara to Site	Surfaced	70.00	Surfaced	70.00
			Unsurfaced	0.00		
			Katcha	0.00		
TOTAL LEAD (km) =					70.00	
Name of Quarry	Material	Road	Distance in km		Total Distance (in km)	
Guwahati paltan Bazar	Cement Steel Pipe,brick	Paltan Bazar to Site	Surfaced	21.00	Surfaced	21.00
			Unsurfaced	0.00		
			Katcha	0.00		
Total Lead (km) =					21.00	

B. Construction Impacts

117. Construction and operation are the two activities in which the project interacts physically with the environment, so they are the two activities during which the environmental impacts occur. Construction impacts are associated with site cleaning, earth works, physical construction related materials movements and works, machinery, vehicles and workers. It also includes the erosion, dust, noise, traffic congestion, water pollution, and waste production associated with the construction activities.

1. Construction Method

118. As far as possible, the raw water rising mains will follow the alignment within the existing ROWs. Pipelines following road alignment (in plane and mostly hill) will be buried in trenches with minimum of 1.2 meter (m) clear cover within the ROW, on or adjacent to the road. The average trench width will be 1500 mm and average depth will be 2500 mm.

119. The trenches will be excavated using heavy equipment such as soil excavator, backhoes. Excavation in hard surfaces like cement concrete roads will be supplemented by pneumatic drill. Excavated soil will be placed nearby and a bed of sand or gravel - obtained from local quarries, will be placed at the bottom of the trench. Pipes (brought to site on trucks and stored on nearby unused land) will be placed in the trench over the clean soil or sand bedding using a small rig. Pipes will be joined by hand, after which excavated soil will be replaced around and on top of the pipe manually.

120. Intake structure will be constructed within the river with consideration of maximum precaution. Structure will be constructed through well sinking. This work shall include construction of well sinking up to the rock level and it down through all kinds of sub-strata,

plugging the bottom, in accordance with the details shown as per the Contractor's design, approved drawings as per standard specifications and as per the directions of the Engineer-In-Charge and as per IRC-78 and IRC-6-2000 or latest publication. Well shall be circular in shape and two wells shall be proposed to accommodate the pumping machinery.

121. To facilitate sinking of well, steel cutting edge is fabricated and connected to a concrete well curb of required shape. On top of the well curb, adequate height of well staining is cast in stages as sinking progresses and the process of sinking is carried out. After a portion of the well has been sunk, another height of well staining is casted on top of the previous section and further sinking carried out. This process is continued till the bottom level of the well reaches rock level / foundation level shall be as per approved drawings. At the top of the well staining, floor slab and pump house to be constructed as per approved design and drawing of the Contractor. Controlled blasting if required and if permitted may have to be resorted to in order to facilitate sinking through difficult strata, such as boulders and rocks etc. The Contractor shall obtain all necessary permission and abide by all rules and regulations thereto. The Contractor shall be liable for all consequences arising out of blasting.

122. **Use of Divers.** Use of divers may be made both for the sinking purpose like removal of obstructions, rock blasting and for inspection. All safety precautions shall be taken as per acceptable safety code for sinking with divers or any statutory regulations in force. Only persons trained in the diving operation shall be employed and shall be certified to be fit for diving by an approved doctor. They shall work under expert supervision. The diving kit and other equipment shall be of acceptable standard and certified to this effect by an approved independent agency. It shall be well maintained for safe use.

123. An approach bridge shall be constructed from river bank to intake well and also in between raw water pumping stations to facilitate access for maintenance, laying of raw water pumping main, electrical power cable to be able to drive out to the intake structure, to transport the raw water pumps, pipes, electrical items and allied works. The bridge shall be constructed at an elevation so that the roadway elevation is one meter above the high water level of 100 year return period. Approximate length of the bridge will depend on the approved pin pointed location of the intake structure. The bridge shall be constructed on R.C.C pillars designed to support a flatbed type truck that is long enough to transport and can support the weight of a raw water pump and motor. The raw water pump header described above shall also be supported on this bridge structure. Detailed information regarding the bridge will be included in the updated IEE.

124. For Water Treatment Plant standard construction method like Construction of Cascade Aerator, Raw water inlet channel, Flash mixers, Flocculation unit, Plate settler (Clarifier), Rapid sand filters, Back wash reservoir, Chemical House and dosing system, Chlorination unit, Sludge handling and disposal unit and clear water reservoir and clear water pumping station will be considered.

125. Small brick rooms will be built alongside WTPs to house the chlorination plant. The foundation will be dug and aggregate and concrete poured in to create the floors, after which the brick walls and roof materials will be added by hand. Chlorine cylinders and other equipment (including flow-meters) will be brought in on trucks and offloaded and attached by hand. A small cavity for the chlorination sump and trenches for pipe-work will also be dug, and the sump will be constructed from concrete and brick.

126. Out of the total working components moderate impact will be resulted during construction of intake structure within River Brahmaputra. Detail impact and mitigation will be

covered in respect to,

- (i) Impact on aquatic ecosystem due to construction of intake, approach bridge for raw water transfer;
- (ii) Impact on water quality- temporary turbidity during construction of intake and bridge; and
- (iii) Impact on river bed sediment- removal of part of sediment within intake structure.

127. Some mitigation measures may be considered, (i) install intake facilities during low flow periods and tidal stage; (ii) incorporate appropriate erosion and sediment control best management practices such as turbidity curtains, silt barriers, or silt curtains; and (iii) have an equipment spill and containment plan and appropriate materials on-site.

128. During sinking of well within the river following design precautions have to be considered.

129. **Precautions during Sinking of well within River**

- (i) When the wells have to be sunk close to each other and clear distance between them is not greater than the diameter of wells, sinking shall be taken up on all wells and they shall be sunk alternately so that sinking of wells proceeds uniformly. Simultaneous and even dredging shall be carried out in the wells in such a manner that the difference in the levels of the sump and cutting edge in the adjacent wells does not exceed half the clear gap between them. Plugging of all the wells shall be done together
- (ii) During sinking of dumb-bell or double D-shaped wells, the excavation in both the dredge holes should be carried out simultaneously and equally.
- (iii) Bore chart shall be referred to constantly during sinking for taking adequate care while piercing different types of strata. The type of soil as obtained during the well sinking should be compared with bore chart so as to take prompt decisions.
- (iv) Before seasonal floods, all wells on which sinking is in progress shall be sunk to sufficient depths below the designed scour level. Further, they shall be temporarily filled and plugged so that they do not suffer any tilt or shift during the floods.
- (v) The dredged / excavated material shall not be allowed to accumulate over the well. It shall be dumped and spread, as far away as possible, and then continuously and simultaneously removed, as directed by the Engineer. In case the river stream flows along one edge of the wellbeing sunk, the dredged material shall not be dumped on the dry side of the bank but on the side on which the river current flows.
- (vi) Very deep sump shall not be made below the well curb, as it entails risk of jumping (sudden sinking) of the well. The depth of sump shall be generally limited to one-sixth of the outer diameter / least lateral dimension of the well in plan. Normally the depth of sump shall not exceed 3.0 m below the level of the cutting edge unless otherwise specially permitted by the Engineer.
- (vii) In case a well sinks suddenly with a jerk, the steining of the well shall be examined to the satisfaction to the Engineer to see that no damage has occurred to it.
- (viii) In pneumatic sinking, the well shall not, at any time, be dropped to a depth greater than 500 mm by the method of "blowing down".

- (ix) Dewatering shall be avoided if sand blows are expected. Any equipment and men working inside the well shall be immediately vacated out of the well as soon as there are any indications of a sand blow.
- (x) Sand blowing in wells can often be minimized by keeping the level of water inside the well higher than the water table and also by adding heavy knowledge.
- (xi) In soft strata prone to settlement / creep, the construction of the abutment wells shall be taken up only after the approach embankment for a sufficient distance near the abutment has been completed.

2. Construction Impacts

130. **Sources of Materials.** Certain amount of gravel, sand, and cement will be required for this subproject. The construction contractor will be required to:

- (i) Use material sources permitted by government;
- (ii) Verify suitability of all material sources (as identified by DBO contractor) and obtain approval of Design, Management and Supervision Consultant (DMSC); and
- (iii) Submit to DMSC on a monthly basis documentation of sources of materials.

131. **Air Quality.** Emissions from construction vehicles, equipment, and machinery used for excavation and construction will induce impacts on the air quality in the construction sites. Anticipated impacts include dusts and increase in concentration of vehicle-related pollutants such as carbon monoxide, sulfur oxides, particulate matter, nitrous oxides, and hydrocarbons) but temporary and during construction activities only. To mitigate the impacts, construction contractors will be required to:

- (i) Consult with DMSC on the designated areas for stockpiling of clay, soils, gravel, and other construction materials;
- (ii) Excavation earth will be carried out along with development of WTP land (presently low land) so that dug/ overburden material is used immediately,
- (iii) Avoiding the need to stockpile on site;
- (iv) Damp down exposed soil and any stockpiled on site by spraying with water when necessary during dry weather;
- (v) Use tarpaulins to cover sand and other loose material when transported by trucks; and
- (vi) Fit all heavy equipment and machinery with air pollution control devices which are operating correctly
- (vii) As per CTE condition Monthly Ambient Air Quality Monitoring report is to be submitted to the pollution board.

132. **Surface Water Quality.** Guwahati receives high intensity rains during monsoons and there are a number of natural and man-made drainage channels crisscrossing the city to carry the runoff safely. Runoff from the excavated areas and material and waste soil stocks likely to contain silt, and this silt runoff will deteriorate the water bodies by silting. Large-scale silting is likely to lead to flooding. This impact will however be considered only during rainy season.

133. Mobilization of settled silt materials, run-off from stockpiled materials, and chemical contamination from fuels and lubricants during construction works can contaminate surface water quality. These potential impacts are temporary and short-term duration only and to ensure these are mitigated, construction contractor will be required to:

- (i) Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets;
- (ii) Prioritize re-use of excess spoils and materials in the construction works. If spoils will be disposed, consult with PIU/DMSC on designated disposal areas;
- (iii) Install temporary silt traps or sedimentation basins along the drainage leading to the water bodies;
- (iv) Place storage areas for fuels and lubricants away from any drainage leading to water bodies;
- (v) Dispose any wastes (sediments due to well sinking) generated by construction activities in designated sites;
- (vi) Conduct surface quality inspection according to the Environmental Management Plan (EMP); and
- (vii) As per CTE condition water quality in & around the site (water intake at Brahmaputra) to be submitted to the Pollution Control Board before and during construction.

134. During construction of intake well there may be temporary deterioration of water quality (only increase of turbidity) during well sinking and piling work for construction of Pipe Bridge.

135. Since there will be slow sinking process of intake structure there is practically no chance of increase in turbidity. Only slight turbidity will be increase for a short period during construction of pipe bridge pillar. This will be reassessed during detailed design stage". Mitigation measures shall include (i) install intake facilities during low flow periods and tidal stage; (ii) incorporate appropriate erosion and sediment control best management practices such as turbidity curtains, silt barriers, or silt curtains; (iii) have an equipment spill and containment plan and appropriate materials on-site; (iv) monitoring of turbidity prior to start of construction works and on a regular basis during construction activity (turbidity can be measured daily using a Secchi disk and monitoring indicator should be no increase in turbidity of surrounding areas).

136. **Noise Levels.** There are no health facilities, scheduled or unscheduled historical, archaeological, paleontological, or architectural sites near the construction sites. However, construction works will be on settlements, along and near schools, and areas with small-scale businesses. The sensitive receptors are the general population in these areas. Increase in noise level may be caused by excavation equipment, and the transportation of equipment, materials, and people. Impact is negative, short-term, and reversible by mitigation measures. The construction contractor will be required to:

- (i) Plan activities in consultation with DMSC so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance;
- (ii) Require horns not be used unless it is necessary to warn other road users or animals of the vehicle's approach; and
- (iii) Minimize noise from construction equipment by using vehicle silencers, fitting jackhammers with noise-reducing mufflers, and portable street barriers the sound impact to surrounding sensitive receptor.
- (iv) Maintain maximum sound levels not exceeding 80 decibels (dbA) when measured at a distance of 10 m or more from the vehicle/s.

137. **Generation of Spoil/ river bed sediment and disposal.** It is estimated that approx.

2400 m³ of intake well inside earth (river sediment) will be generated after sinking of intake well. In case of disposal of the earth within the river turbidity will be increased.

138. The following measures should be taken up,

- (i) Not to dispose any construction materials in river which may pollute the river water and aquatic fauna;
- (ii) Spoil Disposal Management Plan (SDMP) will be prepared and implemented to minimize the potential effects of sediment plumes on aquatic habitats (Ref Table 27 impact mitigation at construction stage);
- (iii) Immediate collection and disposal of excess river earth material at low laying area near ferry ghat or use for bank protection or use in construction of approach road; and
- (iv) Details of the proposed Water Quality Monitoring Program will be included in this management plan.

139. **Existing Infrastructure and Facilities.** Excavation works can damage existing infrastructure/utilities located alongside roads. It is therefore important that construction contractors will be required to:

- (i) Obtain from DMSC the list of affected utilities and operators (line agency);
- (ii) Prepare a contingency plan to include actions to be done in case of unintentional interruption of services

140. There are few structures existing outside the boundary of WTP i.e. outside the impact zone.

141. **Landscape and Aesthetics.** The construction works will produce excess excavated earth materials, and solid waste such as removed concrete, bitumen, packaging materials, empty containers, spoils, oils, lubricants, and other similar items. These impacts are negative but short-term and reversible by mitigation measures. The construction contractor will be required to:

- (i) Prepare and implement Waste Management List;
- (ii) Avoid stockpiling of excess excavated soils;
- (iii) Coordinate with GMC for beneficial uses of excess excavated soils or immediately dispose to designated areas;
- (iv) Recover used oil and lubricants and reuse or remove from the sites;
- (v) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas;
- (vi) Remove all wreckage, rubbish, which are no longer required;
- (vii) Request DMSC to report in writing that the necessary environmental restoration work has been adequately performed before acceptance of work; and
- (viii) Preliminary estimate indicates that 3540 Cubic meter of excess earth will be generated from the excavation during laying of pumping mains.

142. As depth of filling at WTP site is 4m high covering 28,942 sqm areas, so the excavated material from Intake, Raw Water Pumping Mains (RWPM), can be used for filling up of land at proposed WTP site, presently which is low land or will be used for construction of approach road. It has been ascertained that the excavated materials will be suitable for reuse and fill in WTP, the site will require huge filling (112,000 m³).

143. **Landslides.** At some of the areas raw water pumping mains will be laid in and within hill slopes, the excavation activities for laying of part of pipelines through hills can lead to slope disturbance leading to soil slip and landslide in the affected area if proper protection measures are not taken during construction activities. Excavation of trenches during monsoon season can also add to the problem. However, this can be minimized by observing necessary protection measures as suggested below:

- (i) Identify the landslide susceptible areas within the subproject alignment during design stage;
- (ii) Avoid excavation in hilly /susceptible areas by aligning the pipeline above the ground; take appropriate protection measures against the landslide/landslip before start of the excavation at steep slopes susceptible to landslide;
- (iii) Stagger the work in small sections;
- (iv) Ensure safe stacking of the construction materials and excavated earth over flat Surface and provide bund around the stacked area;
- (v) Remove the excess soil immediately from the site;
- (vi) Minimize on-site storage. Bring construction sand/gravel only when required; and
- (vii) Do not carry out excavation works during monsoon.

144. **Surface and Groundwater Quality.** Another physical impact that is often associated with excavation is the effect on drainage and the local water table if groundwater and surface water collect in the voids. To ensure that water will not pond in pits and voids near subproject location, the construction contractor will be required to conduct excavation works on non-monsoon season.

145. **Accessibility.** Some of the roads in the subproject sites are narrow thus excavation and trenching works for laying of pipes along ROWs, hauling of construction materials and operation of equipment onsite can cause traffic problems. Potential impact is negative but short term and reversible by mitigation measures. The construction contractor will be required to:

- (i) Plan transportation routes so that heavy vehicles do not use narrow local roads, except in the immediate vicinity of delivery sites;
- (ii) Schedule transport and hauling activities during non-peak hours;
- (iii) Locate entry and exit points in areas where there is low potential for traffic congestion;
- (iv) Keep the site free from all unnecessary obstructions;
- (v) Drive vehicles in a considerate manner;
- (vi) Coordinate with Guwahati Traffic Office for temporary road diversions and with for provision of traffic aids if transportation activities cannot be avoided during peak hours;
- (vii) Notify affected sensitive receptors by providing sign boards informing nature and duration of construction works and contact number concerns/complaints; and
- (viii) Provide planks across trenches in front of businesses, and ensure works are completed quickly to avoid disruption.

146. **Socio-Economic - Income.** Construction works will impede the access of residents and businesses to specific sites. The potential impacts are negative and moderate but short-term and temporary. The construction contractor will be required to:

- (i) Leave spaces for access between mounds of soil;
- (ii) Provide walkways and metal sheets where required to maintain access across for people and vehicles;
- (iii) Increase workforce in front of critical areas such as institutions, place of worship, and schools;
- (iv) Consult businesses and institutions regarding operating hours and factoring this in work schedules; and
- (v) Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints.

147. **Socio-Economic - Employment.** Manpower will be required during the 36 months construction stage. The final detailed implementation schedule will be provided in the updated IEE once the detailed design phase is completed. Construction phase can result to generation of contractual employment and increase in local revenue. Thus potential impact is positive and long-term. The construction contractor will be required to:

- (i) Employ majority of the labor force, or to the maximum extent, local persons within the 2-km immediate area if manpower is available; and
- (ii) If available, secure construction materials from local market.

148. **Occupational Healths and Safety.** Workers need to be mindful of the occupational hazards which can arise from working in height, within water and excavation works. Potential impacts are negative and long-term but reversible by mitigation measures. The construction contractor will be required to:

- (i) Designate a safeguard focal person and undertake safeguards orientation by PMU/PIU;
- (ii) Ensure H&S plan is easily understandable to workers and laborers. Keep in mind that this plan will be used on-site and workers/laborers may not always understand highly technical terms;
- (iii) Develop and implement site-specific Health and Safety (H&S) Plan, which will include measures such as: (a) excluding public from the site; (b) ensuring all workers are provided with and use Personal Protective Equipment; (c) H&S Training¹¹ for all site personnel; (d) documented procedures to be followed for all site activities; and (e) documentation of work-related accidents;
- (iv) Strict compliance of H&S plan and requirements of wearing personal protective equipment (PPE) during work hours;
- (v) Provide specific guidance for suitable PPE for every on-site work assignment;
- (vi) Ensure that qualified first-aid can be provided at all times. Equipped first-aid stations shall be easily accessible throughout the site;
- (vii) Provide medical insurance coverage for workers;
- (viii) Secure all installations from unauthorized intrusion and accident risks;

¹¹ Some of the key areas that may be covered during training as they relate to the primary causes of accidents include (i) slips, trips and falls; (ii) personal protective equipment; (iii) ergonomics, repetitive motion, and manual handling; (iv) workplace transport; and (v) legislation and responsibilities. Training can provide the foundations of competence but it does not necessarily result in a competent worker. Therefore, it is essential to assess staff competence to ensure that the training provided is relevant and effective. Supervision and monitoring arrangements shall be in place to ensure that training has been effective and the worker is competent at their job. The level of supervision and monitoring required is a management decision that shall be based on the risks associated with the job, the level of competence required, the experience of the individual and whether the worker works as part of a team or is a lone worker.

- (ix) Provide supplies of potable drinking water;
- (x) Provide clean eating areas where workers are not exposed to hazardous obnoxious substances;
- (xi) Provide H&S orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers;
- (xii) Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted;
- (xiii) Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas;
- (xiv) Ensure moving equipment is outfitted with audible back-up alarms;
- (xv) Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate; and
- (xvi) Disallow worker exposure to noise level greater than 85 dBA for a duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively.

149. Since during construction of intake worker should have to work within River, special precaution particularly using safety equipment and training on swimming and mitigation under emergency situation is necessary.

150. **Community Health and Safety.** Hazards posed to the public, specifically in high pedestrian areas may include traffic accidents and vehicle collision with pedestrians. In most of the cases location of project sites at isolated area, hence health and safety risk to community is the minimum. Potential impact is negative but short-term and reversible by mitigation measures. The construction contractor will be required to:

- (i) Plan routes to avoid times of peak-pedestrian activities;
- (ii) Liaise with DMSC in identifying risk areas on route cards/maps;
- (iii) Maintain regularly the vehicles and use of manufacturer-approved Parts to minimize potentially serious accidents caused by equipment malfunction or premature failure;
- (iv) Provide road signs and flag persons to warn of dangerous conditions, in case of location near the road;
- (v) Provide protective fencing around open trenches, and cover any open trench with metal planks during non-construction hours; and
- (vi) Develop and implement a traffic management plan.

151. **Work Camps.** Operation of work camps can cause temporary air and noise pollution from machine operation, water pollution from storage and use of fuels, oils, solvents, and lubricants. Potential impacts are negative but short-term and reversible by mitigation measures. Consultation with DMSC revealed that it is unlikely that work camps are required for this subproject. In the case that it will be needed, the construction contractor will be required to:

- (i) Consult with DMSC before locating project offices, sheds, and construction

- plants;
- (ii) Selection should be away from any water body;
- (iii) Minimize removal of vegetation and disallow cutting of trees;
- (iv) Provide water and sanitation facilities for employees;
- (v) Prohibit employees from cutting of trees for firewood;
- (vi) Train employees in the storage and handling of materials which can Potentially cause soil contamination;
- (vii) Recover used oil and lubricants and reuse or remove from the site;
- (viii) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas;
- (ix) Remove all wreckage, rubbish, or temporary structures which are no longer required; and
- (x) Request DMSC to report in writing that the camp has been vacated and restored to pre-project conditions before acceptance of work.

152. **Social and Cultural Resources.** For this subproject, except 2.3 km raw water pumping mains excavation will occur at specific isolated location (for e.g. WTP site) , so it could be that there is a low risk of such impacts. Nevertheless, the construction contractor will be required to:

- (i) Stop work immediately to allow further investigation if any finds are suspected;
- (ii) Inform DMSC if a find is suspected and take any action they require ensuring its removal or protection in situ; and
- (iii) Request DMSC or any authorized person with archaeological/historical field training to observe excavation.

C. Operation and Maintenance (O&M) Impacts

153. Presently three institutions are responsible for water supply in Guwahati City namely GMC, APHED, and AUWS&SB. AUWS&SB is mainly supplying water in the part of the central portion of Guwahati city. In the South Guwahati eastern zone only PHED is supplying water to some of the institutional consumers. GMC has the maximum coverage of residential consumers but not in the eastern zone.

154. The GMC has a Water Works Branch comprising about 155 staff headed by a superintending engineer and supported by a compliment of executive engineers, inspectors, pump operators, fitters, filter operators, electricians, valve regulators, mechanics, foremen, gang-men and other technical support staff. This represents a staff ratio of about 7 staff per 1,000 connections. However, this does not include the administrative, financial and accounting staff needed to operate and manage the water supply service but assigned in other branches of the local government. The actual staff/connection ratio is probably considerably higher.

155. The main O&M activities of the refurbished infrastructure will be detection and repair of leaks and pipe bursts. These are, however, likely to be minimal as proper design and selection of good quality pipe material should mean that leaks are minimal. Leak repair work will be similar to the pipe laying work as earlier explained. Trenches will be dug to reveal the leaking area; pipe will be removed and replaced if necessary.

156. Work will be executed through a Design built operate Contract (DBO) where contractor

will do the design & construction of the plant and further operation & maintenance, for a further period of 5 years after defect liability period of 12 months. It is presumed that there will no Environment impacts during the O&M period; however necessary precaution will be taken for handling chlorine and used oil. Also monitoring needs to be conducted for River water quality. Municipal Corporation needs to require its O&M contractor to:

- (i) Refill and re-compact trenches soil and backfilled sand will be removed to expose the leaking junction or pipe;
- (ii) Conduct work during non-monsoon period; and
- (iii) Cover or wet excavated material to prevent dusts.

157. **Recurrence of blockage and leakage problems.** Although impact is likely to be minimal due to new and well-designed efficient system, it should be ensured that leak detection and restoration time is minimized to the extent possible.

158. **Intake.** In Intake there shall be no entrapment and impingement of fishes and other aquatic animals in the O&M period. Under design consideration, a course screen of size 12mm X 12 (ss flat strip with bar spacing of 80mm c/c) shall be provided at each gate to prevent entering of fishes, invertebrates and large aspects into the well.

159. **Sludge Handling.** During operation of water treatment plant large volume of physical and chemical sludge will be generated. There will be 3 sludge/waste producing units. A part of existing settling tank/pond is proposed to be used as sludge settling/disposal tank from Pre-settling tank, for proposed WTP. Sludge cake, produced from both WTP, is proposed to dump/stack in the areas within WTP campus. This will be dried and kept on-site prior to disposal. As per bid condition DBO contractor will finalize the design and they will collect sludge from the treatment plant and dispose / use after due permission from PMU/ PIU. Before disposal testing will be carried out. Exact land is not yet selected for final disposal. If the landfill facility in Guwahati is not yet available by the time the WTP is operational, DBO contractor will include in the design sludge handling facility. All government permits on sludge disposal would be secured prior to the operation of the WTP.

160. The possible sludge management plan is shown below.

Table 24: Generation and Management of sludge from different units of WTP

Units producing major sludge	Type of sludge	Nature of sludge	Type of treatment	Sludge generation/ Size required	Final disposal	Remarks
Pre-settling tank	Physical	Muddy water	Settlement in tanks/ponds, will be acting as pre-settling tank within proposed WTP. Supernatant to be disposed to river by	961 m ³ /day= 50m x20m x1 m depth – 2 nos. at Sunshali area	1. Low lying area. No liner is required.	Only mother/parent material of river

Units producing major sludge	Type of sludge	Nature of sludge	Type of treatment	Sludge generation/ Size required	Final disposal	Remarks
			overflow arrangement from the tank.			
Plate/Tube settler (or Clariflocculator) followed by Thickener and then Centrifuge	Chemical	Sludge cake from Centrifuge. Liquid portion will be recycled to the following /next unit of Pre-settling tank	Dumping the sludge cake inside available area within existing WTP, over a layer of clay lining.	181 m ³ per day = 20mx10mx1m	1. Low lying area after proper clay lining. 2. To brick fields	Due to addition of Lime, alum, polyelectrolyte (non-toxic)
Filter back wash	Physical (mainly)	Dirty water	pH control for disposal to Brahmaputra River.	Channel for disposal to be designed during detailed design	River/ reuse	Solids in the filter back wash shall not be more than 100 ppm

161. Environmental issues associated with the WTP include: (i) solid waste; (ii) wastewater; (iii) hazardous chemicals; and (iv) air emissions.

162. **Solid Waste.** Solid waste residuals which may be generated by the WTP include process residuals, used filtration membranes, spent media and miscellaneous wastes. Process residuals primarily consist of settled suspended solids from source water and chemicals added in the treatment process, such as lime and coagulants/ polyelectrolyte. Pre-sedimentation, coagulation (e.g. with aluminum hydroxide [alum] or ferric hydroxide), and iron will produce sludge. Composition of the sludge depends on the treatment process and the characteristics of the source water, lime, and other organic compounds, microorganisms, etc. GMC needs to require its O&M contractor to:

- (i) Minimize the quantity of solids generated by the water treatment process through optimizing coagulation processes;
- (ii) Dispose of lime sludge by land application if allowed, limiting application rates to about 20 dry metric tons per hectare (9 dry tons per acre) to minimize the potential for mobilization of metals into plant tissue and groundwater¹²;
- (iii) Dispose of ferric and alum sludge by land application, if allowed and if such application can be shown through modelling and sampling to have no adverse impacts on groundwater or surface water (e.g. from nutrient runoff); and
- (iv) Potential impact on soil, groundwater, and surface water, in the context of protection, conservation and long-term sustainability of water and land resources, should be assessed when land is used as part of any waste or wastewater treatment system.

¹² Management of Water Treatment Plant Residuals, Technology Transfer Handbook," EPA/625/R-95/008, April 1996.

163. **Wastewater.** Wastewater from water treatment projects include filter backwash. These waste streams may contain suspended solids and organics from the raw water, dissolved solids, high or low pH, heavy metals, etc. GMC needs to require its O&M contractor to:

- (i) Land application of wastes with high dissolved solids concentrations is generally preferred over discharge to surface water subject to an evaluation of potential impact on soil, groundwater, and surface water resulting from such application;
- (ii) Recycle filter backwash into the process if possible; and
- (iii) Treat and dispose of reject streams, consistent with CPHEEO requirements.

164. **Appendix 2** shows the Indian standard for discharge of effluent in environment.

165. **Hazardous Chemicals.** Water treatment may involve the use of chemicals for coagulation, disinfection and water conditioning. For WTP that will use chlorine gas, GMC needs to require its O&M contractor to:

- (i) Store chlorine gas cylinder in cool, dry, and dark conditions for no more than one month, and use equipment constructed of corrosion-resistant materials;
- (ii) Minimize the amount of chlorination chemicals stored on site while maintaining a sufficient inventory to cover intermittent disruptions in supply;
- (iii) Develop and implement a prevention program that includes identification of potential hazards, written operating procedures, training, maintenance, and accident investigation procedures; and
- (iv) Develop and implement a plan for responding to accidental releases.

166. **Air Emissions.** Air emissions from water treatment operations may include gaseous or volatile chemicals used for disinfection processes (e.g., chlorine). Measures related to hazardous chemicals discussed above will mitigate risks of chlorine release.

167. **Water pollution and impact on habitation.** The direct disposal of liquid wastes and leakage of oil and lubricants may affect the downstream river water quality, particularly, during dry season. Proper training to the work force is required for scientific disposal of liquid wastes. At the same time, monitoring will be required to minimize the impact.

168. There are no significant ecological resources in or around the city (project influence area), so any repairs or maintenance work can be conducted without ecological impacts. There is no significant flora and fauna in or around the project site.

169. **Economic Development.** The provision of an improved and expanded water supply system is not expected to have direct economic benefits for business or industry, as connections will only be provided to domestic users. However, businesses will almost certainly benefit from the expected improvement in the health and wellbeing of their workforce as this should result in fewer days lost through illness, and overall increased productivity.

170. **Social and Cultural Resources.** Although there is a risk of excavation in the city discovering material of historical or archaeological importance, there will be no need to take precautions to protect such material when areas are excavated to repair leaks in the pipe, as all work will be conducted in trenches that have already been disturbed when the infrastructure was installed.

171. Repair works could cause some temporary disruption of activities at locations of social and cultural importance such as schools, tourist sites etc, so the same precautions as employed during the construction period should be adopted. GMC needs to require its O&M contractor to:

- (i) Complete work near sensitive receptors quickly; and
- (ii) Provide wooden bridges for pedestrians and metal sheets for vehicles to allow access across open trenches where required.

172. The citizens of the city will be the major beneficiaries of the improved water supply, as they will be provided with a constant supply of better quality (treated) water, piped into their homes. In addition to improved environmental conditions, the subproject will improve the overall health condition of the city as diseases of poor sanitation will be reduced. Moreover, for maintaining the quality of drinking water testing will be done by the operation agency and accordingly correction will be planned as per requirement.

D. Cumulative Impact Assessment

173. The cumulative impact assessment (CIA) examined the interaction between the subproject's residual effects (i.e., those effects that remain after mitigation measures have been applied) and those associated with other past, existing and reasonably foreseeable future projects or activities. The interaction of residual effects associated with multiple projects and/or activities can result in cumulative impacts, both positive and negative. The subproject's potential cumulative effects were considered with respect to Valued Components (VCs) in the categories of environmental, socio-economic, and heritage resources in four areas:

- (i) Of any potential residual project effects that may occur incrementally over time ;
- (ii) Consideration of other known relevant projects or activities within the specified study area boundaries, even if not directly related to the subproject;
- (iii) Potential overlapping impacts that may occur due to other developments, even if not directly related to the proposed project; and
- (iv) Future developments that is reasonably foreseeable and sufficiently certain to proceed.

174. The subproject IEE has identified the VCs as air quality, water (surface and groundwater) quality, noise, traffic management, social- economic and socio-community, and human health. There are no foreseeable projects that will overlap with the subproject. The spatial boundary of the subproject is the area along the alignment and the existing ROWs, WTP and Intake site. The temporal boundary can be considered as the whole Guwahati city.

175. Given the water supply requirement in Guwahati will be met and the source from Brahmaputra is considered adequate¹³, there are no significant cumulative impacts expected on the future water supply.

176. Air quality effects will occur during construction. Consequently, although emissions of

¹³ River Brahmaputra can provide as much as 78.1 billion cubic meters (or 78,100 billion liters) of water during monsoon and 56.12 billion cubic meters (or 56,120 billion liters) in non-monsoon days. These quantities are equivalent to 433.9 billion liters per day during monsoon and 311.8 billion liters per day during non-monsoon season.

common air contaminants (CAC) and fugitive dust may be elevated in proximity to active work sites, this impact will be short-term and localized to the immediate vicinity of the alignment. Greenhouse Gas (GHG) emissions may increase as a result of project activities (i.e., vehicle and equipment operation, disposal of excavated material, landfilling/ utilization of residual earth). Given the subproject's relatively minor contribution to CAC and GHG emissions during construction, the overall significance rating of both these potential residual effects is considered to be negligible during construction.

177. During construction noise levels in the immediate proximity of most work sites are expected to increase. The duration of this exposure will be relatively brief. This exposure represents a temporary, localized, adverse residual effect of low to moderate significance for affected receptors. While building damage due to ground vibrations is unlikely, there may be annoyance to spatially located receptors during construction. Noise levels associated with the project operations will be largely imperceptible as the raw water pipelines and WTP are located in relatively small sites within the city.

178. Land use/traffic management concerns will occur spatially during construction. During construction, site-specific mitigation measures will be implemented to address temporary disruptions to land use and access in the vicinity of the alignment (specifically pipeline area) such as road and sidewalk closures, traffic delays and detours, parking modifications, and increased volumes of construction-related traffic. There should be improved traffic movement along the alignment once construction is completed. Since the subproject will be built in vacant land earmarked for water pipeline laying purposes and WTP, it will not conflict with existing or planned land use. However, following improvement in infrastructures and services, added residential developments, commercial and business facilities and increased densities are expected to develop and enhance the subproject area. This can be considered a long-term cumulative benefit of the subproject.

179. Adverse impacts such as localized disruption of vehicle traffic and pedestrian movements in areas along the alignment, and elevated CAC and fugitive dust emissions in proximity to work sites, elevated noise and vibration levels and visual impacts will occur during construction. These short-term effects will be mitigated by application of mitigation measures. However, upon completion of construction the socio-community will benefit from improved water supply system. This is considered a long-term cumulative benefit.

V. INSTITUTIONAL ARRANGEMENTS AND RESPONSIBILITY

A. Implementation Arrangements

180. The State Government of Assam's Guwahati Development Department (GDD) will be the executing agency. A state-level PMU, headed by a Project Director, will be established as the implementing agency which will be in-charge of overall execution and technical supervision, monitoring, and financial control of all activities under the project.

181. Project Implementation Units (PIUs) dedicated exclusively to the project would be set up in Guwahati and Dibrugarh. The PIUs will be headed by a senior technical officer and assisted by qualified and experienced officers seconded from ULBs, finance and other line departments. The PIUs will be responsible for the day-to-day activities of project implementation in the field and will be under the direct administrative control of the PMU. The PIU in Guwahati will have synergies and a coordination mechanism with the PIUs for JNNURM and JICA projects.

182. The PMU will have a Safeguards Compliance and Monitoring Unit (PMU SCMU) to ensure mitigation of any environmental and social impacts due to the subproject. The PMU SCMU will have a Safeguards Officer (PMU SO) who will have the following responsibilities: (i) address environmental and social safeguards issues; (ii) Overall implement of the EARF/resettlement framework/indigenous peoples planning framework; (iii) monitor physical and on-physical activities under the Project; (iv) overall monitor implementation of safeguards plans; (v) guide the PIUs as and when necessary; and (vi) endorse/submit periodic monitoring reports¹⁴ received from DMSC to the PMU PD, who will then submit these to ADB. The PMU will seek State Government of Assam's clearance for submission and disclosure of the environmental and social monitoring report to ADB. It will also coordinate with national and state agencies to resolve inter-departmental issues, if any.

183. The PMU will be assisted by DMSC. The DMSC will (i) review and finalize all reports in consultation with the PMU SO; (ii) provide project management support, (iii) assure the technical quality of design and construction, (iv) prepare EIA/IEE/resettlement plan/IPP reports; and (iv) provide advice on policy reforms. In addition, the DMSC will assist the PMU on the procurement needs and other project implementation aspects and shall play a central role in ensuring capacity building on environmental management of the PMU, contractors, and line departments through capacity development support and training.

184. As per DBO contract Environment officer of Contractor will be responsible for updating of IEE and field implementation of EMP. DMSC's Environment Specialist will advise contractor's Environment Officer during updating of IEE and field implementation of EMP. DMSC's specialist will oversee implementing and monitoring safeguards compliance activities, public relations activities, gender mainstreaming activities and community participation activities. DMSC's specialist will do field monitoring at least fortnightly and advice contractor for additional/rectification of mitigation measures as per ground condition. DBO contractor will be responsible for obtaining statutory clearances and obtaining NOCs from government agencies /other entities. PMU/PIU/DMSC will assist contractor in this aspect.

185. Environment Specialists will also be appointed as part of the DMSC teams to (i) assist contractor for updating of IEE in the detailed design stage; (ii) assist contractor in the monitoring of EMP during construction stage; and (iii) prepare EIAs/IEEs for new subprojects, where required to comply with national law and/or ADB procedure. **Figure 10** shows the implementation arrangement for environment and resettlement safeguards.

¹⁴ The monitoring report will focus on the progress of implementation of the IEE/EIA and EARF, resettlement plan/resettlement framework and IPP/IPF, issues encountered and measures adopted, follow-up actions required, if any, as well as the status of compliance with subproject selection criteria, and relevant loan covenants.

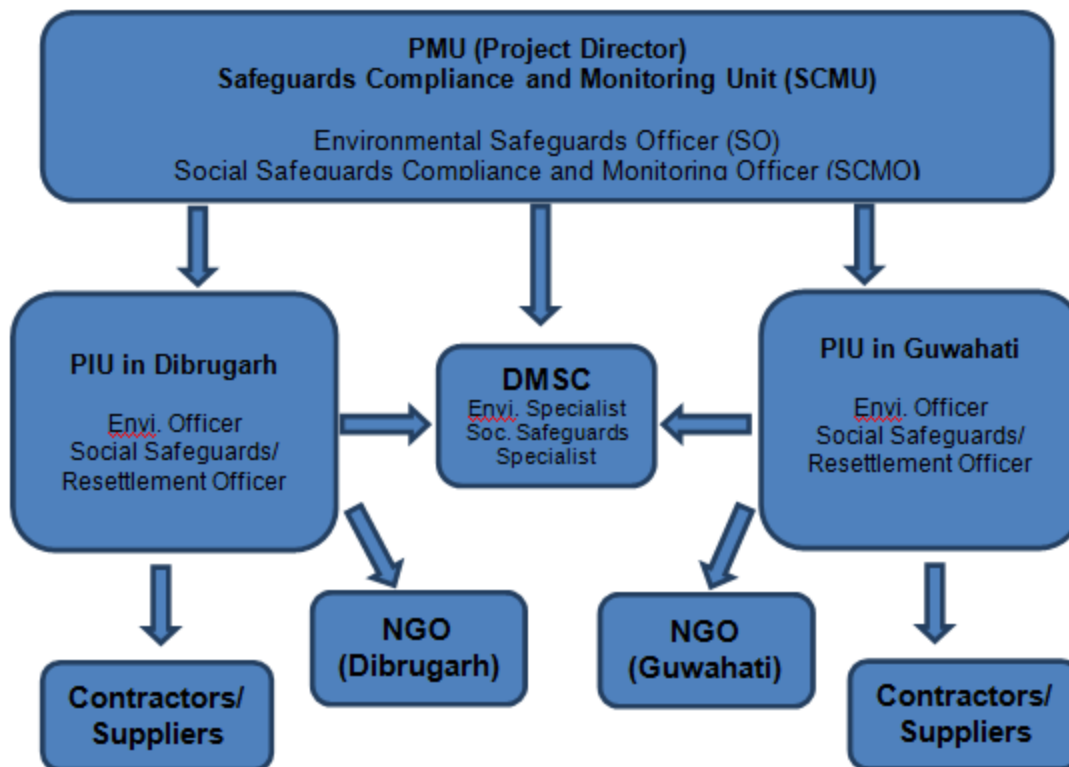


Figure 10: Safeguards Institutional Arrangement

B. Monitoring and Reporting

186. The PMU will monitor and measure the progress of EMP implementation. The monitoring activities will be corresponding with the Project's risks and impacts and will be identified in the EIAs/IEEs for the subprojects. In addition to recording information of the work, deviation of work components from original scope, the PMU, DMSC and PIUs will undertake site inspections for at least fortnightly and document review to verify compliance with the EMP and progress toward the final outcome.

187. DMSC will submit monthly monitoring and implementation reports to PIU, who will take follow-up actions, if necessary. PIU will submit the quarterly monitoring and implementation reports to PMU who will then submit to the PD. The PMU will submit semi-annual monitoring reports to ADB. The suggested monitoring report format is in **Appendix 7**. Project budgets will reflect the costs of monitoring and reporting requirements. For projects likely to have significant adverse environmental impacts during operation, reporting will continue at the minimum on an annual basis. Monitoring reports will be posted in a location accessible to the public.

188. ADB will review project performance against the EA's commitments as agreed in the legal documents. The extent of ADB's monitoring and supervision activities will be commensurate with the Project's risks and impacts. Monitoring and supervising of social and environmental safeguards will be integrated into the project performance management system.

189. ADB will monitor projects on an ongoing basis until a project completion report is issued.

ADB will carry out the following monitoring actions to supervise project implementation:

- (i) conduct periodic site visits for projects with adverse environmental or social impacts;
- (ii) conduct supervision missions with detailed review by ADB's safeguard specialists/officers or consultants for projects with significant adverse social or environmental impacts;
- (iii) review the periodic monitoring reports submitted by EA to ensure that adverse impacts and risks are mitigated as planned and as agreed with ADB;
- (iv) work with EA to rectify to the extent possible any failures to comply with their safeguard commitments, as covenanted in the legal agreements, and exercise remedies to re-establish compliance as appropriate; and
- (v) prepare a project completion report that assesses whether the objective and desired outcomes of the safeguard plans have been achieved, taking into account the baseline conditions and the results of monitoring.

C. Institutional Capacity

190. There is low capacity to implement projects in accordance with ADB safeguard requirements in both project cities. The Guwahati Municipal Corporation (GMC) do not have environmental/ social safeguards personnel, capacity to handle environmental/IR/IP impacts, gender and vulnerability issues. The DMSC will be responsible for training of PMU and PIUs staff on aspects such as environmental planning/resettlement planning/implementation, social protection and gender, including the specific recording, reporting and disclosure requirements.

191. The DMSC's environmental specialist will provide the basic training required for environmental awareness and management in accordance with both ADB and government requirements. Specific modules customized for the available skill set shall be devised after assessing the capabilities of the target participants and the requirements of the Project. The entire training will cover basic principles of environmental assessment and management; mitigation plans and programs, implementation techniques, monitoring methods and tools. Typical modules that will be present for the training session would be as follows: (i) sensitization; (ii) introduction to environment and environmental considerations in urban development projects; (iii) review of IEEs and Integration into the subproject detailed design; (iv) improved coordination within Nodal Departments; (v) monitoring and reporting system. The proposed training program along with the frequency of sessions is presented in **Table 25**.

Table 25: Training Program for Environmental Management

Program	Description	Participants	Form of Training	Duration/ Location	Conducting Agency
A. Pre-Construction Stage					

Program	Description	Participants	Form of Training	Duration/ Location	Conducting Agency
Sensitization Workshop	<p>Introduction to Environment:</p> <ul style="list-style-type: none"> ✓ Basic Concept of environment ✓ Environmental Regulations and Statutory requirements as per Government of India and ADB 	Secretaries, Chief Engineer, Superintendent Engineers of PHED and UDD, the Development Commissioner, Chairman, CEO of DMB and Project Director (PD) and PIUs Environmental Officers (EOs)	Workshop	½ Working Day	DMSC Team
Session I					
Module I	<p>Introduction to Environment:</p> <ul style="list-style-type: none"> ✓ Basic Concept of environment ✓ Environmental Regulations and Statutory requirements as per Government of India and ADB 	Engineers of, PHED and UDD, GMC, PMU (Technical Unit) and PIUs EOs	Lecture	¼ Working Day	DMSC Team
Module II	<p>Environmental Considerations in Urban Development Projects:</p> <ul style="list-style-type: none"> ✓ Environmental components affected by urban development in construction and operation stages ✓ Activities causing pollution during construction and operation stages ✓ Environmental Management Good Practices in Urban Infrastructure Projects 	Engineers of PHED and UDD, GMC, PMU (Technical Unit) and PIUs EOs	Workshop	¼ Working Day	DMSC Team

Program	Description	Participants	Form of Training	Duration/ Location	Conducting Agency
Module III	Review of IEE and its Integration into Designs: <ul style="list-style-type: none"> ✓ IEE Methodology ✓ Requirement of data for updating of design ✓ Environmental Provisions in the EMPs ✓ Implementation Arrangements ✓ Methodology of Assessment of Pollution Monitoring ✓ Methodology for site 	Engineers of, PHED and UDD, GMC, PMU (Technical Unit) and contractor	Lecture and Field Visit	½ Working Day	DMSC Team
Module IV	Improved Coordination with other Departments: <ul style="list-style-type: none"> ✓ Overview of the Project ✓ Environmental and Social Impacts ✓ Statutory Permissions ✓ Procedural Requirements ✓ Cooperation and Coordination with other Departments. 	Engineers of PHED and UDD, GMC, PMU (Technical Unit) and PIU, DBO contractor	Lecture / Interactive Sessions	½ Working Day	DMSC Team
Module V	Special Issues in the Project <ul style="list-style-type: none"> ✓ Bio-Diversity Assessment and Conservation ✓ Geomorphological Assessment and Slope Protection ✓ Statutory Permissions– Procedural Requirements ✓ Consultation and Counseling 	Engineers of PHED and UDD, GMC, PMU (Technical Unit) and PIUs EOs	Lecture	½ Working Day	DMSC Team
B. Construction Stage					
Session II					

Program	Description	Participants	Form of Training	Duration/ Location	Conducting Agency
Module VI	<p>Role during Construction</p> <ul style="list-style-type: none"> ✓ Roles and Responsibilities of officials/ contractors/ consultants towards protection of environment ✓ Implementation Arrangements by DBO contractor ✓ Monitoring mechanisms ✓ Health and Safety issues during project implementation 	Engineers of PHED and UDD, GMC, PMU (Technical Unit) and DBO contractor	Lecture / Field visit/ Interactive Sessions	½ Working Day	DMSC Team
Module VII	Monitoring and Reporting System	PMU (Technical Unit) , Contractor	Lecture / Interactive Sessions	½ Working Day	DMSC Team

Notes: DMSC – Design, Management and Supervision Consultant, DBO- Design build operative, EC – Environmental Clearance, EIA – Environmental Impact Assessment, EMP – Environmental Management Plan, EO- Environment Officer, ES- Environment Specialist, FAM – Facility Administration Memorandum, IEE – Initial Environmental Examination, MoEFCC – Ministry of Environment, Forest and Climate Change, NOC – No Objection Certificate, PHED - Public Health Engineering Department, PIU - Project Implementation Unit, PMU - Program Management Unit, REA – Rapid Environmental Assessment, SS- Safeguard Specialist, UDD - Urban Development Department, ULB - Urban Local Body

VI. CONSULTATION, INFORMATION DISCLOSURE, AND GRIEVANCE REDRESS MECHANISM

A. Public Consultations Conducted

192. A series of consultations were conducted with different categories of stakeholder including (i) the Chairman and ward members; and (ii) local communities, local residents, shopkeepers and businesspeople living and working alongside the roads/lanes, government officials, NGOs, and villagers in the immediate vicinity of the subproject sites. Ad hoc discussions were also held on site with people and communities who could be affected or benefited by the subproject, so that views could be expressed in a less formal setting. The main objective of the public consultation was to identify the stakeholders, to identify additional sources of water, to understand the local needs, preferences of basic infrastructure facilities and to draw up plans to improve the quality of life through better water supply system in Guwahati city. Location wise public consultation details shown in **Appendix 8**.

193. The local people have appreciated the water supply proposal of the government and they have ensured that they will cooperate with the EA during project implementation. They want the project to be started immediately to ensure safe water supply to them. The major issues raised during the public consultations are summarized as follows:

- (i) Proposed water supply project should ensure enough supply of drinking water;
- (ii) Efforts should be made by the government to maintain the drinking water supply round the clock;

- (iii) Livelihood affected households should be given adequate assistance in the mode of cash compensation;
- (iv) Local people should be employed by the contractor during construction work;
- (v) Adequate safety measures should be taken during construction work; and
- (vi) Proper arrangements should be made for access to houses and shops during construction throughout the construction period.

194. There may be some landslide and subsidence problem at hilly area from where raw water pumping mains passing which should be addressed properly in design.

B. Future Consultation and Disclosure

195. The public consultation shall be a continuous process and will continue in future also. DBO contractor will do the public consultation and focus group discussion during updating of IEE. During project implementation contractor will do the consultation regularly with affected persons. DMSC/ PIU will advice contractor the requirement and methodology. The PMU/PIU will extend and expand the consultation and disclosure process during implementation. An experienced NGO will be appointed to handle this key aspect of the program, who will conduct a wide range of activities in consultation with contractor/ PIU/DMSC in relation to all subprojects, to ensure that the needs and concerns of stakeholders are registered, and are addressed in project design, construction or operation where appropriate. The stakeholders will be fully engaged in the subproject and have the opportunity to participate in its development and implementation. The program of activities will be developed during the detailed design stage, and is likely to include the following:

1. Consultation during construction:

- (i) Public meetings with affected communities to discuss and plan work programmers and allow issues to be raised and addressed once construction has started; and
- (ii) Smaller-scale meetings to discuss and plan construction work with individual communities to reduce disturbance and other impacts, and provide a mechanism through which stakeholders can participate in subproject monitoring and evaluation.

2. Project disclosure:

- (i) Public information campaigns (via newspaper, TV and radio) to explain the project to the wider city population and prepare them for disruption they may experience once the construction program is underway;
- (ii) Public disclosure meetings at key project stages to inform the public of progress and future plans, and to provide copies of summary documents in local language;
- (iii) Formal disclosure of completed project reports by making copies available at convenient locations in the study towns, informing the public of their availability, and
- (iv) Providing a mechanism through which comments can be made.

C. Grievance Redress Mechanism

196. A project-specific grievance redress mechanism (GRM) will be established to receive,

evaluate and facilitate the resolution of affected people's concerns, complaints and grievances about the social and environmental performance at the level of the Project. The GRM will aim to provide a time-bound and transparent mechanism to voice and resolve social and environmental concerns linked to the project. The grievance redress mechanism and procedure is depicted in **Figure 11** below. The project-specific GRM is not intended to bypass the government's own redress process; rather it is intended to address affected people's concerns and complaints promptly, making it readily accessible to all segments of the affected people and is scaled to the risks and impacts of the project.

197. The PMU and PIUs will make the public aware of the GRM through public awareness campaigns. Grievances can be filed in writing using the Complaint Register and Complaint Forms (**Appendix 9**) or by phone with any member of the PMU or PIU. The contact phone number of the respective PIUs and the PMU will serve as a hotline for complaints and will be publicized through the media and placed on notice boards outside their offices and at construction sites. The safeguard documents made available to the public in an accessible version will include information on the GRM and will be widely disseminated throughout the corridor by the safeguards officers in the PMU and PIUs.

198. GRM and GRC have already been established on 1 July 2015.

199. **First tier of GRM.** The PIU is the first tier of GRM which offers the fastest and most accessible mechanism for resolution of grievances. The Resettlement Officer and Environmental Officer in each PIU will be designated as the key officers for grievance redress. Resolution of complaints will be done within seven working (7) days. At this stage, the Resettlement Officer and Environmental Officer will inform the PMU's Safeguards Compliance and Monitoring Unit (SCMU) for additional support and guidance in grievance redress matters. Investigation of grievances will involve site visits and consultations with relevant parties (e.g., affected persons, contractors, traffic police, etc.). Grievances will be documented and personal details (name, address, date of complaint, etc.) will be included unless anonymity is requested. A tracking number will be assigned for each grievance, including the following elements:

- (i) Initial grievance sheet (including the description of the grievance) with an acknowledgement of receipt given to the complainant when the complaint is registered;
- (ii) Grievance monitoring sheet with actions taken (investigation, corrective measures); and
- (iii) Closure sheet, one copy of which will be handed to the complainant after he/she has agreed to the resolution and signed-off.

200. The updated register of grievances and complaints will be available to the public at the PIU office, construction sites, and other key public offices along the project corridor. Should the grievance remain unresolved it will be escalated to the second tier.

201. **Second Tier of GRM.** The Resettlement Officer and Environmental Officer in each PIU will activate the second tier of GRM by referring the unresolved issue (with written documentation) to the PMU's Safeguards Compliance and Monitoring Unit who will pass unresolved complaints upward to the Grievance Redress Committee (GRC).¹⁵ The GRC will be

¹⁵ The GRC will consist of the following persons: (i) Project Director; (ii) representative of the affected person(s); (iv) representative of the local Deputy Commissioners office (land); and (v) representative of APCB (for environmental-

established by the PMU's SCMU before commencement of site works. A hearing will be called with the GRC, if necessary, where the affected person can present his/her concern/issues. The process will facilitate resolution through mediation. The local GRC will meet as necessary when there are grievances to be addressed. The local GRC will suggest corrective measures at the field level and assign clear responsibilities for implementing its decision within fifteen (15) working days. At field level contractor will resolve the complaint in consultation with DMSC/ PIU. If unsatisfied with the decision, the existence of the GRC will not impede the complainant's access to the Government's judicial or administrative remedies.

202. During community consultation formation of Grievance Redress committee and implementation of grievance redress mechanism fully explained. After formation of GRC, information will be disseminated at project influence area in local language.

203. The PMU SCMU officers will be responsible for processing and placing all papers before the GRC, maintaining database of complaints, recording decisions, issuing minutes of the meetings and monitoring to see that formal orders are issued and the decisions carried out.

204. **Third tier of GRM.** In the event that a grievance cannot be resolved directly by the PIUs (first tier) or GRC (second tier), the affected person can seek alternative redress through the union Parishad or ward committees or in the appropriate court of law. The PIUs or GRC will be kept informed by the district, municipal or national authority.

205. The safeguard monitoring reports will include the following aspects pertaining to progress on grievances: (i) number of cases registered with the GRC, level of jurisdiction (first, second and third tiers), number of hearings held, decisions made, and the status of pending cases; and (ii) lists of cases in process and already decided upon may be prepared with details such as Name, ID with unique serial number, date of notice, date of application, date of hearing, decisions, remarks, actions taken to resolve issues, and status of grievance (i.e., open, closed, pending).

206. The GRM notwithstanding, an aggrieved person shall have access to the country's legal system at any stage. This can run parallel to accessing the GRM and is not dependent on the negative outcome of the GRM.

207. In the event that the established GRM is not in a position to resolved the issue, the affected persons can also use the ADB Accountability Mechanism through directly contacting (in writing) the Complaint Receiving Officer at ADB headquarters or the ADB India Resident Mission. The complaint can be submitted in any of the official languages of ADB's Developing Member Countries. The ADB Accountability Mechanism information will be included in the Project Information Document to be distributed to the affected communities, as part of the project GRM.

208. **Costs:** All costs involved in resolving the complaints (meetings, consultations, communication and reporting / information dissemination) will be borne by the PMU.

related grievances). The functions of the local GRC are as follows: (i) resolve problems quickly and provide support to affected persons arising from various environmental issues and including dust, noise, utilities, power and water supply, waste disposal, traffic interference and public safety as well as social and resettlement related issues such as land acquisition (temporary or permanent); asset acquisition; and eligibility for entitlements, compensation and assistance; (ii) reconfirm grievances of displaced persons, categorize and prioritize them and aim to provide solutions within a month; (iii) report to the aggrieved parties about developments regarding their grievances and decisions of the GRC.

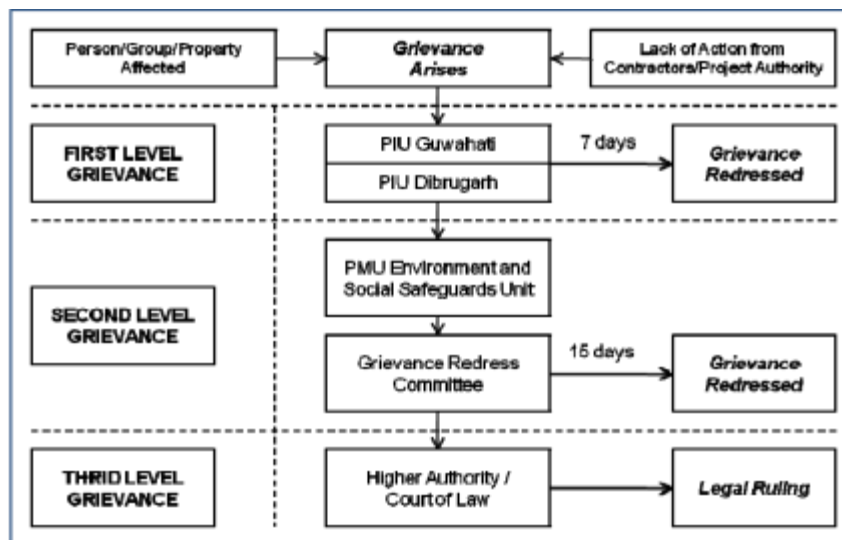


Figure 11: Grievance Redress Mechanism

VII. ENVIRONMENTAL MANAGEMENT P LAN

209. The potential impacts identified and assessed and the mitigation measures formulated to minimize those impacts to acceptable levels identified in the earlier sections are summarized in the following tables. The table also delegates the responsibility of implementing mitigation to various agencies involved in the program implemented as listed above.

210. The EMP will form part of the civil work bidding and contract documents. The contractor will be required to (i) update the IEE during detailed design stage; (ii) establish an operational system for managing environmental impacts (iii) carry out all of the monitoring and mitigation measures set forth in the EMP; (iv) implement any corrective or preventative actions set out in safeguards monitoring reports that the PMU/PIU will prepare from time to time to monitor implementation of this IEE and EMP; and (v) allocate a budget for compliance with these EMP measures, requirements and actions.

A. Environmental Mitigation Plan

211. **Tables 26 to 28** show the potential adverse environmental impacts, proposed mitigation measures, responsible parties. This EMP included in the bid documents and will be further reviewed and updated during detail design and implementation.

B. Environmental Monitoring Program

212. **Tables 29 to 31** show the proposed environmental monitoring program for this subproject. It includes all relevant environmental parameters, location, method of monitoring, indicators/ standards of monitoring including frequency and responsibility of monitoring. Monitoring activities during the detailed engineering design stage will from part of the baseline conditions of the subproject sites and will be used as the reference for acceptance of restoration works by the construction contractors.

Table 26: Anticipated Impacts and Mitigation Measures – Pre-construction Stage

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
Legislation, permits and agreements	Noncompliance on Environmental legislation – work will be stopped	<ul style="list-style-type: none"> In all instances- covering Environment & Forest, implementation agency, contractors and consultants must remain in compliance with relevant local and national legislation. Proof of compliance to Air Act & Noise Act must be forwarded by the contractor to PMU/DMSC/PIU (in relation to hot mixing, batch mix plants, stone crushers, diesel generators, etc. if any) Permission of tree felling if any from forest dept. A copy of the EMP must be kept on site during the construction period 	PIU, PMU, DMSC	(i) Checking of all permit including tree felling if any (ii) Availability of EMP at site
Technical design of the project	Lack of sufficient planning to assure long term sustainability of the improvements and ensure protection of the assets created	Design will include provisions for ensuring effective maintenance and protection of the assets created so as to ensure the long-term sustainability. Designs will be worked out and implemented in accordance with the provisions and will strictly conform to state rule	PIU, DMSC	Checking of technical design – considering sustainability of the project

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
Utilities/ Tree cutting	Telephone lines, electric poles and wires, water lines within proposed project area Trees may be cut after final design	(i) Identify and include locations and operators of these utilities in the detailed design documents to prevent unnecessary disruption of services during construction phase; and (ii) Require construction contractors to prepare a contingency plan to include actions to be done in case of unintentional interruption of services. (iii) Collection of tree cutting permission with assistance DMSC/ PIU	Primary – DBO Contractor Secondary - DMSC	(i) List of affected utilities and operators and revision as per final design (ii) Tree cutting requirement and permission (iii) Bid document to include requirement for a contingency plan for service interruptions
Structure stability in seismic zone V	Affect during earthquake	Design and analysis as per the Peak Ground Acceleration (PGA) and the seismic acceleration response curve and other factors like Response Reduction Factor (RRF) and Importance Factor (IF) as per the Indian Standard code	DMSC/ PIU/ DBO contractor	(i) Checking of design report – consideration of design measures to minimize earth quake risk
Water Supply	Health risk due to closure of water supply	(i) Plan the construction program to keep the cessation of water supplies to the minimum possible (in both area and duration); (ii) . Design consideration as per CPHEEO Manual on water supply and treatment; and (iii) In coordination with GMC, provide alternative potable water to affected households and businesses for the duration of the shut-down if any	Primary – DBO Contractor Secondary - DMSC	(i) Schedule of closure if any; (ii) delivery of potable water to affected people by GMC
Traffic Management	Impede traffic flow during construction	(i) Prepare a short traffic management schedule during preconstruction phase.	Primary – DBO Contractor Secondary -	Ensure Traffic Management schedule is finalized before implementation.

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
Social and Cultural Resources	Ground disturbance can uncover and damage archaeological and historical remains	(i) Consult Archaeological Survey of India (ASI) or concerned department in Guwahati to obtain an expert assessment of the archaeological potential of the site; (ii) Consider alternatives if the site is found to be of medium or high risk; (iii) Develop a protocol for use by the construction contractors in conducting any excavation work, to ensure that any chance finds are recognized and measures are taken to ensure they are protected and conserved.	DMSC Primary – DBO Contractor Secondary - DMSC	Chance Finds Protocol
Construction work camps, hot mix plants, stockpile areas, storage areas, and disposal areas.	Disruption to traffic flow and sensitive receptors	(i) Prioritize areas within or nearest possible vacant space in the subproject location; (ii) If it is deemed necessary to locate elsewhere, consider sites that will not promote instability and result in destruction of property, vegetation and drinking water supply systems; (iii) Do not consider residential areas; (iv) Take extreme care in selecting sites to avoid direct disposal to water body which will inconvenience the community; and (v) Avoid setting up of labour camp near river	DBO contractor to select locations as per selection criteria / considering mitigation measures. PMU/PIU and DMSC to approve locations prior to construction	List of selected sites for construction work camps, hot mix plants, stockpile areas, storage areas, and disposal areas.
Sources of Materials	Extraction of materials can disrupt natural land contours and vegetation resulting in accelerated erosion, disturbance in natural	(i) Prioritize sites already permitted by the Mining Department; (ii) If other sites are necessary, inform construction contractor that it is their responsibility to verify the	DBO Contractor to prepare list of approved quarry sites	(i) List of approved quarry sites and sources of materials; (ii) Bid document to include requirement for verification of suitability of sources and

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
	drainage patterns, ponding and water logging, and water pollution.	suitability of all material sources and to obtain the approval of PMU/PIU and (iii) If additional quarries will be required after construction is started, inform construction contractor to obtain a written approval from PMU/PIU.	and sources of materials PMU/ PIU/DMSC will approve after verification	permit for additional quarry sites if necessary.

DMSC = Design, Management and Supervision Consultant, PMU = Project Management Unit; PIU = Project Implementation Unit

Table 27: Anticipated Impacts and Mitigation Measures – Construction Stage

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
Sources of Materials	Extraction of rocks and material may cause ground instability	(i) Use quarry sites and sources permitted by government; (ii) Verify suitability of all material sources and obtain approval of Investment PMU/PIU; (iii) If additional quarries will be required after construction has started, obtain written approval from PMU/PIU; and (iv) Submit to DMSC on a monthly basis documentation of sources of materials.	DBO Contractor	Construction Contractor documentation
Air Quality	Emissions from construction vehicles, equipment, and machinery used for excavation and construction resulting to dusts and increase in concentration of vehicle-related pollutants such as	(i) Consult with PMU/PIU/DMSC on the designated areas for stockpiling of pipes, soils, gravel, and other construction materials; (ii) Damp down exposed soil and any stockpiled on	DBO Contractor	(i) Location of stockpiles; (ii) complaints from sensitive receptors; (iii) heavy equipment and machinery with air pollution control devices (iv) ambient air for respirable particulate

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
	carbon monoxide, sulfur oxides, particulate matter, nitrous oxides, and hydrocarbons	site by spraying with water when necessary during dry weather; (iii) Use tarpaulins to cover sand and other loose material when transported by trucks; and (iv) Fit all heavy equipment and machinery with air pollution control devices which are operating correctly. (v) Carry out air quality monitoring as per CTE condition		matter (RPM) and suspended particulate matter (SPM); (v) vehicular emissions such as sulphur dioxide (SO ₂), nitrous oxides (NO _x), carbon monoxide (CO), and hydrocarbons
Traffic Management	Impede traffic flow during construction	(i) Implement a traffic management schedule during preconstruction phase.	DBO Contractor	DMSC to ensure traffic management measures are implemented and traffic is not significantly impeded during construction period.
Surface water quality	Mobilization of settled silt materials, run-off from stockpiled materials, and chemical contamination from fuels and lubricants during construction works can contaminate nearby surface water quality. Increase in turbidity of River water during construction of intake	(i) Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets; (ii) Prioritize re-use of excess spoils and materials in the construction works. If spoils will be disposed, consult with PMU/PIU/DMSC on designated disposal areas; (iii) Place storage areas for fuels and lubricants away from any drainage leading to water bodies; (iv) Dispose any wastes	DBO Contractor	(i) Areas for stockpiles, storage of fuels and lubricants and waste materials; (ii) Records of surface water quality testing; (iii) Effectiveness of water management measures.

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		<p>generated by construction activities in designated sites;</p> <p>(v) incorporate appropriate erosion and sediment control best management practices such as turbidity curtains, silt barriers, or silt curtains;</p> <p>(vi) have an equipment spill and containment plan and appropriate materials on-site.; and</p> <p>(vii) Conduct surface water quality monitoring particularly at intake location as per CTE condition and EMP</p>		
Noise Levels	Increase in noise level due to earth-moving and excavation equipment, and the transportation of equipment, materials, and people	<p>(i) Plan activities in consultation with PMU/PIU/DMSC so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance;</p> <p>(ii) Require horns not be used unless it is necessary to warn other road users or animals of the vehicle's approach;</p> <p>(iii) Minimize noise from construction equipment by using vehicle silencers, fitting jackhammers with noise-reducing mufflers, and portable street barriers</p>	DBO Contractor	(i) Complaints from sensitive receptors; (ii) use of silencers in noise-producing equipment and sound barriers; (iii) Equivalent day and night time noise levels

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		<p>the sound impact to surrounding sensitive receptor, and</p> <p>(iv) Maintain maximum sound levels not exceeding 80 decibels (dbA) when measured at a distance of 10 m or more from the vehicle/s.</p>		
Ecological resources – Terrestrial	Felling of the trees (if any) – affect terrestrial ecological balance	<p>(i) Minimize removal of vegetation and disallow cutting of trees;</p> <p>(ii) If tree-removal will be required, obtain tree-cutting permit from Municipal Corporation,</p> <p>(iii) Require to plant three (3) native trees for every one (1) that is removed; and</p> <p>(iv) Prohibit employees from poaching wildlife, bird hunting, and cutting of trees for firewood.</p>	DBO Contractor	(i) Complaints from sensitive receptors; (ii) checking of conservation management plan for tree species
Ecological resources – Aquatic	<p>Impact on aquatic fauna during intake construction,</p> <p>(i) Due to construction activity for intake structure, pipe bridge for raw water transmission</p> <p>(ii) Impact on water quality- temporary turbidity during construction of pipe bridge</p> <p>(iii) Impact on river bed sediment- removal of part of sediment within intake structure</p> <p>(iv) Impact due to</p>	<p>(i) Not to dispose any construction materials in river which may pollute the river water and aquatic fauna,</p> <p>(ii) Spoil Disposal Management Plan (SDMP) will be prepared and implemented to minimize the potential effects of sediment plumes on aquatic habitats,</p> <p>(iii) Use of slow speed boat/ vessel during transportation of materials</p>	DBO Contractor/ DMSC	Site observation to see the arrangement and checking of documents

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
	generated noise and vibration – transportation of man and materials and use of construction equipments	(iv) Most of the construction should be carried out during dry period (v) Before commencing piling, carry-out 'soft-start' for pile driving, slowly increasing intensity of the driving hammer power		
Existing Infrastructure and Facilities	Disruption of service and damage to existing infrastructure at specified project location	(i) Obtain from PMU/PIU/DMSC the list of affected utilities and operators if any; (ii) Prepare a contingency plan to include actions to be done in case of unintentional interruption of service	DBO Contractor	Existing Utilities Contingency Plan
Landscape and Aesthetics	The presence of heavy duty vehicles and equipment, temporary structures at construction camps, stockpiles, may result in impacts on aesthetics and landscape character.	(i) Storage areas will be properly fenced off. (ii) Prepare and implement Waste Management List; (iii) Avoid stockpiling of excess excavated soils; (iv) Coordinate with GMC for beneficial uses of excess excavated soils/sediments of about 5940 cum or immediately dispose to designated areas-proposed WTP land, the site will requires huge filling (112000 m ³).; (v) Recover used oil and lubricants and reuse or remove from the sites; (vi) Manage solid waste according to the following	DBO Contractor	(i) Waste Management List; (ii) Complaints from sensitive receptors; (iii) PMU/PIU/DMSC to report in writing that the necessary environmental restoration work has been adequately performed before acceptance of work.

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		<p>preference hierarchy: reuse, recycling and disposal to designated areas;</p> <p>(vii) Remove all wreckage, rubbish;</p> <p>(viii) Retain mature trees on and around the site where possible;</p> <p>(ix) Cluster construction activities on site on a specific area to avoid "sprawl";</p> <p>(x) Unwanted material and litter will be removed on frequent basis; and</p> <p>(xi) Request PMU/PIU/DMSC to report in writing that the necessary environmental restoration work has been adequately performed before acceptance of work.</p>		
Accessibility	Traffic problems and conflicts near project locations and haul road	<p>(i) Plan transportation routes so that heavy vehicles do not use narrow local roads, except in the immediate vicinity of delivery sites;</p> <p>(ii) Schedule transport and hauling activities during non- peak hours;</p> <p>(iii) Locate entry and exit points in areas where there is low potential for traffic congestion;</p> <p>(iv) Keep the site free from all unnecessary</p>	DBO Contractor	<p>(i) Traffic Management Strategy;</p> <p>(ii) Complaints from sensitive receptors;</p> <p>(iii) Number of signages placed at subproject location</p>

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		obstructions; (v) Drive vehicles in a considerate manner; (vi) Coordinate with Guwahati Traffic Office for temporary road diversions and with for provision of traffic aids if transportation activities cannot be avoided during peak hours; (vii) Notify affected sensitive receptors by providing sign boards informing nature and duration of construction works and contact numbers for concerns/complaints; (viii) Close observation on river fauna/ animal during movement of boats or vessels; and (ix) Provide planks across trenches in front of businesses, and ensure works are completed quickly to avoid disruption		
Socio-Economic – Income.	Impede the access of residents and customers to nearby shops	(i) Leave spaces for access between mounds of soil; (ii) Provide walkways and metal sheets where required for people; (iii) Increase workforce in front of critical areas such as institutions, place of worship, business establishment, hospitals, and schools; (iv) Consult businesses and	DBO Contractor	(i) Complaints from sensitive receptors; (ii) Number of walkways, signages, and metal sheets placed at subproject location.

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		<p>institutions regarding operating hours and factoring this in work schedules; and</p> <p>(v) Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints.</p>		
Employment Generation	<ul style="list-style-type: none"> • Generation of contractual employment and increase in local revenue 	<p>(i) The use of labor intensive construction measures will be used where appropriate;</p> <p>(ii) Employ local (unskilled) labor if possible;</p> <p>(iii) Training of labor to benefit individuals beyond completion of the subproject;</p> <p>(iv) The training of unskilled or previously unemployed persons will add to the skills base of the area. and</p> <p>(iv) Recruitment of labors will take place offsite.</p>	DBO Contractor	<p>(i) Employment records;</p> <p>(ii) records of sources of materials</p>
Occupational Health and Safety	Occupational hazards which can arise during work	<p>(i) Develop and implement site-specific Health and Safety (H&S) Plan which will include measures such as: (a) excluding public from the site; (b) ensuring all workers are provided with and use Personal Protective Equipment like helmet, gumboot, gloves, nose mask and ear plugs; (c) H&S Training for all site personnel; (d) documented</p>	DBO Contractor	<p>(i) Site-specific Health and Safety (H&S) Plan;</p> <p>(ii) Equipped first-aid stations;</p> <p>(iii) Medical insurance coverage for workers;</p> <p>(iv) Number of accidents;</p> <p>(v) Supplies of potable drinking water;</p> <p>(vi) Clean eating areas where workers are not exposed to hazardous or noxious substances;</p>

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		<p>procedures to be followed for all site activities; and (e) documentation of work-related accidents;</p> <p>(ii) Designate a safeguard focal person and undertake safeguards orientation by PMU/PIU;</p> <p>(iii) Ensure H&S plan is easily understandable to workers and laborers. Keep in mind that this plan will be used on-site and workers/laborers may not always understand highly technical terms;</p> <p>(iv) Strict compliance of H&S plan and requirements of wearing personal protective equipment (PPE) during work hours;</p> <p>(v) Provide specific guidance for suitable PPE for every on-site work assignment</p> <p>(vi) Ensure that qualified first-aid can be provided at all times. Equipped first-aid stations shall be easily accessible throughout the project site;</p> <p>(vii) Provide medical insurance coverage for workers;</p> <p>(viii) Secure all installations from unauthorized intrusion and accident risks;</p>		<p>(vii) record of H&S orientation trainings</p> <p>(viii) personal protective equipments;</p> <p>(ix) % of moving equipment outfitted with audible back-up alarms; and</p> <p>(x) sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal.</p>

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		<p>(ix) Provide supplies of potable drinking water at working sites;</p> <p>(x) Provide clean eating areas where workers are not exposed to hazardous or noxious substances; and</p> <p>(xi) Provide H&S orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers;</p> <p>(xii) Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted;</p> <p>(xiii) Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas;</p> <p>(xiv) Ensure moving equipment is outfitted with audible back- up alarms;</p> <p>(xv) Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage</p>		

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		<p>equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate; and</p> <p>(xvi) Disallow worker exposure to noise level greater than 85 dBA for a duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively.</p> <p>(xvii) During work within the river special precaution particularly using safety equipment/ belt and training on swimming and mitigation under emergency situation is necessary.</p>		
Community Health and Safety.	Traffic accidents and vehicle collision with pedestrians during material and waste earth transportation	<p>(i) Plan routes to avoid times of peak-pedestrian activities. (ii) Liaise with PMU/PIU/DMSC in identifying high-risk areas on route cards/maps. (iii) Maintain regularly the vehicles and use of manufacturer- approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure.</p>	DBO Contractor	<p>(i) Traffic Management Strategy; (ii) Complaints from sensitive receptors</p>

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		<p>(iv) Provide road signs and flag persons to warn.</p> <p>(v) Provide protective fencing around open trenches, and cover any open trench with metal planks during non-construction hours. potentially cause soil contamination;</p> <p>(vi) Recover used oil and lubricants and reuse or remove from the site; (vii) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas; (viii) Develop and implement a traffic management plan and (ix) Request PMU/PIU/DMSC to report in writing that the camp has been vacated and restored to pre-project conditions before acceptance of work.</p>		
Camp sites	Temporary air and noise pollution from machine operation, water pollution from storage and use of fuels, oils, solvents, and lubricants	<p>(i) Consult PMU/PIU/DMSC before locating project offices, sheds, and construction plants;</p> <p>(ii) Minimize removal of vegetation and disallow cutting of trees;</p> <p>(iii) Provide water and sanitation facilities for employees;</p> <p>(iv) Prohibit employees from</p>	DBO Contractor	<p>(i) Complaints from sensitive receptors;</p> <p>(ii) Water and sanitation facilities for employees ; and</p> <p>(iii) PMU/PIU/DMSC report writing that the camp has been vacated and restored to pre-project conditions</p>

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		<p>cutting of trees for firewood;</p> <p>(v) Train employees in the storage and handling of materials which can potentially cause soil contamination;</p> <p>(vi) Recover used oil and lubricants and reuse or remove from the site;</p> <p>(vii) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas;</p> <p>(viii) Remove all wreckage, rubbish, or temporary structures (such as buildings, shelters, and latrines) which are no longer required; and (ix) Request PMU/PIU/DMSC to report in writing that the camp has been vacated and restored to pre-project conditions before acceptance of work.</p>		
Social and Cultural Resources	Risk of archaeological chance finds	<p>(i) Strictly follow the protocol for chance finds in any excavation work;</p> <p>(ii) Request PMU/PIU/DMSC or any authorized person with archaeological field training to observe excavation;</p> <p>(iii) Stop work immediately to allow further investigation</p>	DBO Contractor	Records of chance finds

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		if any finds are suspected; and (iv) Inform PMU/PIU/DMSC if a find is suspected, and take any action they require ensuring its removal or protection in situ.		

DMSC = Design, Management and Supervision Management Consultant, H&S = health and safety, RPM = respirable particulate matter, PMU = Project Management Unit; PIU = Project Implementation Unit; SPM = suspended particulate matter, GMC = Guwahati Municipal Corporation

Table 28: Anticipated Impacts and Mitigation Measures – Operation and Maintenance Stage

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
General	General impact	(i) Refill and re-compact trenches soil and backfilled sand will be removed to expose the leaking junction or pipe; (ii) Conduct work during non- monsoon period; and (iii) Cover or wet excavated material to prevent dusts. (iv) DBO contractor will ensure compliance with conditions of the environmental permit/clearance during its operation.	DBO Contractor later GMC	Complaints from sensitive receptors
Solid Wastes	Environmental pollution - Potential impact on soil, groundwater, and surface water nearby the disposal site	(i)Minimize the quantity of solids generated by the water treatment process, (ii)Dispose of lime sludge by land application, (iii)limiting application rates of sludge to minimize the potential for mobilization of metals into plant tissue and groundwater,	DBO Contractor later GMC	(i)Complaints from sensitive receptors (ii) Field checking (iii) Testing of soil, surface and ground water nearby

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		(iv)Dispose of ferric and alum sludge by controlled land application not near water body, (v)Assessment of soil, ground water and surface water nearby solid waste disposal		
Wastewater	Discharge into water causing water pollution	(i) Land application of wastes with high dissolved solids concentrations (ii) Recycle filter backwash into the process (iii) Treat and dispose of reject streams as per CPHEEO norm	DBO Contractor later GMC	(i)Complaints from sensitive receptors (ii) Field checking (iii) Testing of soil, surface and ground water
Hazardous Chemicals	Release to nature causing air, water and soil pollution	(i)Store of chlorine gas in cool, dry, and dark conditions for no more than one month, (ii)Use equipment constructed of corrosion-resistant materials, (iii)Minimize the amount of chlorination chemicals stored on site, (iv)Develop and implement a prevention program that includes identification of potential hazards, written operating procedures, training, maintenance, and accident investigation procedures; (v)Develop emergency plan for responding to accidental releases	DBO Contractor later GMC	(i)Complaints from sensitive receptors (ii) Site checking (iii) Checking of awareness and emergency training document

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation			Monitoring of Mitigation
Air Emissions	Air pollution from gaseous or volatile chemicals used for disinfection processes	Proper storage and scientific utilization of chemicals utilized in treatment process Collection of air samples as per CTO	DBO GMC	Contractor	later	Complaints from sensitive receptors
Social and Cultural Resources	Temporary disruption of activities	(i) Complete work in sensitive areas quickly; (ii) Consult municipal authorities, custodians of important buildings, cultural and tourism authorities and local communities in advance of the work to identify and address key issues, and avoid working at sensitive times, such as religious and cultural festivals.	DBO GMC	Contractor	later	Complaints from sensitive receptors
Land Uses	<ul style="list-style-type: none"> • With augmentation of water supply system, the presently water scarce areas can be put to their utmost possible use. • The proposed project is expected to facilitate an integrated development approach to the area thereby improving the overall quality of life. • The proposed development is expected to bring about positive economic benefits in the medium- to long-term. 	Regular maintenance of the water supply infrastructure so as to ensure that its functional capacity and efficiency does not reduce.	DBO GMC	Contractor	later	Complaints from sensitive receptors

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
	<ul style="list-style-type: none"> Local businesses and educational facilities, etc. are likely to benefit from the subproject. 			
Health and Safety	<ul style="list-style-type: none"> Improvement of water supply system is expected to significantly enhance the quantity and quality of the supplied water. Reduction in leakages will ensure adequate supply of potable drinking water minimizing contamination risks with corresponding reduction in health risks to the citizens. 	<ul style="list-style-type: none"> Undertake regular monitoring and maintenance of water supply infrastructure. Carry out water quality monitoring as per CTO 	DBO Contractor later GMC	Complaints from sensitive receptors
Ecological Resources	Affect on aquatic biodiversity – particularly aquatic fauna due to production of noise, movement of boat for repairing job, disposal of waste	(i)Continued protection plan application during any repairing job as per design mitigation (ii)Non allow of direct disposal of liquid wastes and leakage of oil and lubricants may affect the downstream river water quality, particularly, during dry season (iii)Proper training to the work force for scientific disposal of solid and liquid wastes (iv)Regular maintenance of	DBO Contractor later GMC	(i) Records of complain from sensitive receptors; (ii) Conservation plan for terrestrial flora and aquatic animal

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		pumping machinery		

H&S = health and safety, O&M = operation and maintenance, GMC = Guwahati Municipal Corporation

Table 29: Pre-construction Environmental Monitoring Program

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
Legislation, permits and agreements	-As per requirement	PIU, PMU, DMSC	Checking of all permit including tree felling if any Availability of EMP at site	Checking of records and documents	Recorded and documents related to NOC/ permit	Start, continued as per requirement	PMU, DMSC
Technical design of the project	Office, project sites	PIU, DMSC	Checking of technical design – considering sustainability of the project	Checking of records and documents	Design document availability – showing maintenance and protection of the assets and confirmation of state rules	Once, after change of design	PMU, DMSC
Utilities/ tree cutting if any	As per site requirement	Primary – DBO Contractor Secondary - DMSC	(i) List of affected utilities if any and operators; (ii) Bid document to include requirement for a contingency plan for service interruptions (ii)Collection of tree cutting permission with assistance DMSC/ PIU	Checking of records	(i) List of affected utilities and operators prepared; (ii)Tree cutting requirement and permission; and (ii) Requirement for a contingency plan for service interruptions (if any) included in bid documents	Once	PMU/PIU
Baseline Environmental Condition – Ambient Air Quality	Subproject sites	Primary – DBO Contractor Secondary - DMSC	Establish baseline values Respirable particulate matter (RPM), Sulphur dioxide, Nitrogen oxides and (v)	Air sample collection and analyses by in-house laboratory or accredited	GOI Ambient Air Quality Standards	Once prior to start of construction	PMU/PIU

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
			Carbon monoxide	3rd party laboratory			
Baseline Environmental Condition - Water Quality	Subproject sites	Primary - DBO Contractor Secondary - DMSC	Establish baseline values of suspended solids (TSS), pH, chemical oxygen (COD), biological oxygen demand (BOD), turbidity, dissolved oxygen, oil and grease, fecal coliform and other parameters as per standard	Water sample collection and analyses by in-house laboratory or accredited 3rd party laboratory	GOI Water Quality Standards	Once prior to start of construction	PMU/PIU
Water Supply Cessation	As per site requirement	Primary - DBO Contractor Secondary - DMSC With the help of GMC	(i) schedule of closure; (ii) Design consideration as per CPHEEO Manual on water supply and treatment; and (iii) delivery of GMC of potable water to affected people	Checking of records	(i) Tentative schedule of closure made known to affective people 2 weeks prior to cessation of water supply; (ii) Coordination with GMC for supply of potable water to 100% affected people	Once	PMU/PIU, DMSC
Social and Cultural Heritage	As per site requirement	Primary - DBO Contractor Secondary - DMSC	Chance Finds Protocol	Checking of records	Chance Finds Protocol provided to construction contractors prior to commencement of activities	Once	PMU/PIU/DM SC
Traffic flow management strategy	As per site requirement	Primary - DBO Contractor	Traffic Management Strategy	Checking of Traffic Management	Documents/ maps showing area of intervention and	Quarterly	PMU/PIU/DM SC

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
		Secondary - DMSC		Strategy	application of TMP		
Construction work camps, hot mix plants, stockpile areas, storage areas, and disposal areas.	As per site requirement	DBO contractor to select locations as per selection criteria / considering mitigation measures. PMU/PIU and DMSC to approve locations prior to construction	List of selected location for construction work camps, hot mix plants, stockpile areas, storage areas, and disposal areas.	Checking of records	List of selected sites for construction work camps, hot mix plants, stockpile areas, storage areas, and disposal areas provided to construction contractors prior to commencement of works.	Once	PMU/PIU/DM SC
Sources of Materials	As per site requirement	DBO Contractor to prepare list of approved quarry sites and sources of materials PMU/ PIU/DMSC will approve after verification	(i)List of approved quarry sites and sources of materials; (ii) Bid document to include requirement for verification of suitability of sources and permit for additional quarry sites if necessary. (iii)Quality pipes needs to be procured after approval of DMSC/PIU	Checking of records	(i) List of approved quarry sites and sources of materials provided to construction contractors (ii) Bid document included requirement for verification of suitability of sources and permit for additional quarry sites if necessary. (iii) BID document provide details of the pipe	Once	PMU/PIU/DMS C

DMSC = Design, Management and Supervision Management Consultant, O&M = operation and maintenance, PMU = Project Management Unit; PIU = Project Implementation Unit

Table 30: Construction Environmental Monitoring Program

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
Sources of Materials	Quarries and sources of other materials	DBO Contractor	Construction Contractor documentation	(i) Checking of records; (ii) visual inspection of sites	(i) Sites are permitted; (ii) Report submitted by construction contractor monthly (until such time there is excavation work)	Monthly submission for construction contractor As needed for DMSC	DMSC
Air Quality	Construction sites and areas designated for stockpiling of materials	DBO Contractor	(i) Location of stockpiles; (ii) complaints from sensitive receptors; (iii) heavy equipment and machinery with air pollution control devices (iv) ambient air for respirable suspended particulate matter; (v) vehicular emissions such as sulphur dioxide (SO ₂), nitrous oxides (NO _x), carbon monoxide (CO), and hydrocarbons (HC) – considering requirement as per CTE	(i) Checking of records; (ii) visual inspection of sites	(i) stockpiles on designated areas only; (ii) complaints from sensitive receptors satisfactorily addressed; (iii) air pollution control devices working properly; (iv) GOI Ambient Quality Standards for ambient air quality; (v) GOI Vehicular Emission Standards for SO ₂ , NO _x , CO and HC.	Monthly for checking records	DMSC in coordination with pollution control board
Surface Water	(i) Construction	DBO	(i) Areas for	Testing and	(i) designated areas	Monthly	DMSC

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
Quality	sites; (ii) areas for stockpiles, storage of fuels and lubricants and waste materials	Contractor	stockpiles, storage of fuels and lubricants and waste materials; (ii) testing of surface water quality as per CTE; (iii) effectiveness of water management measures	visual inspection	only; (ii) silt traps installed and functioning; (iii) no noticeable increase in suspended solids and silt from construction activities; and (iv) GOI Standards for Water Discharges to Inland Waters and Land for Irrigation		
Noise Levels	(i) Construction sites; (ii) areas for stockpiles, storage of fuels and lubricants and waste materials; (iii) work camps	DBO Contractor	(i) Complaints from sensitive receptors; (ii) use of silencers in noise-producing equipment and sound barriers, (iii) Equivalent day and night time noise levels	(i) Checking of records; (ii) visual inspection and measurement	(i) Complaints from sensitive receptors satisfactorily addressed; (ii) silencers in noise-producing equipment functioning as design; and (iii) sound barriers installed where necessary	Monthly	DMSC in coordination with Assam Pollution Control Board
Existing Utilities and Infrastructure	Construction sites	DBO Contractor	(i) Existing Utilities Contingency Plan	(i) Checking of records; (ii) visual inspection	Implementation according to Utilities Contingency Plan	As needed	DMSC
Traffic	Construction sites	DBO Contractor	(i) ensure traffic management strategy is part of contract documents and being	(i) Checking of records; (ii) visual inspection	Implementation according to traffic management plan	As needed	DMSC

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
			implemented				
Landscape and Aesthetics	(i) Construction sites; (ii) areas for stockpiles, storage of fuels and lubricants and waste materials; (iii) work camps	DBO Contractor	(i) Waste Management List; (ii) complaints from sensitive receptors; (iii) PMU/PIU/DMSC to report in writing that the necessary environmental restoration work has been adequately performed before acceptance of work.	(i) Checking of records; (ii) visual inspection	(i) No accumulation of solid wastes on-site; (ii) implementation of Waste Management List; (iii) complaints from sensitive receptors satisfactorily addressed.	Monthly	DMSC
Accessibility	(i) Construction sites; (ii) traffic haul road	DBO Contractor	(i) Traffic Management Strategy; (ii) complaints from sensitive receptors; (iii) number of signages placed at subproject location.	Visual inspection	(i) Implementation of Traffic Management Strategy, if required; (ii) complaints from sensitive receptors satisfactorily addressed; (iii) signages visible and located in designated areas	Monthly	DMSC
Socio-Economic Income	Construction sites	DBO Contractor	(i) Complaints from sensitive receptors; (ii) number of walkways, signages, and	Visual inspection	(i) Complaints from sensitive receptors satisfactorily addressed; (ii) walkways, ramps, and metal sheets	Quarterly	DMSC

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
			metal sheets placed at subproject location.		provided (iii) signages visible and located in designated areas		
Socio-Economic - employment	Construction sites	DBO Contractor	(i) Employment records; (ii) records of sources of materials	Checking of records	Number of employees from Guwahati equal or greater than 50% of total workforce	Quarterly	DMSC
Ecological resources – Terrestrial and aquatic	Construction sites	DBO Contractor	Record related of tree felling and aquatic floral and faunal impact if any	(i) Checking of records; (ii) visual inspection	(i) Complaints from sensitive receptors; (ii) checking of conservation management plan for tree species	Quarterly	DMSC
Occupational Health and Safety	Construction sites	DBO Contractor	(i) Site-specific Health and Safety (H&S) Plan; (ii) Equipped first-aid stations; (iii) Medical insurance coverage for workers; (iv) Number of accidents; (v) Supplies of potable drinking water; (vi) Clean eating areas where workers are not exposed to hazardous or noxious substances; (vii) record of H&S	(i) Checking of records; (ii) visual inspection	(i) Implementation of H&S plan; (ii) number of work-related accidents; (iii) % usage of personal protective equipment; (iv) number of first-aid stations, frequency of potable water delivery, provision of clean eating area, and number of sign boards are according to approved plan; (v) % of moving equipment outfitted with audible back-up alarms	Quarterly	DMSC

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
			orientation trainings (viii) personal protective equipments; (ix) % of moving equipment outfitted with audible back-up alarms; (x) sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal.				
Community Health and Safety	Construction sites	DBO Contractor	(i) Traffic Management Strategy; (ii) complaints from sensitive receptors	Visual inspection	(i) Implementation of Traffic Management Strategy; (ii) complaints from sensitive receptors satisfactorily addressed	Quarterly	DMSC
Work Camps	Work camps	DBO Contractor	(i) Complaints from sensitive receptors; (ii) water and sanitation facilities for	Visual inspection	(i) Designated areas only; (ii) complaints from sensitive receptors satisfactorily addressed	Quarterly	DMSC

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
			employees; and (iii) PMU/PIU/DMSC report in writing that the camp has been vacated				

BOD = biological oxygen demand, DMSC = Design, Management and Supervision Management Consultant, H&S = health and safety, RPM = respirable particulate matter, GOI= Government of India, SPM = suspended particulate matter; PMU = Project Management Unit; PIU = Project Implementation Unit

Table 31: Operation and Maintenance Environmental Monitoring Program

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
General Maintenance work (pipe cleaning, declogging, pipe replacement, final sludge disposal)	Subproject location	DBO Contractor later GMC	Complaints from sensitive receptors	Checking of records	Complaints from sensitive receptors satisfactorily addressed	As needed	PMU/PIU
Accessibility	Subproject location	DBO Contractor later GMC	Complaints from sensitive receptors	Checking of records	Complaints from sensitive receptors satisfactorily addressed	As needed	PMU/PIU
Water Quality	At WTP, intake location and pipe line points	DBO Contractor later GMC	Drinking water quality parameter: pH, total metals, chloride, fluoride, turbidity, coliform, BOD	Sample collection and laboratory analyses	GOI Drinking Water Standards	As needed	PMU/PIU
Solid Wastes	Near	DBO	Complaints	Sample	Complaints from	Quarterly	PMU/PIU

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
	treatment plant Disposal location	Contractor later GMC	from sensitive receptors	collection and laboratory analyses	sensitive receptors satisfactorily addressed		
Effluent quality	Treatment plant	DBO Contractor later GMC	Complaints from sensitive receptors	Sample collection and laboratory analyses	Complaints from sensitive receptors satisfactorily addressed	Quarterly	PMU/PIU
Hazardous Wastes	Treatment plant	DBO Contractor later GMC	Complaints from sensitive receptors	(ii) Site checking (iii) Checking of document	Complaints from sensitive receptors satisfactorily addressed Awareness and emergency training document	Quarterly	PMU
Air Emissions	Treatment plant location	DBO Contractor later GMC	Complaints from sensitive receptors	Air sample collection and laboratory testing	GOI air quality standard	Quarterly – as per CTO	PMU
Land Uses	subproject location	DBO Contractor later GMC	Complaints from sensitive receptors	Checking of records	Complaints from sensitive receptors satisfactorily addressed	As needed	PMU/PIU
Health and Safety	subproject location	DBO Contractor later GMC	Complaints from sensitive receptors	Checking of records	Complaints from sensitive receptors satisfactorily addressed	As needed	PMU/PIU

CPCB = Central Pollution Control Board; O&M = operation and maintenance, GMC = Guwahati Municipal Council PMU = Project Management Unit; PIU = Project Implementation Unit

C. Environmental Management Plan Costs

213. The subproject is assessed to have no design or location impacts. Both intake and WTP will be located within the Govt. land and raw water mains will be laid within ROWs.

214. Construction stage impacts are typical for the construction activity and mitigation provided is mainly in terms of good construction practices like water sprinkling to arrest dust generation, clearing of excess soil, which will be incorporated into the Bill of Quantities and construction contractor's documents which will be binding during implementation. Also there will be requirement of monitoring of noise level and water quality as per monitoring plan. There will be no additional costs of environmental management beyond the contractor's costs which are absorbed in the overall project costs for civil works. The operation phase mitigation measures are again of good operating practices, which will be the responsibility of operation agency, therefore there are no additional costs. Construction phase clauses are shown in **Appendix 8**.

215. The monitoring proposed mainly includes site inspections and informal discussions with workers and local people and this will be the responsibility of PMU, costs of which are part of project management. The air quality and noise level monitoring of construction phase will be conducted by the contractor, since this is an additional cost, and therefore it needs to be part of subproject cost. The environmental management and monitoring costs are summarized in **Table 32**.

Table 32: Indicative Cost for Environmental Management and Monitoring

Component	Description	Number	Cost per Unit (₹)	Cost (₹)	Source of Funds
Legislation, Permits and Agreements	Consent to Establish and Consent to Operate for plants and machinery of the contractor.	As required	Applicable	Applicable	-
Public consultations and information disclosure	Information disclosure and consultations during preconstruction and construction phase.	As required	Lump sum	70,000	Concerned Contractor
Providing access to commercial establishments and properties.	Providing access, in case of access disruptions, to affected properties.	As per requirement	Contractor's liability	Not applicable	Covered under engineering cost
Dust Suppression at subproject sites	Application of dust suppression measures during construction phase.	As required	Lump sum	2,00,000	Concerned Contractor
Traffic management	Safety Signboards, delineators, traffic regulation	Wherever required throughout	Contractor's liability	Not applicable	Covered in engineering cost

Component	Description	Number	Cost per Unit (₹)	Cost (₹)	Source of Funds
	equipments, flagman, temporary diversions, etc	subproject corridor			
Baseline Monitoring	Site preparation and preliminary activities				
Air	Once before start of construction works at 7 locations – 2 intake, 3 WTP, 2 raw water main	7 samples	7,000 per sample	49,000	Covered under engineering design and cost – Concerned Contractor
Noise	Once before start of construction works at 7 locations – 2 intake, 3 WTP, 2 raw water main	7 samples	1,000 per sample	7,000	Covered under engineering design and cost – Concerned Contractor
Water quality	At proposed intake site once before start of construction – 3 samples	3	10,000 per sample	30,000	Covered under engineering design and cost – Concerned Contractor
Construction Monitoring					
Air	Monthly at 5 locations near project sites for at least 2.5 years	150 samples	7,000 per sample	10,50,000	Covered under engineering design and cost – Concerned Contractor
Noise	Monthly at 5 locations near project sites for at least 2.5 years	150 samples	1,000 per sample	150,000	Covered under engineering design and cost – Concerned Contractor
Water quality	Monthly at intake site throughout the construction period Measure of specially River water turbidity during construction	30 samples	10000 per sample	300,000	Covered under engineering design and cost – Concerned Contractor
Defect Liability Period (No. of sites will be finalized as per Consent to Operate condition)					
Air	Twice at 7 locations near project sites for 1 year	14 samples	7,000 per sample	98,000	Covered under engineering design and cost – Concerned Contractor
Noise	Twice at 7 locations near project sites for 1	14 samples	1,000 per sample	14,000	Covered under engineering design and cost –

Component	Description	Number	Cost per Unit (₹)	Cost (₹)	Source of Funds
	year				Concerned Contractor
Water quality	From intake and WTP – raw and treated	10 samples	10000 per sample	100,000	Covered under engineering design and cost – Concerned Contractor
Any unanticipated impact due to subproject implementation (including compensation for tree felling)	Mitigation of any unanticipated impact arising during construction phase and defect liability period.	Lump sum	Lump sum	3,00,000	As per requirement - PMU
TOTAL (₹) Rupees twenty three sixty eight thousand only				23,68,000	
				TOTAL (US\$)	35343

VIII. FINDINGS AND RECOMMENDATIONS

216. The Initial Environmental Examination (IEE) assessed the environmental impacts of all components proposed under the Guwahati Water Supply Subproject part. Potential negative impacts were identified related to design, location, construction and operation of the subproject. Negative impacts are assessed to be minimal.

217. The potential adverse environmental impacts of the proposed construction of intake, WTP and pumping mains pipelines subproject are mainly related to the construction period, which can be minimized by the mitigating measures and environmentally sound engineering and construction practices.

218. As stated above, most impacts are due to construction; this is because construction work is to be carried out in the city including populated areas. The important impacts identified are; generation of dust and noise from construction activities; increase in turbidity during construction of intake; disturbance to traffic flows; impacts due to disposal/ utilization of large quantities of surplus soil; disturbance and inconvenience to local people due to trenching along the road; public safety; interference and damage to other infrastructure facilities, landslide or landslip due to excavation along hill slopes.

219. These impacts are mostly temporary in nature and can be effectively avoided or mitigated by observing the proposed mitigation measures. The mitigation measures includes careful alignment of pipelines in order to minimize the impact, following existing alignment along roads, laying of pipeline over ground to avoid excavation and cutting of trees, minimizing the construction area, wetting of soil and construction area to reduce the dust; immediate transport of excess soil; beneficial use of excess soil; scheduling of activities to reduce the noise impacts; special precaution near to sensitive areas as well along hill slopes, and, traffic diversions and public information to reduce the impact. Proper safety measures during construction activities for ensuring worker's as well public safety.

220. Once the system is operating, most facilities (intake, WTP, pump house, water mains) will operate with routine maintenance, which should not affect the environment. Leaks in the pipeline will need to be repaired from time to time, but environmental impacts will be much less than those of the construction period as the work will be infrequent, affecting small areas only. It will also be conducted in areas that have already been excavated, so there will be no need to protect archaeological material. Disposal of sludge from WTP is also to be done regular interval.

221. The main impacts of the operating water supply system will be beneficial as the citizens of Guwahati will be provided with a constant supply of water, which will serve a greater proportion of the population, including slum-dwellers. This will improve the quality of life of people as well as benefiting both individual and public health as the improvements in hygiene should reduce the incidence of disease associated with poor sanitation. This should lead to economic gains as people will be away from work less and will spend less on healthcare, so their incomes should increase.

222. Mitigation will be assured by a program of environmental monitoring conducted during construction and operation to ensure that all measures are implemented, and to determine whether the environment is protected as intended. This will include observations on- and off-site, document checks, and interviews with workers and beneficiaries, and any requirements for remedial action will be reported to the PMU. There will also be longer-term surveys to monitor the expected improvements in the quality of domestic water and the health of the population.

IX. CONCLUSIONS

223. This IEE has assessed all potential environmental impacts associated with the subproject. There are no impacts that are significant or complex in nature, or that need an in-depth study to assess the impact. Thus, the subproject is unlikely to cause significant adverse impacts. The potential adverse impacts that are associated with design, construction, and operation can be mitigated to standard levels without difficulty through proper engineering design and the incorporation or application of recommended mitigation measures and procedures.

224. Based on the findings of the IEE, the classification of the Project as Category "B" is confirmed, and no further special study or detailed EIA needs to be undertaken to comply with ADB SPS (2009).

APPENDIX 1: CONSENT TO ESTABLISH - WATER TREATMENT PLANT



Pollution Control Board, Assam

(Department of Environment & Forests, Government of Assam)

অসম প্ৰদূষণ নিয়ন্ত্ৰণ পৰিষদ
(অসম চৰকাৰৰ বন আৰু পৰিৱেশ বিভাগ)

No. WB/GUW/T-2342/12-13/94

To

Dated Guwahati, the 11th July' 2014

The Chief Executive Officer
Guwahati Metropolitan Development Authority
Bhangagarh, Guwahati-781005.

Sub: Extension of validity of "Consent to Establish" for WTP (South Guwahati East Zone) – ADB assisted Guwahati Water Supply Project.

**Ref: i) Your letter No. GMDA/ENV/3/2012/105 dtd. 24.06.2014.
ii) CTE granted vide letter No. WB/GUW/T-2342/12-13/92/859 dtd. 19.10.2012.**

Sir,

With reference to your application the Board is pleased to extend the validity of "Consent to Establish" for another 3 (three) years with effect from 18.10.2014.

Other terms & conditions will remain same.

Yours faithfully,

Member Secretary (i/c)

Dated Guwahati the 11th July' 2014

Memo No. WB/GUW/T-2342/12-13/94-A,

Copy to:

1. The Chairman, Pollution Control Board, Assam for favour of information.
2. The Sr. Env. Engineer, Regional Office, Guwahati for information & necessary action.

Member Secretary (i/c)

*Bhaskar
Bhaskar
Bhaskar*

**POLLUTION CONTROL BOARD, ASSAM
BAMUNIMAIDAM:GUWAHATI – 21**

No.WB/GUW/T-2342/12-13/92

859

Dated Guwahati, *19/10/12*

“CONSENT TO ESTABLISH”

Provisional “CONSENT TO ESTABLISH” is hereby granted to The Guwahati Metropolitan Development Authority for setting up a Water Treatment Plant (South Guwahati East Zone) at Chunchali, Guwahati in the district of Kamrup (M) Assam under the following terms and conditions:-

1. No Air, Water, Soil pollution shall be created by the industry beyond the permissible limits prescribed by the Board. The industry would incorporate adequate pollution control measures before they put the plant into operation.
2. To maintain the environment and ecology in the area provisions for planting selected species of tree within the compound and approaches along with provisions for park, garden and fountain shall have to be made. Massive afforestation will have to be made by the industry in the factory and township if any.
3. As per provisions of Water (Prevention & Control of Pollution) Act, 1974 and Air (Prevention & Control of Pollution) Act, 1981 any officer, employed by this Board on its behalf shall without any interruption, the right at any time to enter the industry for inspection, to take samples for analysis and any call for any information etc. violation of this right will be withdrawal of this permission.
4. As per provisions of the Act, regular monitoring is to be done by the industry from the location/points fixed by the Board and the report to be submitted to the board monthly.
5. Effluent carrying drains must be segregated from storm water drain and effluent must be disposed in effluent pond in no case effluent will be allowed to discharge into nearby nullah/natural water course etc. without treatment and bringing it within permissible limits fixed by the Board.
6. Standard linings on flat embankment of effluent pond shall have to be provided to prevent and control of overflow seepage and leakage of effluent to the nearby areas.
7. To regularise the subsequent, the legal provisions of “Consent to Operate” as per Act and Cess Returns as per Cess Act, 1977 shall have to timely adhered to.
8. Gaseous pollution due to the burning of fuel to run engine boiler, etc. should be controlled by adopting preventive measures adequately.
9. Solid waste that arises during the operation should be properly graded and disposed of scientifically without causing nuisances.
10. For Low lying areas, special care is to be taken by the industry to prevent any overflow, seepage and leakage of effluent.
11. For warning (Alarm, Siren) is to be installed by the unit to guard against accidental pollution/ mishap together with fire fighting devices.

-2-

12. All pipe connection, Joints; fittings etc. in the factory and plant are to be frequently checked and shall be leak proof all the time.
13. Proper housekeeping and adequate maintenance has to be ensured/ enforced as per provisions of Acts.
14. All unwanted Toxic Chemical/Fluid/Gases are to be neutralized and flared up as necessary.
15. Production process is to be monitored and in the event of danger immediate shut down is to be ensured by the industry.
16. Provisional "**CONSENT TO ESTABLISH**" has been issued basing on the particulars furnished by the applicant and subject to imposition to further/more conditions if warranted by the subsequent development.
17. The "**CONSENT TO ESTABLISH**" will be valid for two year from the date of issue of the order.
18. Healthy working environment for the worker must be maintained and there should not be health Hazard to the workers for in adequate arrangement for ventilation, dust removal arrangements should be adequate and full proof for the health of the workers. Their health should be regularly monitored.
19. The unit must submit compliance report of action taken on the conditions given by the Board before commissioning the unit.
20. Adequate trees should be planted and maintained in the vacant space of the premises and all around the factory and township if any.
21. The Board will be at liberty to withdraw the "**CONSENT TO ESTABLISH**" at any time without notice, if necessary steps for prevention of pollution and prevention of environment is not taken by the industry as per mentioned conditions.
22. This issuance of the "**CONSENT TO ESTABLISH**" does not convey any property right in their real or personal property or any exclusive privileges nor does it authorize any injury to private property nor any invasion right any infringement of Central, State or Local Laws or Regulations.
23. The "**CONSENT TO ESTABLISH**" does not authorize or approve the construction of any physical structures or facilities or the undertaking of any work in any natural watercourse except of the works specially instructed herein.
24. The unit shall not discharge any waste water outside the campus without treatment.
25. The unit shall not use any fuel which may create Air Pollution.
26. No noise pollution is to be created by the unit.
27. Noise damping wall have to arrange.
28. All the pollution control devices have to be installed prior to the commissioning of the unit.
29. Adequate fire fighting with fittings like fire hydrant etc shall have to be provided in order to prevent fire hazard.
30. Monthly Ambient Air Quality Monitoring report of the site should be submitted to ..

-3-

31. Noise level of the site to be submitted monthly to the Board as per classification of the land use.
32. Water quality in & around the site to be submitted to the Board before and during construction.
33. The following Rules to be adopted :-
 - (a) Hazardous (Management & Handling & Transboundary Movement) Rule, 2008.
 - (b) Municipal Solid Waste (Management & Handling) to be adhered to.
 - (c) Battery (Management & Handling) Rule, 2001 to be followed.
34. "Consent to Establish" & "Consent to Operate" for all the D. G. sets to be obtained.
35. During construction of reservoir and treatment plant, adequate care should be taken, so that soil and other loose material does not slide down the unit.
36. Natural flowing of stream in the activities area should not be broken at any case.
37. Details of sludge generation, treatment and disposal are to be furnished to the Board before commissioning of the plant.
Necessary soil conservation measure should be adopted in the activity area.
38. Compliance report should be submitted to the Board monthly.
39. The Board will have the liberty to withdraw the "**CONSENT TO ESTABLISH**" if adequate pollution control and safety measures are not taken.

sd/

Member Secretary

Memo No. WB/GUW/T-2342/12-13/92-A,

Dated Guwahati,

Copy to:

- ✓ 1) The Guwahati Metropolitan Development Authority, Chunchali, Guwahati, Dist.: Kamrup (M), Assam for information & necessary action. The "**CONSENT TO ESTABLISH**" is valid subject to fulfillment of above terms & conditions and also subject to obtaining necessary permission from other competent Authorities.
- 2) The Deputy Secretary to the Govt. of Assam, Department of Environment & Forest, Dispur, Guwahati-6 for favour of information.
- 3) The Deputy Commissioner, Kamrup (M) district for favour information.
- 4) The General Manager, DI & CC, Kamrup (M) for favour information.
- 5) The Sr. Env. Engineer, Regional Office, Guwahati, Pollution Control Board, Assam for information & necessary action. The "**CONSENT TO ESTABLISH**" is valid subject to fulfillment of above terms and conditions and also subject to obtaining necessary permission from other competent Authorities. This has a reference to his letter No. APCB/ROG/T-4180/12-13/93 dtd. 14/09/2012.

f.

Point Wise Compliance Report on CTE Conditions

CTE CONDITIONS	COMPLIANCE
1. No Air, Water, Soil pollution shall be created by the industry beyond the permissible limits prescribed by the Board. The industry would incorporate adequate pollution control measures before they put the plant into operation	1. Agreed, necessary pollution control measures will be taken before putting the plant into operation
2. To maintain the environment and ecology in the area provisions for planting selected species of tree within the compound and approaches along with provisions for park, garden and fountain shall have to be made. Massive afforestation will have to be made by the industry in the factory and township if any.	2. Afforestation will be made in the space available in consultation with Pollution Control Board Assam (PCBA).
3. As per provisions of Water (Prevention & Control of Pollution) Act, 1974 and Air (Prevention & Control of Pollution) Act, 1981 any officer, employed by this Board on its behalf shall without any interruption, the right at any time to enter the industry for inspection, to take samples for analysis and any call for any information etc. violation of this right will be withdrawal of this permission.	3. Agreed.
4. As per provisions of the Act, regular monitoring is to be done by the industry from the location/points fixed by the Board and the report to be submitted to the board monthly	4. Agreed, monthly monitoring will be done and results will be submitted to PCBA
5. Effluent carrying drains must be segregated from storm water drain and effluent must be disposed in effluent pond in no case effluent will be allowed to discharge into nearby nullah/natural water course etc. without treatment and bringing it within permissible limits fixed by the Board.	5. Yes, provision will be made for recycling & treatment of effluent in treatment plant via sump in DBO contract.
6. Standard linings on flat embankment of effluent pond shall have to be provided to prevent and control of overflow seepage and leakage of effluent to the nearby areas.	6. Yes, sump will be provided as stated in SL 5
7. To regularize the subsequent, the legal provisions of 'Consent to Operate' as per Act and Cess Returns as per Cess Act, 1977 shall have to timely adhered to.	7. Agreed, as per statutory norms.
8. Gaseous pollution due to the burning of fuel to run engine boiler, etc. should be controlled by adopting preventive measures adequately,	8. There will be no boiler, however, necessary preventive measures for air pollutant from DG sets will be taken.
9. Solid waste that arises during the operation should be properly graded and disposed of scientifically without causing nuisances.	9. The solid waste generated (sediment) will be stored separately and may be used as raw material for manufacturing bricks
10. For Low lying areas, special care is to be taken by the industry to prevent any overflow, seepage and leakage of effluent	10. All care will be taken to prevent over flow, seepage etc.
11. For warning (Alarm, Siren) is to be installed by the unit to guard against accidental pollution/ mishap together with fire fighting devices.	11. Alarm /siren will be installed in the WTP.
12. All pipe connection, Joints; fittings etc. in the factory and plant are to be frequently checked and shall be leak proof all the time.	12. Yes, this will be done on regular basis.
13. Proper housekeeping and adequate maintenance has to be ensured, enforced as per provisions of it	13. Yes, agreed.

CTE CONDITIONS	COMPLIANCE
14. All unwanted Toxic Chemical/Fluid/Gases are to be neutralized and flared up as necessary	14. Yes, chlorine absorption chamber and chlorine mitigation system will be provided
15. Production process: is to be monitored and in the event of danger immediate shut down is to be ensured by the industry	15. Yes, agreed. Monitoring system will be adopted through SCDA.
16. Provisional "CONSENT TO ESTABLISH" has been issued basing on the particulars furnished by the applicant and subject to imposition to further/more conditions if warranted by the subsequent development	16. Noted
17. The "CONSENT TO ESTABLISH" will be valid for two year from the date of issue of the order.	17. Noted
18. Healthy working environment for the worker must be maintained and there should not be health Hazard to the workers for in adequate arrangement for ventilation, dust removal arrangements should be adequate and full proof for the health of the workers. Their health should be regularly monitored,	18. Yes, proper working environment will be maintained and monitoring will be done as per HSE norms.
19. The unit must submit compliance report of action taken on the conditions given by the Board before commissioning the unit,	19. The compliance report will be submitted accordingly.
20. Adequate trees should be planted and maintained in the vacant space of the premises and all around the factory and township if any.	20. Trees will be planted as stated in SL no..2.
21. The Board will be at liberty to withdraw the "CONSENT TO ESTABLISH" at any time without notice, if necessary steps for prevention of pollution and prevention of environment is not taken by the industry as per mentioned conditions.	21. Noted
22.This issuance of the "CONSENT TO ESTABLISH" does not convey any property right in their real or personal property or any exclusive privileges nor does it authorize any injury to private property nor any invasion right any infringement of Central, State or Local Laws or Regulations	22. Agreed.
23. The "CONSENT TO ESTABLISH" does not authorize or approve the construction of any physical structures or facilities or the undertaking of any work in any natural watercourse except of the works specially instructed herein.	23. Agreed
24. The unit shall not discharge any waste water outside the campus without treatment.	24. Agreed.
25. The unit shall not use any fuel which may create Air Pollution.	25. Agreed, only recommended fuel will be used in DG sets.
26.No noise pollution is to be created by the unit	26. Noise level will be maintained as per statutory norms.
27. Noise damping wall have to arrange.	27. If required noise damping wall will be provided as per the advice of PCBA.
28.All the pollution control devices have to be installed prior to the	28. Agreed, as stated earlier

CTE CONDITIONS	COMPLIANCE
commissioning of the unit	
29. Adequate firefighting with fittings like fire hydrant etc. shall have to be provided in order to prevent fire hazard,	29. Adequate fire fighting system will be provided.
30. Monthly Ambient Air Quality Monitoring report is to be Submitted to the board.	30. Monthly ambient air quality monitoring report will be submitted to APCB.
31. Noise level of the site to be submitted monthly to the Board as per classification of the land use	31. Noise level monitoring report will be submitted to APCB monthly
32. Water quality in & around the site to be submitted to the Board before and during construction	32. Water quality of the river Brahmaputra will be submitted to APCB quarterly.
33. The following Rules to be adopted (a) Hazardous (Management & Handling Transboundary Movement) Rule: 2008. (b)Municipal Solid Waste(Management & Handling) to be adhered to (c)Battery (Management & Handling) Rule, 2001 to be followed.	33. All the statutory rules will be followed strictly.
34. 'Consent to Establish" & 'Consent to Operate' for all the D. G. sets to be obtained.	34. For DG sets CTE and CTO will be obtained from APCB.
35. During construction of reservoir and treatment plant, adequate care should be taken, so that soil and other loose material does not slide down the .unit,	35. Yes, this will be taken care as per EMP.
36. Natural flowing of stream in the activities area should not be broken at any case.	36. Yes, there is no natural flowing stream in the area other than river Brahmaputra.
37. Details of sludge generation, treatment and disposal Details of sludge generation, treatment and disposal are to be furnished to the Board .before, commissioning of the, plant. Necessary soil conservation measure should be adopted in the activity area.	37. Yes, report in this regard will be submitted to APCB Yes, report in this regard will be submitted to APCB in due course.
38. Compliance report should 'be submitted to the Board monthly.	38. Yes, agreed.
39.The Board will have the liberty to withdraw the "CONSENT TO ESTABLISH" if adequate pollution control and safety measures are not taken	39. Noted

**APPENDIX 2: CENTRAL POLLUTION CONTROL BOARD (CPCB) APPLICABLE
ENVIRONMENTAL STANDARDS**

General Standards for Discharge of Environmental Pollutants: Effluents

S. No.	Parameter	Standards			
		Inland surface water	Public sewers	Land of irrigation	Marine/coastal areas
		(a)	(b)	(c)	(d)
1.	Colour and odour	remove as far as practicable			
2.	Suspended solids mg/l. max.	100	600	200	(a) For process waste water 100 (b) For cooling water effluent 10% above total suspended matter of influent.
3.	Particle size of suspended solids	shall pass 850 micron IS Sieve			(a) Floatable solids, max. 3mm. (b) Settable solids (max 850 micron)
4.	pH value	5.5. to 9.0	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0
5.	Temperature	shall not exceed 5°C above the receiving water temperature			shall not exceed 5°C above the receiving water temperature
6.	Oil and grease, mg./l, max.	10	20	10	20
7.	Total residual chlorine, mg/l. max.	1.0			1.0
8.	Ammonical nitrogen (as N.) mg/l max	50	50		50
9.	Total Kjeldahl Nitrogen (as NH ₃) mg/l. max	100			100
10.	Free ammonia (as NH ₃), mg/l.max	5.0			5.0
11.	Biochemical oxygen demand (3 days at 27°C), mg/l. max.	30	350	100	100
12.	Chemical oxygen demand, mg/l, max.	250			250

S. No.	Parameter	Standards			
		Inland surface water	Public sewers	Land of irrigation	Marine/coastal areas
13.	Arsenic (as As) mg/l, max.	0.2	0.2	0.2	0.2
14.	Mercury (As Hg), mg/l, max.	0.01	0.01		0.01
15.	Lead (as Pb) mg/l, max	0.1	1.0		2.0
16.	Cadmium (as Cd) mg/l. max	2.0	1.0		2.0
17.	Hexavalent chromium (as Cr. +6). mg/l, max	0.1	2.0		1.0
18.	Total Chromium (as Cr) mg/l, max	2.0	2.0		2.0
19.	Copper (as Cu) mg/l, max	3.0	3.0		3.0
20.	Zinc (as Zn) mg/l, max	5.0	15		15
21.	Selenium (as Se) mg/l, max	0.05	0.05		0.05
22.	Nickel (as Ni) mg/l, max	3.0	3.0		5.0
23.	Cyanide (as CN) mg/l, max	0.2	2.0	0.2	0.2
24.	Fluoride (as F) mg/l, max	2.0	15		15
25.	Dissolved phosphates (as P) mg/l, max	5.0			
26.	Sulfide (as S) mg/l, max	2.0			5.0
27.	Phenolic compounds (as C ₆ H ₅ OH) mg/l, max	1.0	5.0		5.0
28.	Radioactive materials: (a) Alfa emitters microcurie/ml, max. (b) Beta emitters micro curie/ml,max.	10 ⁻⁷	10 ⁻⁷	10 ⁻⁸	10 ⁻⁷
		10 ⁻⁶	10 ⁻⁶	10 ⁻⁷	10 ⁻⁶

S. No.	Parameter	Standards			
		Inland surface water	Public sewers	Land of irrigation	Marine/coastal areas
29.	Bio-assay test	90% Survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent
30.	Manganese (as Mn)	2 mg/l	2 mg/l		2 mg/l
31.	Iron (as Fe)	3 mg/l	3 mg/l		3 mg/l
32.	Vanadium (as V)	0.2 mg/l	0.2 mg/l		0.2 mg/l
33.	Nitrate Nitrogen	10 mg/l			20 mg/l

These standards shall be applicable for industries, operations or process other than those industries operations or process for which standards have been specified in schedule of the Environment Protection Rules, 1989

CPCB Primary Water Quality Criteria

Designated-Best-Use	Class of Water	Criteria
Drinking Water Source without conventional treatment but after disinfection	A	<ul style="list-style-type: none"> ❖ Total Coliform Organisms: MPN # 50 per 100ml ❖ 6.5 # pH # 8.5 ❖ Dissolved Oxygen: \geq 6 mg/L ❖ Biochemical Oxygen Demand (5 days @ 20°C): # 2 mg/L
Outdoor bathing (organized)	B	<ul style="list-style-type: none"> ❖ Total Coliform Organisms: MPN # 500 per 100ml ❖ 6.5 # pH # 8.5 ❖ Dissolved Oxygen: \geq 5 mg/L ❖ Biochemical Oxygen Demand (5 days @ 20°C): # 3 mg/L
Drinking water sources after conventional treatment and disinfection	C	<ul style="list-style-type: none"> ❖ Total Coliform Organisms: MPN # 5000 per 100ml ❖ 6 # pH # 9 ❖ Dissolved Oxygen: \geq 4 mg/L ❖ Biochemical Oxygen Demand (5 days @ 20°C): # 3 mg/L
Propagation of wildlife and fisheries	D	<ul style="list-style-type: none"> ❖ 6.5 # pH # 8.5 ❖ Dissolved Oxygen: \geq 4 mg/L ❖ Free ammonia (as N): # 1.2 mg/L
Irrigation, industrial cooling, controlled waste disposal	E	<ul style="list-style-type: none"> ❖ # pH # 8.5 ❖ Electrical conductivity at 25°C: #2250 micro mhos/cm ❖ Sodium absorption ratio: Max 26 ❖ Boron: Max 2 mg/L

Indian Standards for Drinking Water - Specification (BIS 10500: 2012)

S. No	Substance or Characteristic	Requirement (Desirable Limit)	Permissible Limit in the absence of Alternate source
Essential characteristics			
1.	Colour, (Hazen units, Max)	5	25
2.	Odour	Unobjectionable	Unobjectionable
3.	Taste	Agreeable	Agreeable
4.	Turbidity (NTU, Max)	5	10
5.	pH Value	6.5 to 8.5	No Relaxation
6.	Total Hardness (as CaCO ₃) mg/lit.,Max	300	600
7.	Iron (as Fe) mg/lit,Max	0.3	1.0
8.	Chlorides (as Cl) mg/lit,Max.	250	1000
9.	Residual, free chlorine, mg/lit, Min	0.2	--
Desirable Characteristics			
10.	Dissolved solids mg/lit, Max	500	2000
11.	Calcium (as Ca) mg/lit, Max	75	200
12.	Magnesium (as Mg)mg/lit, Max.	30	100
13.	Copper (as Cu) mg/lit, Max	0.05	1.5
14.	Manganese (as Mn)mg/lit ,Max	0.10	0.3
15.	Sulfate (as SO ₄) mg/lit, Max	200	400
16.	Nitrate (as NO ₃) mg/lit, Max	45	100
17.	Fluoride (as F) mg/lit, Max	1.0	1.5
18.	Phenolic Compounds (as C ₆ H ₅ OH) mg/lit, Max.	0.001	0.002
19.	Mercury (as Hg)mg/lit, Max	0.001	No relaxation
20.	Cadmiun (as Cd)mg/lit, Max	0.01	No relaxation
21.	Selenium (as Se)mg/lit,Max	0.01	No relaxation
22.	Arsenic (as As) mg/lit, Max	0.05	No relaxation
23.	Cyanide (as CN) mg/lit, Max	0.05	No relaxation
24.	Lead (as Pb) mg/lit, Max	0.05	No relaxation
25.	Zinc (as Zn) mg/lit, Max	5	15
26.	Anionic detergents (as MBAS) mg/lit, Max	0.2	1.0
27.	Chromium (as Cr ⁶⁺) mg/lit, Max	0.05	No relaxation
28.	Polynuclear aromatic hydro carbons (as PAH) g/lit, Max	--	--
29.	Mineral Oil mg/lit, Max	0.01	0.03
30.	Pesticides mg/l, Max	Absent	0.001
31.	Radioactive Materials		
	i. Alpha emitters Bq/l, Max	--	0.1
	ii. Beta emitters pci/l,Max	--	1.0
32.	Alkalinity mg/lit. Max	200	600
33.	Aluminium (as Al) mg/l,Max	0.03	0.2
34.	Boron mg/lit, Max	1	5

Ambient Air Quality Standards

Pollutant	Time Weighted Average	Industrial, Residential, Rural and Other Areas	Sensitive Area (Notified by Central Govt.)	Method of Measurement
-----------	-----------------------	--	--	-----------------------

Pollutant	Time Weighted Average	Industrial, Residential, Rural and Other Areas	Sensitive Area (Notified by Central Govt.)	Method of Measurement
Sulphur Dioxide(SO ₂)	Annual Average * 24 hours Average**	50 µg / m ³ 80 µg/m ³	20 µg / m ³ 80 µg/m ³	<ul style="list-style-type: none"> Improved West & Gaeke method Ultraviolet Fluorescence
Oxides of Nitrogen (NO _x)	Annual Average *24 hours Average**	40 µg / m ³ 80 µg/m ³	30 µg / m ³ 80 µg/m ³	<ul style="list-style-type: none"> Jacobs & Hochheiser modified (NaOH – NaAsO₂) method Gas Chemiluminescence
Particulate Matter (PM ₁₀) (Size <10 µm)	Annual Average * 24 hours Average**	60 µg / m ³ 100 µg/m ³	60 µg / m ³ 100 µg/m ³	<ul style="list-style-type: none"> Gravimetric TOEM Beta Attenuation
Particulate Matter (PM _{2.5}) (Size <2.5 µm)	Annual Average * 24 hours Average**	40 µg / m ³ 60 µg/m ³	40 µg / m ³ 60 µg/m ³	<ul style="list-style-type: none"> Gravimetric TOEM Beta Attenuation
Ozone (O ₃)	8 hours average **1 hour **	100 µg/m ³ 180 µg/m ³	100 µg/m ³ 180 µg/m ³	<ul style="list-style-type: none"> UV photometric Chemiluminescence Chemical method
Lead (Pb)	Annual Average * 24 hours Average**	0.5 µg / m ³ 1.0 µg / m ³	0.5 µg/m ³ 1.0 µg/m ³	<ul style="list-style-type: none"> AAS method after sampling using EPM 2000 or equivalent filter paper
Carbon Monoxide (CO)	8 hours Average** 1 hour **	2.0 mg/ m ³ 4.0 mg/ m ³	2.0 mg/ m ³ 4.0 mg/ m ³	<ul style="list-style-type: none"> Non Dispersive Infrared Spectroscopy
Ammonia (NH ₃)	Annual Average *24 hours Average**	100 µg / m ³ 400 µg / m ³	100 µg / m ³ 400 µg / m ³	<ul style="list-style-type: none"> Chemiluminescence Indophenol blue method
Benzene (C ₆ H ₆)	Annual Average *	5 ng/ m ³	5 ng/ m ³	<ul style="list-style-type: none"> Gas Chromatography continuous analyzer Adsorption & desorption followed by GC analysis
Benzo(o)pyrene particulate phase only	Annual Average *	1 ng/ m ³	1 ng/ m ³	<ul style="list-style-type: none"> Solvent extraction followed by GC/HPLC analysis
Arsenic (As)	Annual Average *	6 ng/ m ³	6 ng/ m ³	<ul style="list-style-type: none"> AAS/ICP method after sampling using EPM 2000 or equivalent filter paper
Nickel (Ni)	Annual Average *	20 ng/ m ³	20 ng/ m ³	<ul style="list-style-type: none"> AAS/ICP method after sampling using EPM 2000 or equivalent filter paper

(Source: Central Pollution Control Board, New Delhi, Notification dated 18th November 2009)

Notes:

1. * Indicate Annual Arithmetic Mean of Minimum 104 measurement in a year measured twice a week, 24 hourly at uniform intervals
2. ** 24 hourly / 8 hourly/1 hourly values should be met 98% of the time in a year. However, 2% of the time, it may exceed by not on two consecutive days

Noise Standards

Noise limits for domestic appliances and construction equipments at the manufacturing stage in dB(A).

Window air conditioners of 1 -1.5 tonne	68
Air coolers	60
Refrigerators	46
Diesel generator for domestic purposes	85
Compactors (rollers), front loaders, concentrate mixers, cranes (movable), vibrators and saws	75

National Ambient Noise Standards**The Noise Pollution (Regulation and Control) Rules, 2000**

Area Code	Category of Area	Limit in dB(A) Leq*	
		Day Time	Night Time
A.	Industrial area	75	70
B.	Commercial area	65	55
C.	Residential area	55	45
D.	Silence zone	50	40

Note-1 Day time is reckoned in between 6 a.m. and 10 p.m.

Note-2 Night time is reckoned in between 10 p.m. and 6 a.m.

Note-3 Silence zone is an area comprising not less than 100 m around hospitals, educational institutions, courts, religious places or any other area which is declared as such by the competent authority

Note-4 Mixed categories of areas may be declared as one of the four above mentioned categories by the competent authority.

* dB(A) Leq denotes the time weighted average of the level of sound in decibels on scale A which is relatable to human hearing.

A "decibel" is a unit in which noise is measured.

"A", in dB(A) Leq, denotes the frequency weighting in the measurement of noise and corresponds to frequency response characteristics of the human ear.

Leq: It is an energy mean of the noise level over a specified period.

**APPENDIX 3: ACTIVITIES TO BE PERFORM BY DBO CONTRACTOR - TIMELINE, FOR
THE UPDATING OF IEE AND IMPLEMENTATION OF EMP**

S. No.	Activities	Assistance	Time line
1	Carry out final design – intake location, raw water transmission, WTP with consideration of less environmental impact and minimization of mitigation measures	DMSC, PIU	Within 90 days after awarding of contract
2	Generation of base line data- air, water, noise and ecological survey in and around the project locations	DMSC, PIU, DMSC, Pollution Control Board	Within 6 months after awarding of contract
3	Public consultation, FGD with households, owners of commercial establishment, committee for sensitive receptors like religious place, school, health center within the impact zone	DMSC, PIU	Within 6 months after awarding of contract
4	Updation of IEE and EMP as per revised design and base line data	DMSC	Within 7 months after awarding of contract by the contractor
5	Collection of consent and other permission / NOC from concerned agencies	DMSC, PMU	Within 8 months after awarding of contract by the contractor
6	Orientation training program for contractor	By DMSC	Within 8 months after awarding of contract
7	Application of EMP	DMSC	From starting of work to completion of all activities

APPENDIX 4: PHOTO ILLUSTRATION



Photo 1: Proposed Intake site at Brahmaputra



Photo 2: Survey conducted near intake at Brahmaputra



Photo 3: Proposed water treatment site at Sunshali



Photo 4: Proposed water treatment plant and surrounding



Photo 5: Raw water rising main alignment – survey going on



Photo 6: Raw water rising main near IOCL

APPENDIX 5: RAPID ENVIRONMENTAL ASSESSMENT (REA) CHECKLIST
Guwahati Water Supply Subproject: Construction of Intake and Water Treatment Plant at Guwahati

Screening Questions	Yes	No	Remarks
A. Project siting Is the project area...			
• Densely populated?	✓		Built-up area in Guwahati accounts for about 50% of the land. The project will cover South Guwahati's East Zone (total area of 71 km ²) which have a 0.202 million population in 2001 and projected population of 0.64 million by 2040. However, there are no major negative impacts envisaged because the pipe-laying activities will be done along sides of existing roads with RoW without causing significant disturbance to houses and commercial establishments. In narrow streets, disruption to road users is likely, and measures like best activity scheduling, alternative routes, prior information to road users, houses and shops will minimize the impacts. These measures will be included in the EMP.
• Heavy with development activities?		✓	The subproject areas cover predominantly residential, commercial, and public and semi-public areas as per the Land Use Zoning Plan 2025 of Guwahati Metropolitan Development Authority (GMDA).
Adjacent to or within any environmentally sensitive areas?		✓	
• Cultural heritage site		✓	
• Protected area		✓	
• Wetland		✓	
• Mangrove		✓	
• Estuarine		✓	
• Buffer zone of protected area		✓	
• Special area for protecting biodiversity		✓	
• Bay		✓	
B. Potential environmental impacts Will the project cause...			
• Pollution of raw water supply from upstream wastewater discharge from communities, industries, agriculture, and soil erosion runoff?		✓	Not anticipated. The existing water supply source is the Brahmaputra River. The existing environmental condition of the river is good. No industries/agricultural activities are present upstream of the water intake. As vegetation in the water intake area is good, soil erosion runoff draining towards the water source is insignificant.
• Impairment of historical/cultural monuments/areas and loss/damage to these sites?		✓	Not applicable.
• Hazard of land subsidence caused		✓	Not applicable.

Screening Questions	Yes	No	Remarks
by excessive ground water pumping?			
<ul style="list-style-type: none"> Social conflicts arising from displacement of communities? 		✓	Displacement of communities is not required in this subproject. The subproject does not require acquisition of private land. However, during distribution pipe-laying, temporary economic displacement is anticipated. A Resettlement Plan (RP) has been developed to mitigate these temporary impacts.
<ul style="list-style-type: none"> Conflicts in abstraction of raw water for water supply with other beneficial water uses for surface and ground waters? 		✓	Not anticipated. The average discharge of the Bhramaputra River is 4,500 m ³ /sec and flows nearly full for a considerable length of time. The level of water remains at 48.17 m above mean sea level (MSL) for 50% of the days out of 150 monsoon days. Water quantity is sufficient and additional abstraction from the river will not have significant impact. Groundwater will not be used as source.
<ul style="list-style-type: none"> Unsatisfactory raw water supply (e.g. excessive pathogens or mineral constituents)? 		✓	Not anticipated. Findings of water quality tests conducted for the subproject and IEE show no issues.
<ul style="list-style-type: none"> Delivery of unsafe water to distribution system? 		✓	Not anticipated. Water will be chlorinated prior to distribution. Water quality of treated water will comply with the Indian Standards for Drinking Water/IFC EHS Guideline (most stringent).
<ul style="list-style-type: none"> Inadequate protection of intake works or wells, leading to pollution of water supply? 		✓	Not applicable.
<ul style="list-style-type: none"> Over pumping of ground water, leading to salinization and ground subsidence? 		✓	Not applicable.
<ul style="list-style-type: none"> Excessive algal growth in storage reservoir? 		✓	Not anticipated.
<ul style="list-style-type: none"> Increase in production of sewage beyond capabilities of community facilities? 	✓		Guwahati Development Department of the State Government of Assam is in the process of improving the existing sewerage system.
<ul style="list-style-type: none"> Inadequate disposal of sludge from water treatment plants? 		✓	Not applicable.
<ul style="list-style-type: none"> Inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances and protect facilities? 		✓	Not applicable.
<ul style="list-style-type: none"> Impairments associated with transmission lines and access roads? 	✓		Anticipated during construction activities. However, impacts are temporary and short in duration. The EMP includes measures to mitigate impacts.
<ul style="list-style-type: none"> Health hazards arising from inadequate design of facilities for receiving, storing, and handling of chlorine and other hazardous chemicals. 		✓	Not applicable.
<ul style="list-style-type: none"> Health and safety hazards to workers from handling and management of chlorine used for disinfection, other contaminants, and biological and physical hazards during project construction and 		✓	Not applicable.

Screening Questions	Yes	No	Remarks
operation?			
• Dislocation or involuntary resettlement of people?		✓	Dislocation is not anticipated. However, during pipe-laying work, temporary economic displacement is anticipated. An RP has been prepared to mitigate these temporary impacts.
• Disproportionate impacts on the poor, women and children, indigenous peoples or other vulnerable groups?		✓	Not applicable.
• Noise and dust from construction activities?	✓		Anticipated during construction activities. However, impacts are temporary and short in duration. The EMP includes measures to mitigate impacts.
• Increased road traffic due to interference of construction activities?	✓		Anticipated during construction activities. However, impacts are temporary and short in duration. The EMP ensures measures are included to mitigate impacts. Construction contractors will be required to coordinate with local traffic police.
• Continuing soil erosion/silt runoff from construction operations?		✓	Not anticipated. The construction areas are all flat lands thus soil erosion and silt runoff are least expected except during monsoon months. The EMP includes measures to mitigate impacts. Construction contractors will be required to include silt traps or canalizations where required.
• Delivery of unsafe water due to poor O&M treatment processes (especially mud accumulations in filters) and inadequate chlorination due to lack of adequate monitoring of chlorine residuals in distribution systems?		✓	Not anticipated. The O&M Manuals include schedule for regular maintenance and appropriate chemical dosing.
• Delivery of water to distribution system, which is corrosive due to inadequate attention to feeding of corrective chemicals?		✓	Not anticipated.
• Accidental leakage of chlorine gas?		✓	Not applicable.
• Excessive abstraction of water affecting downstream water users?		✓	Not applicable.
• Competing uses of water?		✓	Not anticipated.
• Increased sewage flow due to increased water supply	✓		Guwahati Development Department of the State Government of Assam is in the process of improving the existing sewerage system.
• Increased volume of sullage (wastewater from cooking and washing) and sludge from wastewater treatment plant		✓	Not applicable.
• Large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?		✓	Not anticipated. Improved water supply management systems through capacity building and institutional development will ensure reduced burden on services and infrastructure.
• Social conflicts if workers from other regions or countries are hired?		✓	Not anticipated. Priority in employment will be given to residents.
• Risks to community health and		✓	Not applicable. Construction will not involve use

Screening Questions	Yes	No	Remarks
safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during operation and construction?			of explosives and chemicals. Trenching will be done manually. Use of chemical during O&M will be limited only on sites.
<ul style="list-style-type: none"> Community safety risks due to both accidental and natural hazards, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning? 		✓	Not anticipated. Operational area will be clearly demarcated and access will be controlled. Only worker and project concerned members will be allowed to visit the operational sites.

Climate change and disaster risk questions	Yes	No	Remarks
The following questions are not for environmental categorization. They are included in this checklist to help identify potential climate and disaster risks			
<ul style="list-style-type: none"> Is the Project area subject to hazards such as earthquakes, floods, landslides, tropical cyclone winds, storm surges, tsunami or volcanic eruptions and climate changes ? 	✓		Project location may experience flooding during high rain season.
<ul style="list-style-type: none"> Could changes in temperature, precipitation, or extreme events patterns over the Project lifespan affect technical or financial sustainability (e.g., changes in rainfall patterns disrupt reliability of water supply; sea level rise creates salinity intrusion into proposed water supply source)? 		✓	No
<ul style="list-style-type: none"> Are there any demographic or socio-economic aspects of the project area that are already vulnerable (e.g. high incidence of marginalized populations, rural-urban migrants, illegal settlements, ethnic minorities, women or children)? 		✓	No
<ul style="list-style-type: none"> Could the project potentially increase the climate or disaster vulnerability of the surrounding area (e.g., by using water from a vulnerable source that is relied upon by many user groups, or encouraging settlement in earthquake zones)? 		✓	No

APPENDIX 6: DESIGN CONSIDERATIONS AS PER CPHEEO MANUAL ON WATER SUPPLY AND TREATMENT

Basic design considerations

Area and population: ADB loan assistance has been sanctioned for South – East zone of Guwahati, The projected population, 2030 and 2045 is 508025 and 804877 respectively. Total 17 wards are covered under this project.

The design Period : Design period considered for WTP, Intake and other units- 15 Years, Raw water and clear water pumping mains-30 years, Distribution system-30 years. In this case ,for Phase I -Design year 2030 and for Phase II - Design year 2045 considering 2015 as base year.

Per capita rate of water supply and other water need in the area: The water demand assessment is based on 135 lpcd water supply rate and IEC demand at 28.40 lpcd. The water loss of water in distribution system is 15% and 10% upto year 2030 and 2045 respectively. The losses in WTP are estimated at 5%.

The nature and location of facilities to be provided : Street tap as well as House to House connection for 24x7 portable supply of water.

Utilization of centralized or multiple points of treatment facilities: Centralized treatment facilities.

Points of water supply intake : Single point Intake – Location near Noon Mati IOCL refinery Gate no. 1.

Waste water disposal: A waste (dirty) backwash water holding tank (WBWH) shall be provided to equalize the WBW water being conveyed via. a pipeline or dedicated RCC channel to a suitable d/s location of Intake point to river. The WBW water will be conveyed to discharge point in the river under gravity flow from this storage tank and at least 3 m below normal water level of the river.

Selection of Source (Intake)

- Nature of Source : Surface water.
- Type of Source : River Brahmaputra.

Flow in the river (lean period) and abstraction of water: Observed flow in the river at Guwahati is 3647 cumsec in winter season of year 2007. The total proposed river abstraction is 0.65 cumsec which is less than 0.02 percent of the minimum level.

Flow in Brahmaputra in Guwahati City

S. No.	Year	River Flow in Guwahati in Season (Cumecc)		
		Flood	Winter	Summer
1	2003	31265	9360	6080
2	2004	28657	5659	8196

3	2005	26890	7854	3662
4	2006	21178	3869	4641
5	2007	18723	3647	6554
6	2008	25657	4520	3752
7	2009	20461	4725	11378

:

Raw water quality: For assessment of quality of water near Intake locations, raw water samples are collected and analysed in the laboratory of Assam State Pollution Control Board while preparing the DPR. The water quality analysis indicates that conventional water treatment is required to make the water potable.

**APPENDIX 7: SEMI-ANNUAL ENVIRONMENTAL MONITORING REPORT FORMAT
(Intake and WTP, Raw Water Transmission Main)**

I. INTRODUCTION

- Overall project description and objectives
- Environmental category as per ADB Safeguard Policy Statement, 2009
- Environmental category of each subproject as per national laws and regulations
- Project Safeguards Team

Name	Designation/Office	Email Address	Contact Number	Roles
1. PMU				
2. PIUs				
3. Consultants				

- Overall project and sub-project progress and status
- Description of subprojects (package-wise) and status of implementation (preliminary, detailed design, on-going construction, completed, and/or O&M stage)

Package	Components/List	Contract Status	Status of Implementation	If On-going Construction
----------------	------------------------	------------------------	---------------------------------	---------------------------------

Number	of Works	(specify if under bidding or contract awarded)	(Preliminary Design/Detailed Design/On-going Construction/Completed/O&M) ¹⁶	%Physical Progress	Expected Completion Date

II. COMPLIANCE STATUS WITH NATIONAL/STATE/LOCAL STATUTORY ENVIRONMENTAL REQUIREMENTS¹⁷

Package No.	Subproject Name	Statutory Environmental Requirements ¹⁸	Status of Compliance ¹⁹	Validity if obtained	Action Required	Specific Conditions that will require environmental monitoring as per Environment Clearance, Consent/Permit to Establish ²⁰

III. COMPLIANCE STATUS WITH ENVIRONMENTAL LOAN COVENANTS

No. (List schedule and paragraph number of Loan Agreement)	Covenant	Status of Compliance	Action Required

IV. COMPLIANCE STATUS WITH THE ENVIRONMENTAL MANAGEMENT PLAN (REFER TO EMP TABLES IN APPROVED IEE/S)

- Confirm if IEE/s require contractors to submit site-specific EMP/construction EMPs. If not, describe the methodology of monitoring each package under implementation.

¹⁶ If on-going construction, include %physical progress and expected date of completion.
¹⁷ All statutory clearance/s, no-objection certificates, permit/s, etc. should be obtained prior to award of contract/s. Attach as appendix all clearance obtained during the reporting period. If already reported, specify in the “remarks” column.
¹⁸ Specify (environmental clearance, permit/consent to establish, forest clearance, etc.).
¹⁹ Specify if obtained, submitted and awaiting approval, application not yet submitted.
²⁰ Example: Environmental Clearance requires ambient air quality monitoring, Forest Clearance/Tree-cutting Permit requires two trees for every tree, etc.

Package-wise IEE Documentation Status

Package Number	Final IEE based on Detailed Design				Site-specific EMP (or Construction EMP) approved by Project Director? (Yes/No)	Remarks
	Not yet due (detailed design not yet completed)	Submitted to ADB (Provide Date of Submission)	Disclosed on project website (Provide Link)	Final IEE provided to Contractors (Yes/No)		

- For each package, provide name/s and contact details of contractor/s' nodal person/s for environmental safeguards.

Package-wise Contractor/s' Nodal Persons for Environmental Safeguards

Package Name	Contractor	Nodal Person	Email Address	Contact Number

- With reference to approved EMP/site-specific EMP/construction EMP, complete the table below

Summary of Environmental Monitoring Activities (for the Reporting Period)²¹

Impacts (List from IEE)	Mitigation Measures (List from IEE)	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name of Person Who Conducted the Monitoring
Design Phase						

²¹ Attach Laboratory Results and Sampling Map/Locations.

Pre-Construction Phase						
Construction Phase						
Operational Phase						

Overall Compliance with CEMP/ EMP

No.	Sub-Project Name	EMP/ CEMP Part of Contract Documents (Y/N)	CEMP/ EMP Being Implemented (Y/N)	Status of Implementation (Excellent/ Satisfactory/ Partially Satisfactory/ Below Satisfactory)	Action Proposed and Additional Measures Required

V. APPROACH AND METHODOLOGY FOR ENVIRONMENTAL MONITORING OF THE PROJECT

- Briefly describe the approach and methodology used for environmental monitoring of each sub-project.

VI. MONITORING OF ENVIRONMENTAL IMPACTS ON PROJECT SURROUNDINGS (AMBIENT AIR, WATER QUALITY AND NOISE LEVELS)

- Discuss the general condition of surroundings at the project site, with consideration of the following, whichever are applicable:
 - Confirm if any dust was noted to escape the site boundaries and identify dust suppression techniques followed for site/s.
 - Identify if muddy water is escaping site boundaries or if muddy tracks are seen on adjacent roads.
 - Identify type of erosion and sediment control measures installed on site/s, condition of erosion and sediment control measures including if these are intact following heavy rain;
 - Identify designated areas for concrete works, chemical storage, construction materials, and refueling. Attach photographs of each area in the Appendix.
 - Confirm spill kits on site and site procedure for handling emergencies.

Noise Quality Results

Site No.	Date of Testing	Site Location	LA _{eq} (dBA) (Government Standard)	
			Day Time	Night Time

Site No.	Date of Testing	Site Location	LA _{eq} (dBA) (Monitoring Results)	
			Day Time	Night Time

VII. GRIEVANCE REDRESS MECHANISM

- Provide information on establishment of grievance redress mechanism and capacity of grievance redress committee to address project-related issues/complaints. Include as appendix Notification of the GRM (town-wise if applicable).

VIII. COMPLAINTS RECEIVED DURING THE REPORTING PERIOD

- Provide information on number, nature, and resolution of complaints received during reporting period. Attach records as per GRM in the approved IEE. Identify safeguards team member/s involved in the GRM process. Attach minutes of meetings (ensure English translation is provided).

IX. SUMMARY OF KEY ISSUES AND REMEDIAL ACTIONS

- Summary of follow up time-bound actions to be taken within a set timeframe.

X. APPENDIXES

- Photos
- Summary of consultations
- Copies of environmental clearances and permits
- Sample of environmental site inspection report
- all supporting documents including **signed** monthly environmental site inspection reports prepared by consultants and/or contractors
- Others

APPENDIX 8: RECORDS OF PUBLIC CONSULTATION

Subproject-: Construction of Intake, WTP and Rising mains of Guwahati Water Supply Project

Issues discussed

- Awareness and extent of the project and development components
- Benefits of Project for the economic and social Upliftment of Community
- Labour availability in the Project area or requirement of outside labour involvement
- Local disturbances due to Project Construction Work
- Necessity of tree felling etc. at project sites
- Water logging and drainage problem if any
- Drinking water problem
- Forest and sensitive area nearby the project site
- Movement of wild animal if any
- Other problems, encountered, if any

Consultation 1

Area: Sunshali WTP site

Date & Time: 21st September , 2013. From 4.0 pm to 7.0 pm

Sr. No.	Issues	Perception	Action taken
1	Awareness and extent of the project and development components	Local people are not much aware on components of the project. In 20% cases they have some idea	Awareness program at different project locations related to project components is essential
2	Perceptions and view of the local community on the project—is the project relevant or not?	The people in the project areas agreed on the relevance of the project. They shared that sufficient & quality water is required throughout the day	New project will satisfy after completion of the project. Treated water will be supply
3	In what way they may associate with the project	At the construction phase some people can work as laborers, after completion, water supply to nearby areas shall be improved	Local people will be engaged in construction
4	Presence of any forest, wild life or any sensitive / unique environmental components nearby the project area	The project area is Govt. land for which permission has been granted. There is no forest land, wild life or sensitive/ unique environmental components in the project area. The project area at WTP is surrounded by residences.	Permission not required. If the issue arise in future action will be taken up
5	Presence of historical/ cultural/ religious sites nearby	There is no historical / religious site nearby.	No action
6	Unfavourable climatic condition	The pick summer is hot and humid and not suitable for continuous work at open area.	Working period will be shifted to early morning
7	Occurrence of flood	No such case is reported. During monsoon, temporary water logging occurs for a very short duration	Drainage project will be designed considering the issue

8	What is the nature of drainage/ solid waste problem in the community at present? What is the view of the people on improving it?	No such problem reported.	No action
9	Drainage problem facing	No such problem being reported	
10	Present drinking water problem – quantity and quality	There is scarcity of drinking water The local residents use river water for other household purposes. Presence of iron is not reported.	Sufficient treated water will be supply after completion of the project
11	Present solid waste collection and disposal problem	As per local people – done partly by GMC.	
12	Availability of labour during construction time	Some local people may work as labor during construction phase.	Local people will be engage
13	Access road to project Site	Yes existing bitumen road partly except hilly area	
14	Perception of locals On tree felling and afforestation	Generally not required in most of the cases. No tree cutting is required.	If required compensatory plantation will be done as per Govt. rule
15	Dust and noise pollution and disturbances during construction work	Request for arresting of dust and protection of habitation from noise pollution	Mitigation measures will be applied as per EMP
16	Setting up worker camp site within the village/ project locality	Project area does not have sufficient space for workers camp.	Work camp will be set up outside
17	Safety of residents during construction phase and plying of vehicle for construction activities	Local requested for safety arrangement particularly where excavation is being planned near main city road.	As per EMP all safety arrangement will be considered during construction
18	Whether they want complaint / suggestion system through Grievance redressal system related to work	They appreciate that it will be helpful if contact number for compliant placed at working locations in local language	Will be done during construction

NAME AND POSITION OF PERSONS CONSULTED:

- 1) Sri Ravindra Sahani
- 2) Sri Jita deka
- 3) Sri Lakhon Chouhan
- 4) Sri Girish Medhi
- 5) Sri Rajesh Boro
- 6) Smti Jonali Paswan
- 7) Smti Rupa Paswan
- 8) Sri Ram Sevak Choudhury
- 9) Smti Anjali Haloi
- 10) Smti Asha Devi
- 11) Smti Kosila Devi
- 12) Sri Dinesh Ravi
- 13) Smti Uma Basfore
- 14) Sri S.Basfore
- 15) Sri Dilip Basfore
- 16) Sri Dharendra Kumar

- 17) Smti Raisor Devi
- 18) Smti Anima Devi
- 19) Sri Shiv Kumar Paswan
- 20) Sri Manish Jadav
- 21) Sri Ram Chandra Roy
- 22) Smti Santana Deka
- 23) Sri Umesh Chowracia

Consultation 2:

Area: Jaypore L.P.School, near IOCL gate no.1

Date & Time: 12th March , 2014. From 12.20 pm to 2.00 pm.

Sr. No.	Issues	Perception	Action taken
1	Awareness and extent of the project and development components	Local people are not much aware on components of the project.	Awareness program at different project locations related to project components is essential
2	Perceptions and view of the local community on the project—is the project relevant or not?	The people in the project areas agreed on the relevance of the project. They shared that sufficient & quality water is required throughout the day	Sufficient & quality water will be supplied after commissioning of the project
3	In what way they may associate with the project	At the construction phase some people can work as laborers, after completion, water supply to nearby areas shall be improved	
4	Presence of any forest, wild life or any sensitive / unique environmental components nearby the project area	There is no forest area near by the site. The site is river and green belt.	
5	Presence of historical/ cultural/ religious sites nearby	There is no historical / religious site nearby.	No action
6	Unfavourable climatic condition	The pick summer is hot and humid and not suitable for continuous work at open area.	Working period will be shifted to early morning
7	Occurrence of flood	No such case is reported.	
8	What is the nature of drainage/ solid waste problem in the community at present? What is the view of the people on improving it?	No such problem reported.	
9	Drainage problem facing	No such problem being reported	
10	Present drinking water problem – quantity and quality	There is scarcity of drinking water People use deep/sallow well water for day to day use.	Sufficient treated water will be supply after completion of the project
11	Present solid waste collection and disposal problem	As per the local people it is disposed in municipality garbage bin	

12	Availability of labour during construction time	Some local people may work as labor during construction phase.	Local people will be engage
13	Access road to project Site	There is metallic bituminous road near the site	
14	Perception of locals On tree felling and afforestation	Generally not required in most of the cases. No tree cutting is required.	If required compensatory plantation will be done as per Govt. rule
15	Dust and noise pollution and disturbances during construction work	Request for arresting of dust and protection of habitation from noise pollution	Mitigation measures will be applied as per EMP
16	Setting up worker camp site within the village/ project locality	Project area does not have sufficient space for workers camp.	Work camp will be set up outside
17	Safety of residents during construction phase and plying of vehicle for construction activities	Local requested for safety arrangement particularly where excavation is being planned near main city road.	As per EMP all safety arrangement will be considered during construction
18	Whether they want complaint / suggestion system through Grievance redressal system related to work	They appreciate that it will be helpful if contact number for compliant placed at working locations in local language	Will be done during construction

NAME AND POSITION OF PERSONS CONSULTED:

- 1) Smti Kabita Das .
- 2) Smti. Deepa Das.
- 3) Smti Lakshmi Devi Mahanta.
- 4) Smti. Jaya Das
- 5) Sri Chatradhar Das.

N.B: Some person resides in the area and others are working in the school. The location does not have sufficient residents.

Summary of outcome: People consulted are very much interested in the proposed project. They requested to complete the project as early as possible. All types of cooperation is expected from the people. During construction time there is necessity to apply mitigation measures as per the Environment Management Plan.

Public Consultation at Different Locations



Photo 1: Public Consultation – Intake site



Photo 2: Public Consultation – Intake site



Photo 3: Public Consultation at WTP site



Photo 4: Public Consultation at WTP site

Attendance sheet

14

ASSAM URBAN INFRASTRUCTURE INVESTMENT PROGRAM

Attendance Sheet of Public Consultation Meeting
Name of the project: Water Supply Subproject, Guwahati
(Sunsali Intake, WTP & Raw Water Transmission Main Site)

District Kamrup Metro
Venue Sunsali WTP Site

Block

Duration of Discussion

Date 21.9.2013

Time

04:00 PM to 07:00 PM

Total No. of Participants

Male

Female

Total

13

10

23

S. No	Name	Sex	Age	Profession	Social Category	Signature
				1. Service 2. Business 3. Agriculture 4. Labour 5. Not working 6. Any other	1 SC 2 ST 3 OBC 4 Gen 5 Any Other	
1	RAVINDRA SAHANI	M	37	2	3	Rahani
2	Jita Deba	F	40	5	4	Jita Deba
3	Sri Lakshmi Debnath	M	40	2	4	Sri Lakshmi Debnath
4	Girish Mehta	M	41	2	3	Girish Mehta
5	Rajesh Baro	M	26	5	2	Rajesh Baro
6	Jonali Paswan	F	35	5	1	Jonali Paswan
7	Rupa Paswan	F	26	5	1	Rupa Paswan
8	राजेश बरो	M	60	2	3	Rajesh Baro
9	श्री लक्ष्मी देवनाथ	F	40	2	3	Sri Lakshmi Debnath
10	शारदा देवी	F	39	2	3	Sharada Devi
11	Koshila Devi	F	46	2	3	Koshila Devi
12	Dimesh Rai	M	30	2	3	Dimesh Rai

15

S. No.	Name	Sex	Age	Profession 1. Service 2. Business 3. Agriculture 4. Labour 5. Not working 6. Any other	Social Category 1. SC 2. ST 3. OBC 4. Gen 5. Any Other	Signature
13	Uma Rastose (Signature)	M	38	1	1	(Signature)
14	Jahar Barik (Signature)	M	42	2	1	(Signature)
15	Dilip Barik (Signature)	M	32	2	1	(Signature)
16	Chamendra Kumar (Signature)	M	34	1	1	(Signature)
17	Raswar Ravi (Signature)	M	50	2	3	(Signature)
18	ସତ୍ୟଜିତ ରାଉତ (Signature)	F	56	5	4	(Signature)
19	Shiv Kumar Paswan (Signature)	M	50	2	1	(Signature)
20	MANISH JADAV (Signature)	F	27	2	4	RamchandraRay
21	Ramchandra Ray (Signature)	F	55	2	4	RamchandraRay
22	ସତ୍ୟଜିତ ରାଉତ (Signature)	F	41	2	4	(Signature)
23	Santana. Deka (Signature)	F	32	2		(Signature)
24						
25						
26						
27						
28						
29						

ASSAM URBAN INFRASTRUCTURE INVESTMENT PROGRAM

Attendance Sheet of Public Consultation Meeting

Name of the project: Transmission Clear Water Pipeline subproject, Guwahati
(In P.A. No.)

District Kamrup
 Venue Jaypore L.P. School near 10th Gate-1 (Intake)
 Date 12.03.14
 Block
 Duration of Discussion 40 Minutes
 Total No. of participants Male 1 Female 4 Total 5
 Time 12:20 - 12:30 PM & 12:30 PM - 1:00 PM

Sl No.	Name	Sex (M/F)	Age (Yrs)	Profession 1. Service 2. Business 3. Agriculture 4. Labour 5. Not working 6. Any other	Social Category 1. SC 2. ST 3. OBC 4. Gen 5. Any other	Signature	Road Name
1	Kakita Das	F	31	6	4	Kakita Das	
2	Deepa Das	F	40	1.	4.		
3	Lakshmi Devi Mahanta	F	34	L	4	Lakshmi	
4	Jaya Das	F	36	1	4	Jaya Das	
5	Chakradhar Das	M	60	1	4	Ch Das	
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							

APPENDIX 9: SAMPLE GRIEVANCE REGISTRATION FORM

(To be available in Hindi, Assamese and English or local language, if any)

The **Assam Urban Infrastructure Investment Program (AUIIP)** welcomes complaints, suggestions, queries and comments regarding project implementation. We encourage persons with grievance to provide their name and contact information to enable us to get in touch with you for clarification and feedback.

Should you choose to include your personal details but want that information to remain confidential, please inform us by writing/typing ***(CONFIDENTIAL)*** above your name. Thank you.

Date		Place of registration			
Contact Information/Personal Details					
Name		Gender	Male Female	Age	
Home Address					
Village / Town					
District					
Phone no.					
E-mail					
Complaint/Suggestion/Comment/Question Please provide the details (who, what, where and how) of your grievance below:					
If included as attachment/note/letter, please tick here:					
How do you want us to reach you for feedback or update on your comment/grievance?					

FOR OFFICIAL USE ONLY

Registered by: (Name of official registering grievance)	
If – then mode:	
<input type="checkbox"/> Note/Letter	
<input type="checkbox"/> E-mail	
<input type="checkbox"/> Verbal/Telephonic	
Reviewed by: (Names/Positions of Official(s) reviewing grievance)	
Action Taken:	
Whether Action Taken Disclosed:	<input type="checkbox"/> Yes <input type="checkbox"/> No
Means of Disclosure:	

GRIEVANCES RECORD AND ACTION TAKEN

Sr. No.	Date	Name and Contact No. of Complainer	Type of Complain	Place	Status of Redress	Remarks