Environmental Impact Assessment (EIA)

GSM Industries Limited

Gutudia, Dumuria, Khulna.

Prepared by

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Declaration

This Environmental Impact Assessment (EIA) report has been prepared for GSM Industries Ltd. by EnviroNest Engineering - EnviroNest. The report encompasses various management plans tailored specifically for the factory, highlighting significant environmental impacts and outlining the necessary mitigation measures. It emphasizes the strategies to minimize, reuse, reduce, and recover different resources throughout the development process, detailing the actions required by the project proponents to address these impacts effectively.

Shamim Ur Rahman is the principal author of this EIA report, and the entire EnviroNest Engineering team has provided comprehensive support and collaboration. Our team's collective effort made the successful completion of this report possible.

We gratefully acknowledge the valuable data and information the Board of Directors of GSM Industries Ltd. provided, which has been instrumental in preparing this report.

Shamim Ur Rahman
Chief Executive Officer
EnviroNest Engineering

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Abbreviations

EMP	Environmental Management Plan
EIA	Environmental Impact Assessment
DOE	Department of Environment
EIA	Environmental Impact Assessment
DGHS	Directorate General of Health Services
ECR	Environment Conservation Rules
GOB	Government of Bangladesh
ETP	Effluent Treatment Plant
STP	Sewage Treatment Plant
OHSA	Occupational Health and Safety Administration
EPA	Environmental Protection Agency
WHO	World Health Organization
ECA	Environment Conservation Act
DG	Director General
ECC	Environmental Clearance Certificate
NOC	No Objection Certificate
ADB	Asian Development Bank
DPDC	Dhaka Power Development Corporation
DCC	Dhaka City Corporation
OT	Operation Theatre
EQS	Environmental Quality Standard
GPS	Global Positioning System
MOEF	Ministry of Environment and Forests
NGO	Non-Government Organization
SDG	Sustainable Development Goals
TOR	Terms of Reference
UNDP	United Nations Development Program
WASA	Water And Sewer Authority
BMD	Bangladesh Meteorological Department
CEA	Comprehensive Environmental Assessment
IEE	Initial Environmental Examination
EHS	Environment, Health and Safety
ERP	Emergency Response Plan
SDG	Sustainable Development Goals
WWTP	Wastewater Treatment Plant

Physical Units

m	= Meter
he	= Hectares
km	= Kilometers
sq.m	= Square Meters
l	= Liter
sq.ft	= Square Feet
sq.km	= Square Kilometer
435.6 sq.ft	= 1 Decimal
720 sq.ft	= 1 Katha
3 Bigha	= 1 Acre
20 Katha	= 1 Bigha
100 Decimal	= 1 Acres

Executive Summary

GSM Industries Limited will establish a state-of-the-art manufacturing facility in Gutudia, Dumuria, Khulna, dedicated to producing sulfuric acid, sodium sulfate (Glauber salt), hydrochloric acid (HCl), and polyaluminum chloride (PAC). The production of PAC, a widely used coagulant in water treatment and industrial processes, will further enhance the company's ability to serve diverse sectors. By delivering high-quality chemical products, the project aims to support industries such as textiles, pharmaceuticals, water treatment, and other manufacturing sectors while prioritizing sustainability and innovation. Equipped with advanced production technologies, the facility will strive to enhance operational efficiency and significantly minimize its environmental footprint.

The facility's primary objective will be to meet the growing demands of various industries by providing superior products, adopting innovative technologies, and adhering to environmentally sustainable practices. Additionally, the project will contribute to local economic development by creating employment opportunities and fostering skill development among the local workforce. Its strategic location will ensure reliable access to essential utilities such as electricity, gas, and transportation infrastructure, enabling seamless operations and logistics.

The project site will be situated on land presently used for agricultural purposes. Site selection has been carefully undertaken to minimize environmental and social impacts. Measures will be implemented to ensure sustainable land use practices and mitigate potential effects on local livelihoods. The facility's establishment will comply with relevant national regulations and guidelines to ensure responsible and environmentally sensitive development.

While the construction and operation of the factory may lead to potential environmental impacts, GSM Industries Limited will implement comprehensive mitigation measures to address these concerns. Key potential impacts include air emissions, wastewater generation, and solid waste disposal. The facility will operate under a robust Environmental Management Plan (EMP), which will outline strategies for managing emissions, wastewater, and solid waste while ensuring compliance with the Environment Conservation Rules (ECR), 2023. All liquid effluents will be treated in an Effluent Treatment Plant (ETP) with a capacity of 50 cubic meters per hour, ensuring safe discharge into nearby water bodies in adherence to national discharge standards. Solid waste, including sludge and other by-products, will be managed through partnerships with certified waste management organizations. Periodic environmental

monitoring and audits will be conducted to minimize environmental impacts and maintain sustainable operations.

The inclusion of PAC production will allow the facility to meet the increasing demand for high-quality coagulants essential for municipal and industrial water treatment. By offering this critical product, GSM Industries Limited will contribute to improving water quality standards in Bangladesh and beyond. The facility will also promote the use of eco-friendly and innovative production methods to support environmental sustainability.

In addition to its environmental initiatives, the project will support local economic growth by creating numerous employment opportunities, fostering industrial development, and contributing to the overall growth of Bangladesh's chemical manufacturing sector. With its commitment to innovation, sustainability, and quality, GSM Industries Limited aims to set a benchmark in producing sulfuric acid, Glauber salt, hydrochloric acid, and polyaluminum chloride while supporting the nation's industrial and economic progress.

Chapter One: Introduction

1.1 General

GSM Industries Limited, a chemical manufacturing company, aims to establish a state-of-the-art production facility in Gutudia, Dumuria, Khulna. This facility will focus on producing sulfuric acid, sodium sulfate (Glauber salt), hydrochloric acid (HCl), and Polyaluminium Chloride (PAC). These chemicals are essential to various industrial sectors, including textiles, pharmaceuticals, water treatment, and agriculture, making this project a significant contributor to the nation's industrial and economic growth.

The global demand for industrial chemicals has increased due to their extensive application across diverse sectors. With its growing industrial base, Bangladesh relies heavily on imported chemicals to meet local demands. Establishing GSM Industries Limited's facility will reduce dependence on imports, enhance the availability of high-quality chemicals locally, and contribute to industrial self-sufficiency (Bangladesh Bureau of Statistics, 2025).

The production of sulfuric acid, one of the key outputs of the facility, is vital for industries such as fertilizers, batteries, and wastewater treatment. Sodium sulfate is widely used in detergents and textiles, while hydrochloric acid is crucial in steel production, food processing, and water treatment. Polyaluminium Chloride (PAC), a high-demand chemical, is extensively used in water purification processes, enabling cleaner water supplies and supporting environmental sustainability (OECD, 2025).

Technological advancements will be a cornerstone of GSM Industries Limited's operations. The facility will integrate cutting-edge manufacturing processes, including energy-efficient production technologies, automated systems for quality control, and environmentally friendly practices. These measures aim to minimize resource consumption, reduce emissions, and ensure compliance with the Environment Conservation Rules (ECR), 2023. Modern equipment will also help achieve operational efficiency and align with global best practices (ECR, 2023).

The project is strategically located in Gutudia, Dumuria, Khulna, ensuring convenient access to transportation networks and essential utilities like electricity and gas. The site selection process has been carefully undertaken to minimize environmental and social impacts, aligning with sustainable development goals (Ministry of Industries, 2025).

While industrial development offers significant economic benefits, it is essential to address potential environmental impacts. GSM Industries Limited is committed to implementing a comprehensive Environmental Management Plan (EMP) to mitigate adverse effects. The EMP will include measures for controlling emissions, managing solid and liquid waste, and conserving resources. Regular environmental monitoring and audits will ensure compliance with national and international environmental standards (Glasson, Therivel, & Chadwick, 2013).

Moreover, establishing this facility will create employment opportunities, foster skill development among the local workforce, and contribute to the region's socio-economic growth. By prioritizing innovation, sustainability, and quality, GSM Industries Limited aims to set a benchmark in chemical manufacturing while supporting Bangladesh's industrial progress and environmental goals.

1.2 Environmental Impact Assessment (EIA) and Its Significance

An Environmental Impact Assessment (EIA) is a systematic process designed to assess the potential environmental impacts of a proposed project before implementation. Its primary objective is identifying, evaluating, and mitigating adverse effects throughout the project lifecycle, encompassing design, construction, operation, and decommissioning (Glasson, Therivel, & Chadwick, 2013). The EIA process typically involves several stages. Screening determines whether a full EIA is required based on the potential environmental impacts (Burdge, 2004). Scoping identifies the critical environmental issues to address (Wood, 2003). During the impact assessment phase, positive and negative effects are evaluated, and mitigation measures are proposed to minimize or offset adverse impacts (Petts, 1999; Morgan, 2012). The results are compiled into an Environmental Impact Statement (EIS), which undergoes review to inform project approval and further requirements (Glasson et al., 2013).

The EIA is crucial for integrating environmental considerations into decision-making, ensuring a balance between development and environmental protection. By identifying potential impacts early, the EIA enables effective mitigation strategies to address concerns before they escalate (Wood, 2003). Public consultation, often included in the process, fosters transparency and addresses community concerns (Petts, 1999). Additionally, the EIA helps ensure regulatory compliance, reducing legal and financial risks while supporting sustainable development through resource conservation for future generations (Morrison-Saunders & Partidário, 2013).

The EIA is essential for promoting environmentally responsible project execution and sustainable growth.

1.3 Aims and Objectives of the EA

The Environmental Impact Assessment (EIA) for GSM Industries Ltd. (GSMIL) aims to systematically identify, evaluate, and address potential environmental impacts associated with establishing and operating the proposed chemical facility. The EIA ensures the project is developed in an environmentally responsible manner, aligning the need for advanced services with protecting and conserving the surrounding environment.

To achieve this aim, the EIA report is guided by the following objectives:

- **Assess Environmental Impacts:** To evaluate potential environmental impacts of the proposed facility on local land, air, water, and ecosystems. This includes assessing direct and indirect effects during construction, operation, and closure.
- **Identify Key Environmental Issues:** Identify and analyze critical environmental concerns specific to the Gutudia, Dumuria, and Khulna sites. This involves evaluating impacts on nearby communities, natural resources, and infrastructure.
- **Propose Mitigation Measures:** To recommend strategies and actions to mitigate identified adverse environmental impacts. This includes plans for waste management, pollution control, and resource efficiency.
- **Enhance Positive Outcomes:** To identify opportunities to maximize the facility's positive environmental and social contributions, such as improving local conditions and supporting sustainable development.
- **Ensure Compliance with Regulations:** Adhere to all relevant environmental laws, regulations, and standards. The EIA outlines how GSMIL intends to meet legal requirements and secure necessary approvals.
- **Encourage Public Engagement:** To foster transparency and inclusivity by engaging with local communities and stakeholders. This includes incorporating their feedback and addressing environmental concerns.
- **Facilitate Informed Decision-Making:** The EIA considers the balance between environmental protection and project benefits and equips decision-makers with comprehensive and accurate information to make informed approvals and project implementation decisions.

- **Document Findings and Recommendations:** The environmental examination's findings should be presented clearly and organized. This includes recommendations for managing environmental impacts and monitoring the effectiveness of mitigation measures.

The EIA ensures that GSM Industries Ltd. (GSMIL) operates environmentally soundly and promotes sustainable development practices.

1.4 Methodology

EnviroNest Engineering systematically designed the methodology for the Environmental Impact Assessment (EIA) for GSM Industries Ltd. (GSMIL) to meet the requirements of the Environment Conservation Rules (ECR), 2023. The process began with assembling a skilled EIA team of professionals from environmental science, engineering, and social sciences. This team was tasked with overseeing the entire assessment process.

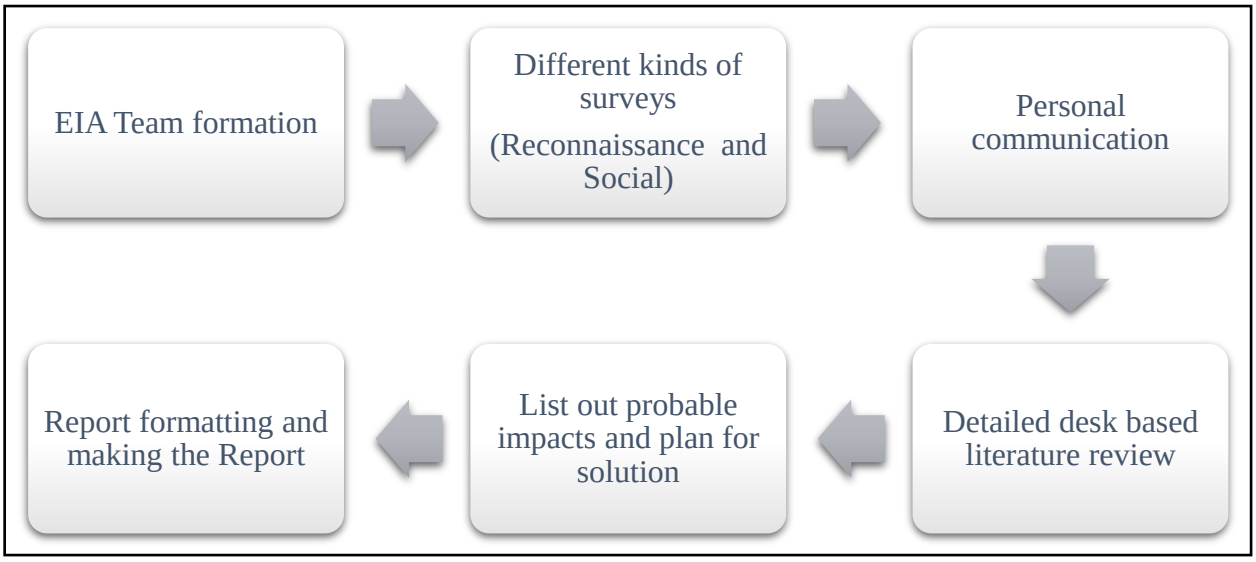


Figure 1.1: Schematic diagram of methodology

Initially, the existing environmental conditions of the project site and its surrounding areas were assessed to establish a baseline. This baseline is crucial for comparing potential environmental impacts from the project's implementation. A reconnaissance survey was conducted to identify the project area's critical environmental and social issues.

Data collection followed a structured approach. This included a detailed desk-based literature review to gather background information from existing studies and reports. Personal communications with stakeholders, including local community members and government officials, provided additional insights into the local context and concerns.

Social surveys helped to understand the socio-economic and cultural aspects of the community. These surveys were complemented by consultations with various government departments and agencies to ensure comprehensive data gathering.

The EIA assessed potential environmental impacts during the construction and operational phases. This involved evaluating direct and indirect effects on the environment and local communities. Based on this assessment, a comprehensive Environmental Management Plan (EMP) was developed.

The EMP includes measures to mitigate adverse impacts, enhance positive effects, and provide monitoring recommendations throughout the construction and operational phases. Additionally, the EIA identified issues that may require further study to address any uncertainties or gaps in the assessment.

Finally, the EIA report was prepared following the prescribed formats and guidelines the Department of Environment (DoE) set. This ensures that all potential environmental impacts are thoroughly assessed and managed, aligning with regulatory requirements and best practices.

1.5 Organizing of the Report

This report consists of a total of twelve chapters.

- **Chapter One** introduces the report and GSM Industries Ltd. (GSMIL), outlining the purpose and scope of the Environmental Impact Assessment (EIA) and the methodologies used in the report.
- **Chapter Two** covers the relevant Acts, Policies, Rules, and Regulations that govern environmental management and compliance for chemical manufacturing facilities.
- **Chapter Three** provides a detailed project description, including information on GSMIL's location, infrastructure, and operational characteristics.
- **Chapter Four** discusses the existing environment, including flora and fauna, air quality, water resources, land use, and noise levels near GSMIL.
- **Chapter Five** identifies the potential environmental impacts of GSMIL's operations and outlines mitigation measures to address these impacts.
- **Chapter Six** presents the Environmental Management Plan (EMP), detailing the strategies and actions to be implemented to manage environmental impacts during the project's lifecycle.

- **Chapter Seven** outlines the Environmental Management Policy and Monitoring Plan, specifying how GSMIL will monitor and manage environmental performance and ensure compliance with environmental standards.
- **Chapter Eight** analyzes alternatives, evaluating different scenarios and approaches to achieving the project's objectives while minimizing environmental impacts.
- **Chapter Nine** describes the Decommissioning Plan, including procedures and measures to be taken when ceasing operations to ensure environmental protection and site restoration.
- **Chapter Ten** covers the Public Consultation process, highlighting stakeholder engagement, feedback collection, and addressing public concerns.
- **Chapter Eleven** concludes the report, summarizing the key findings, policies, and plans adopted to ensure environmental sustainability and compliance with regulatory requirements.
- **Chapter Twelve** lists all the references used throughout the report.

1.6 Performance of the Assessment

This Phase of EIA consists of the following steps

- **Site Visit:** The EIA team members visited the site to determine the possible environmental impacts of the existing project and recorded the prevailing environmental conditions as they existed before the project's implementation.
- **Identification and Evaluation:** The adverse and beneficial effects of the existing project on the environment have been evaluated.
- **Discussion of Alternatives:** Various possible alternatives have been discussed.
- **Preparation of Checklist:** A checklist has been prepared to ensure complete coverage of all the possible consequences of the existing project so that it can be determined as to what administrative actions should be taken.
- **Developed of Environmental Impact Due to The Project:** To identify the project's impact on the environment, a checklist of environmental attributes has been developed that reflect the impact on the environment resulting from a particular action.
- **Decommissioning Considerations:** The assessment includes planning for the project's decommissioning, addressing potential environmental impacts, and ensuring proper waste management and site restoration upon project completion.

1.7 Limitations of the Report

The Environmental Impact Assessment (EIA) report for this project relies predominantly on data provided by the client, insights gathered from discussions with relevant process personnel, and observations from various surveys and investigations conducted within the project area. Throughout this study, professional judgment and subjective interpretation have been utilized. It is crucial to acknowledge that any modifications to the project's location, design, or activities could result in variations in the identified impacts. Furthermore, technological advancements during the construction and operational phases may influence the extent and severity of these impacts. As with any environmental assessment report, certain limitations must be recognized:

- **Predictive Uncertainty:** Anticipating which potential environmental and social issues will materialize as actual problems in the future is inherently challenging. Environmental regulations and enforcement priorities are subject to frequent changes, affecting the relevance and applicability of the findings and recommendations outlined in this report (Glasson, Therivel, & Chadwick, 2013). Consequently, unforeseen regulatory changes could necessitate revisions to the impact assessment and the proposed mitigation measures.
- **Estimation of Liabilities:** Estimating the liabilities of mitigating identified environmental and social issues is often complex and imprecise. Legal and technological standards for addressing environmental concerns are continually evolving, and liability can be significantly influenced by negotiations with regulatory agencies, which are inherently unpredictable (Wood, 2003). This variability underscores the need for adaptive management approaches to address emerging issues as they arise.
- **Applicability of Data and Practices:** The policies, methods, and plans included in this report are based on data and practices derived from various sources, which may not always be directly applicable to this project. The report incorporates hypothetical scenarios and predictive modeling, acknowledging that not all proposed measures may be effective or relevant in every situation (Canter, 1996). As a result, there is a need for continuous monitoring and adjustment of the environmental management strategies to ensure their efficacy.
- **Technological and Methodological Evolution:** Technological advancements and methodological innovations during the project's lifecycle may influence the environmental impacts and the effectiveness of mitigation strategies. It is essential to

remain vigilant about emerging technologies and best practices that could enhance environmental performance and reduce potential impacts (Sadler, 1996).

These limitations highlight the inherent uncertainties present in Environmental Impact Assessment. They emphasize the importance of ongoing review, monitoring, and adaptation as new information, regulations, and technologies become available. Proactive and flexible environmental management practices will address these uncertainties and ensure the project's long-term sustainability.

1.8 Scope of the Present EIA

The Environmental Impact Assessment (EIA) for GSM Industries Ltd. will be meticulously prepared and submitted to the Department of Environment (DoE) for review and approval to obtain Environmental Clearance. The scope of the EIA study encompasses several critical components.

Firstly, it involves a comprehensive review of relevant environmental legislation, regulatory policies, and guidelines specific to the chemical sector, ensuring that GSM Industries Ltd. adheres to legal requirements and integrates best practices for environmental management.

Secondly, the EIA will provide an in-depth description of the existing conditions at the proposed site for GSM Industries Ltd., evaluate environmental characteristics, and assess the suitability of the location from an environmental perspective. This includes documenting current environmental quality and identifying any pre-existing issues that may impact the project.

The assessment will also thoroughly evaluate potential environmental impacts associated with GSM Industries Ltd.'s development, construction, and operational phases. Standard methodologies and checklists will be employed to analyze the potential effects on environmental quality parameters and identify significant impacts.

Additionally, the EIA will discuss various alternatives to determine the most environmentally sustainable options for GSM Industries Ltd. This evaluation will include assessing the potential impacts of different approaches and recommending strategies for minimizing adverse effects.

Another crucial aspect of the EIA is the development of mitigation measures. The EIA will propose strategies to address identified adverse impacts and enhance positive outcomes,

incorporating these measures into a detailed Environmental Management Plan (EMP). The EMP will outline monitoring programs and strategies for managing environmental performance throughout GSM Industries Ltd.'s lifecycle.

Lastly, the EIA will identify areas requiring further study to address uncertainties or emerging issues that could affect GSM Industries Ltd.'s environmental performance. This comprehensive scope ensures that all relevant environmental aspects are thoroughly examined, contributing to its sustainable development.

1.9 EIA Team

The EIA report for GSM Industries Ltd. has been prepared by a highly qualified, knowledgeable, and dynamic team from EnviroNest Engineering. This team comprises experts from diverse fields, including engineering, science, and sociology, ensuring a comprehensive approach to the assessment. Throughout the preparation of the report, the team engaged in collaborative efforts, including round-table meetings, field visits, and discussions with both the client and local communities near the project site. The collective expertise and cooperative approach of the EIA team have been pivotal in developing a thorough and effective Initial Environmental Examination. The members of the EIA team are listed as follows.

Table 1.1: EIA Team Member

S.N.	Name	Designation	Signature
1	Shamim Ur Rahman	Manager (Environment) (Chief Author) M.Sc. in Environmental Sciences and Management Jahangirnagar University (JU) shamimurrahman.env@gmail.com Experience: 7 Years	
2	Eimtiaz Ibne Easin	Senior Executive (Environment) B.Sc. in Civil Engineering Ahsanullah University of Science and Technology Experience: 3 Years	
3	Md. Shamimul Islam	Senior Executive (Environment) M.Sc. in Environmental Science Jahangirnagar University (JU) Experience: 6 Years	
5	Shahadat Hossain	Geologist Masters in Geological Science Jahangirnagar University Experience: 1.5 Years	
6	Fatema Islam Lucky	Senior Executive (Green Economy) Master of Business Administration National University Experience: 2 Years	
7	Haider Ali	Sr. Mechanical Engineer Diploma in Mechanical Engineering Experience: 15 Years	

Numerous individuals and agencies contributed valuable data, information, and support in preparing this EIA report for GSM Industries Ltd. Their cooperation and openness in discussing environmental issues were crucial to the thoroughness of the assessment. We thank

the Department of Environment (DoE) personnel and the Khulna zone Office for their assistance and collaboration throughout the study. Their support has been instrumental in ensuring the accuracy and comprehensiveness of the Initial Environmental Examination.

Chapter Two: Policy and Legal Considerations

2.1. Introduction

Some legal and institutional requirements govern development projects. So, considerations of relevant legal provisions, policies, strategies, and institutional issues are essential for any project proponent or developer before they execute a program or plan. Obviously, at the operational stages of projects, no project can deny these rules, which set the boundary limits for each project. The proponent has to be well aware of these requirements and comply with the provisions as applicable and necessary. The following sections review the relevant national legislation and policies and some international laws.

2.2. Environmental Policy

Environment Conservation Act, 1995 (ECA '95) is currently one of Bangladesh's main legislative documents relating to environmental protection. Under this act, no industrial unit or project shall be established or adopted without obtaining environmental clearance, in the manner prescribed by the rules, from the Director General. Compliance with the provision of this Act is the responsibility of the Department of Environment (DoE). A set of the relevant rules to implement the ECA'95 had been promulgated in August 1997. The rules mainly consist of:

- Categorized list (green, orange, and red) of the projects.
- Application format to take environmental clearance.
- Ambient standards about water pollution, air pollution, and noise, as well as permitted discharge/emission levels of water and air pollutants and noise by industries.

In accordance with section 20 of The Bangladesh Environment Conservation of Act No. 1 of 1995, the Government in March 2023 passed the Bangladesh Environment Conservation Rules, 2023. This Article discussed various important provisions of the Regulation:

- Categorized list (green, yellow, orange, and red) of the projects.
- Application format to take site clearance and environmental clearance.
- Ambient standards in relation to water pollution, air pollution, and noise, as well as permitted discharge/emission levels of water, air pollutants, and noise by industries.
- Procedure for issuance of Environmental Clearance and Location Clearance Certificate.
- Services, fees, and mode of payment Services, fees, and mode of payment.

Given the categorization made under the above ECR, '23, **GSM Industries Ltd. (GSMIL)** falls under the **"Red"** category.

According to ECR'23, industries in the Green and Yellow categories are not required to undertake an Initial Environmental Examination (IEE) or an Environmental Impact Assessment (EIA) study. Orange projects are required to undertake an IEE, while Red category projects must undertake an EIA and/or EMP.

Being committed to environmental protection, GSMIL has taken positive actions from the beginning to meet ECA, '95, ECR, '23, and other environmental protection rules and regulations.

2.3. Provisions Under the Environmental Legislation

2.3.1. National Water Management Plan (NWMP), 2001 (approved in 2004)

The National Water Resources Council approved on March 31, 2004, a 25-year National Water Management Plan. The plan provides a framework within which all concerned with the development, management, and use of water resources and water services in Bangladesh can plan and implement their activities in a coordinated and integrated manner. The planned activity programs have been presented in the eight sub-sectoral clusters: i) Institutional Development, ii) Enabling Environment, iii) Main River, iv) Towns and Rural Areas, v) Major Cities; vi) Disaster Management; vii) Agriculture and Water Management, and viii) Environment and Aquatic Resources. Each cluster comprises several individual programs. WARPO was assigned to monitor the NWMP.

2.3.2. Natural Water Bodies Protection Act 2000

- According to this Act, the character of water bodies, i.e., rivers, canals, tanks, or floodplains identified as water bodies, in the master plans or the master plans formulated under the laws establishing municipalities in division and district towns shall not be changed without approval of the concerned ministry.
- Anyone disobeying this act will be subjected to a maximum of 5 years of imprisonment or a maximum 50,000-taka penalty or both.

2.3.3. National Water Policy (1999)

The National Water Policy of 1999 was passed to ensure efficient and equitable management of water resources, proper harnessing, and development of surface and groundwater,

availability of water to all concerned, and institutional capacity building for water resource management. It has also addressed issues like river basin management, water rights and allocation, public and private investment, water supply and sanitation, and water needs for agriculture, industry, fisheries, wildlife, navigation, recreation, environment, preservation of wetlands, etc.

2.3.4. National Agricultural Policy, 1999

The overall objective of the National Agriculture Policy is to make the nation self-sufficient in food through increasing production of all crops including cereals and ensure a dependable food security system for all. One of the specific objectives of the National Agricultural Policy is to take necessary steps to ensure environmental protection as well as environment-friendly sustainable agriculture. Through increased use of organic manure and strengthening of the integrated pest management program. The policy also suggests creating awareness so that the chemical fertilizers and pesticides used for increased crop production do not turn out to be responsible for environmental pollution. Water logging and salinity are identified as one of the serious problems in some parts of the country including the coastal areas for agricultural activities and environmental damage. The policy recommends for crop rotation and salt tolerant crop varieties.

2.4. Other Sectoral Policies/Legislation of Relevance

Any industry in the country is also required to comply with the industrial and export/import policy of the country. The industry is also required to comply with the Factories and Establishment Act and to undertake the license from concerned licensing authority.

In addition to the above National rules and regulations BTSM in its operational phase must comply with other national acts, policies, and rules, some of which are as follows:

2.4.1. Forest Policy (1994)

The National Forest Policy of 1994 is the amended and revised version of the National Forest Policy of 1977 in light of the National Forestry Master Plan. The major target of the policy is to conserve the existing forest areas and bring about 20% of the country's land area under the forestation Program and increase the reserve forest land by 10% by the year 2015 through coordinated efforts of GO-NGOs and active participation of the people.

Amendments to the existing laws (acts, rules, and regulations) relating to the forestry sector and the creation of new laws for sectoral activities have been recognized as important conditions for achieving the policy goals and objectives. The Forestry Policy also recognizes the importance of fulfilling the responsibilities and commitments under International Conventions, Treaties, and Protocols (ICTPs).

2.4.2. National Fisheries Policy, 1999

The National Fisheries Policy, 1999 was formulated following the review and intent of the East-Bengal Protection and Conservation of Fish Act 1950, which was updated by the Protection and Conservation of Fish (Amendment) Ordinance 1982 and further refined by the Protection and Conservation of Fish (Amendment) Act 1995. These Acts and ordinances provide provisions for the protection and conservation of fish in fresh water and brackish water bodies.

The Fisheries Policy highlights the need to conserve fish breeding grounds and habitats. It intends to promote fisheries development and conservation in all water bodies. The project should consider these policies to protect the habitats, migration, and connectivity of fish and fisheries resources around the project area. Measures to reduce any potential negative impacts on local fish populations will be incorporated into all stages of the Project.

2.4.3. National Land Use Policy, 2001

The National Land Use Policy was enacted in 2001 aims at managing land use effectively to support trends in accelerated urbanization, industrialization, and diversification of development activities. The policy urges that increasing the land area of the country may be not possible through artificial land reclamation process, which is cost-effective only in the long run. The major contents of this policy are the following:

- Stopping the high conversion rate of agricultural land to non-agricultural purposes;
- Utilizing agro-ecological zones to determine maximum land-use efficiency;
- Adopting measures to discourage the conversion of agricultural land for urban or development purposes;
- Improving the environmental sustainability of land-use practice

2.4.4. The Embankment and Drainage Act, 1952

The East Bangle Act No. 1, 1953 was amended in 1953 and was adopted by the People's Republic of Bangladesh, by the Bangladesh Order (adaptation of Existing Laws), 1972

(President's Order No. 48 of 1972). The Act consolidates the laws relating to embankments and drainage, providing provision for the construction, maintenance, management, removal, and control of embankments and water courses for the better drainage of lands and their protection from floods, erosion, or other damage by water.

The specific Sections and Articles relevant to the project are mentioned below:

- **Section 4 (1)** of the Act states that the embankment, watercourse, tow-path, earth, pathways, gates, berms, and hedges of the embankments shall vest in the Government of the Authority (BWDB).
- **Section 56 (1)** states that the person will be subject to a penalty (500 takas or imprisonment… if he erects, or causes or willfully permits to be erected, any new embankment, or any existing embankment, or obstructs of diverts, or causes or willfully permits to be obstructed or diverted, any watercourse).
- **Section 15** allows the engineer (engineer in charge of Divisional level BWDB) to construct new embankments or to enlarge, lengthen, or repair existing embankments.
- The other sections of the Act give powers and access to the Government or Authority or Engineers to commence necessary project activities for land acquisition (through the DC) and site clearing activities, including removal of trees or houses (if necessary).

2.4.5. Bangladesh Climate Change Strategy and Action Plan (BCCSAP), 2009

The GOB also prepared the BCCSAP in 2008 and revised it in 2009. This is a comprehensive strategy to address Bangladesh's Climate Change (CC) challenges. BCCSAP built on and expanded the NAPA. It is built around the following six themes:

- **Food security, social protection, and health** to ensure that the poorest and most vulnerable in society, including women and children, are protected from CC and that all programs focus on their needs for food security, safe housing, employment, and access to basic services, including health.
- **Comprehensive disaster management** to strengthen the country's already proven disaster management systems to deal with increasingly frequent and severe natural calamities.
- **Infrastructure** to ensure that existing assets (e.g., coastal and river embankments) are well maintained and fit for purpose and that urgently needed infrastructure (e.g., cyclone shelters, and urban drainage) is put in place to deal with the likely impacts of climate change.

- **Research and Knowledge management** to predict the likely scale and timing of CC impacts on different sectors of the economy and socio-economic groups; to underpin future investment strategies; and to ensure that Bangladesh is networked into the latest global thinking on climate change.
- **Mitigation and low carbon development** to evolve low carbon development options and implement these as the country's economy grows over the coming decades.
- Capacity building and Institutional strengthening to enhance the capacity govt. ministries, civil society, and the private sector to meet the challenge of CC.

2.4.6. Sound Pollution Control Rules, 2006

Table 2.1: Bangladesh Standards for Noise

SL. No.	Area Category	Standard Values (All values in dB)	
		Day	Night
1.	Silent Area	50	40
2.	Residential area	55	45
3.	Mixed area (basically residential and together used for commercial and industrial purposes)	60	50
4.	Commercial	70	60
5.	Industrial	75	70

Source: *MOEF, 2006*

Note: **1)** The time from 6 a.m. to 9 p.m. is counted as daytime.

2) The time from 9 p.m. to 6 a.m. is counted as night time

2.5. Compliance with DoE's EIA Guideline

2.5.1. The Environmental Conservation Act, 1995

The Bangladesh Environmental Conservation Act of 1995, is an umbrella legislation enacted to provide for conservation of the environment, improvement of environmental standards, and control and mitigation of environmental pollution. The DOE was created under the Act. The provisions of the Act authorize the Director General (DG) of the Department of Environment to undertake any activity he deems fit and necessary to conserve and enhance the quality of the environment and to control, prevent, and mitigate pollution. The main provisions of the Act have been listed in table 2.2.

Table 2.2: Various Provisions of the Bangladesh Environmental Conservation Act, 1995

Sections	Provisions
Section 3	A Department of Environment, headed by a Director General (DG), should be established by the government for carrying out the purposes of this Act.
Section 4	The powers and functions of the DG will include taking necessary measures for conservation and protection of environment and issuing directions to concerned persons, to be carried out within a specified time limit, including that of closure after sending a written notice.
Section 4(A)	The DG or any other authorized person may seek assistance from law-enforcing agencies in case of non-compliance with directions of closure. In such cases, the electricity, gas, telephone and water services for the non-compliant party can be discontinued.
Section 5	The government can declare an area ecologically critical, and issue a notice specifying the activities or processes that cannot be initiated or continued in it.
Section 6	This section specifies the restrictions regarding (a) vehicles emitting smoke injurious to environment and (b) manufacture, sale etc. of articles injurious to environment.
Section 7	The DG may seek compensation and/or corrective measures from the concerned person whose act/emission has caused direct/indirect injury to the ecosystem, failing which a civil suit and/or criminal case can be filed in a competent court.
Section 8	This section allows a person affected or likely to be affected by environmental pollution or degradation to apply to the DG for remedy.
Section 9	The person responsible and the person in charge of the place of occurrence of accidental pollution shall take measures to control or mitigate it, expenses for which are payable to the DG.
Section 10	Any person generally or specially authorized by the DG shall have the right to enter any building.
Section 11	A person authorized by the DG may, in the manner prescribed by rules, collect from any factory, premises or other place any sample of air, water, soil or other substance for analysis.
Section 12	An Environmental Clearance Certificate must be obtained from the DG for the establishment and undertaking of an industrial project.
Section 13	The government may formulate and publish environmental guidelines for conservation and improvement of environment and control and mitigation of pollution.
Section 14	This section allows a person aggrieved by a notice, order or direction issued under this Act to appeal to the appellate authority constituted by the government, within 30 days from its issuance.
Section 15	This section specifies the penalty to be paid for various offences.
Section 16	When a company violates any provision of this Act or fails to perform its duties in accordance with a notice issued under this Act or the Rules, it will amount to a violation.
Section 17	This section introduces the grounds for taking cognizance of an offence and claim for compensation by a court.

Sections	Provisions
Section 18	An action taken by the government or the DG, which caused or is likely to cause injury to any person, cannot be legally contested, if taken in good faith.
Section 19	The government may delegate its powers to the DG, who may delegate his to any other officer of the department.
Section 20	The government is vested with the power to make various rules for carrying out the purposes of this Act.

Source: *The Bangladesh Environmental Conservation Act, 1995*

2.5.2. The Environmental Conservation Rules (ECR), 1997

The Environment Conservation Rules, 1997 are the first set of rules promulgated under the Environment Conservation Act, 1995. ECR'97 provides additional guidance for specific components of the Act. The rules mainly consist of:

- The National Environmental Quality Standards (EQS) for ambient air, surface water, groundwater, drinking water, industrial effluents, emissions, noise and vehicular exhaust;
- Categorization of industries, development projects, and other activities on the basis of pollution activities of the existing or proposed industries/development projects/activities
- Procedure for obtaining environmental clearance;
- Requirement for undertaking IEE and EIA as well as formulating EMP according to categories of industries/development projects/activities;
- Procedure for damage claim by persons affected or likely to be affected due to polluting activities or activities causing hindrance to normal civic life.

The Rules incorporate "inclusion lists" of projects requiring varying degrees of environmental investigation.

Green: Industries/development projects/activities are considered relatively pollution-free and, therefore, do not require an environmental clearance certificate from the DOE or an environmental study.

Orange: Industries/development projects/activities fall into two categories. Orange "A" is less polluted, and Orange "B" is moderately polluted. To obtain environmental site and environmental clearance, industries/development projects/activities must submit general information, a process flow diagram, and schematic diagrams of waste treatment facilities along with their application to the DoE.

Red: Industries/development projects/activities which fall in RED category are those which may cause significant adverse environmental impacts and are therefore required to submit an EIA report. It should be noted that they might obtain an environmental site clearance based on an IEE report, and subsequently submit an EIA report for obtaining environmental clearance along with other necessary papers.

Certain criteria and conditions have also been established by the Department of Environment (DoE) for siting an industrial plant or project. These are as follows:

- The location of the industry should be in an area that is/will be designated as an industrial zone, under the town and country planning regulations.
- While selecting sites for red and orange categories, a few considerations are to be kept in mind environmentally/ otherwise sensitive areas: nearest human settlement highway/railway boundary and high tide line (coastal regions) or natural/modified flood plain boundary.
- Forest land and prime agricultural land should be avoided as far as practicable.
- The plant should adequately provide for storage of solid wastes, treatment of wastewater, use of treated wastewater (if feasible), and a green belt around the perimeter.
- Highly polluting industrial plants should not be located in the vicinity of a recharge area /aquifer, the catchment area of a public water supply reservoir, the habitat of an endangered species, areas prone to floods/earthquakes, and areas of frequent inversions.
- Other factors also need to be considered like induced growth around the industrial site, views of the likely project-affected people, effects on availability of existing infrastructural facilities to the local population, and assimilative capacity of the receiving body of water.
- It is advisable to shortlist a few potential sites keeping in mind the above criteria, and then select a site with minimal environmental impacts.

Environmental standards in operation in Bangladesh is also Promulgated under the Environment Conservation Rules 1997. There are standards prescribed for varying water sources, ambient air, noise, odor, industrial effluent and emission discharges, vehicular Emission etc.

The Bangladesh standards intend to impose restrictions on the volume and concentrations of wastewater/solid waste/gaseous emission etc. discharged into the environment. In addition, a number of surrogate pollution parameters like Biochemical Oxygen Demand, Chemical Oxygen Demand; Total Suspended Solids, etc. are specified in terms of concentration and/or total allowable quality discharged in case of wastewater/solid waste. Additionally, specific parameters depending on the manufacturing process are specified such as phenol, cyanide, copper, zinc, chromium, etc. Air emission quality standards refer mostly to the concentration of mass emission of various types of particulates, sulfur dioxide, and oxides of nitrogen and in some cases volatile organic compounds and other substances.

The Bangladesh standards in general are less stringent compared to the developed countries. This is in view to promote and encourage industrialization in the country. The Bangladesh standards are not for any specific period of time. There is no provision for partial compliance too.

2.5.3. The Environmental Conservation Rules (ECR), 2023

The Environment Conservation Rules, 2023 are the first set of rules promulgated under the Environment Conservation Act, 2023. ECR, '23 provides additional guidance for specific components of the Act. The rules mainly consist of:

- Categorization of industries, development projects, and other activities on the basis of pollution activities of the existing or proposed industries/development projects/activities (Section-1);
- The National Environmental Quality Standards (EQS) for surface water, groundwater, drinking water, and industrial effluents (Section 2);
- Procedure for obtaining environmental clearance;
- Requirement for undertaking IEE and EIA as well as formulating EMP according to categories of industries/development projects/activities;
- Procedure for damage claim by persons affected or likely to be affected due to polluting activities or activities causing hindrance to normal civic life;
- Guideline for preparing Environmental Impact Assessment (EIA) report (Section-11).

The Rules incorporate "inclusion lists" of projects requiring varying degrees of environmental investigation.

Green: Industries/development projects/activities are considered relatively pollution-free and therefore do not require an environmental clearance certificate from the DoE and no environmental study.

Yellow: Industries/development projects/activities fall in Yellow category are those which are causing medium pollution on the environment and human health. These projects/activities required to submit general information, an IEE report, application to DoE for obtaining environmental site clearance and environmental clearance.

Orange: Industries/development projects/activities fall in Orange category are moderately polluted required to submit general information, a process flow diagram and schematic diagrams of waste treatment facilities, an IEE and EMP along with their application to DOE for obtaining environmental site clearance and environmental clearance.

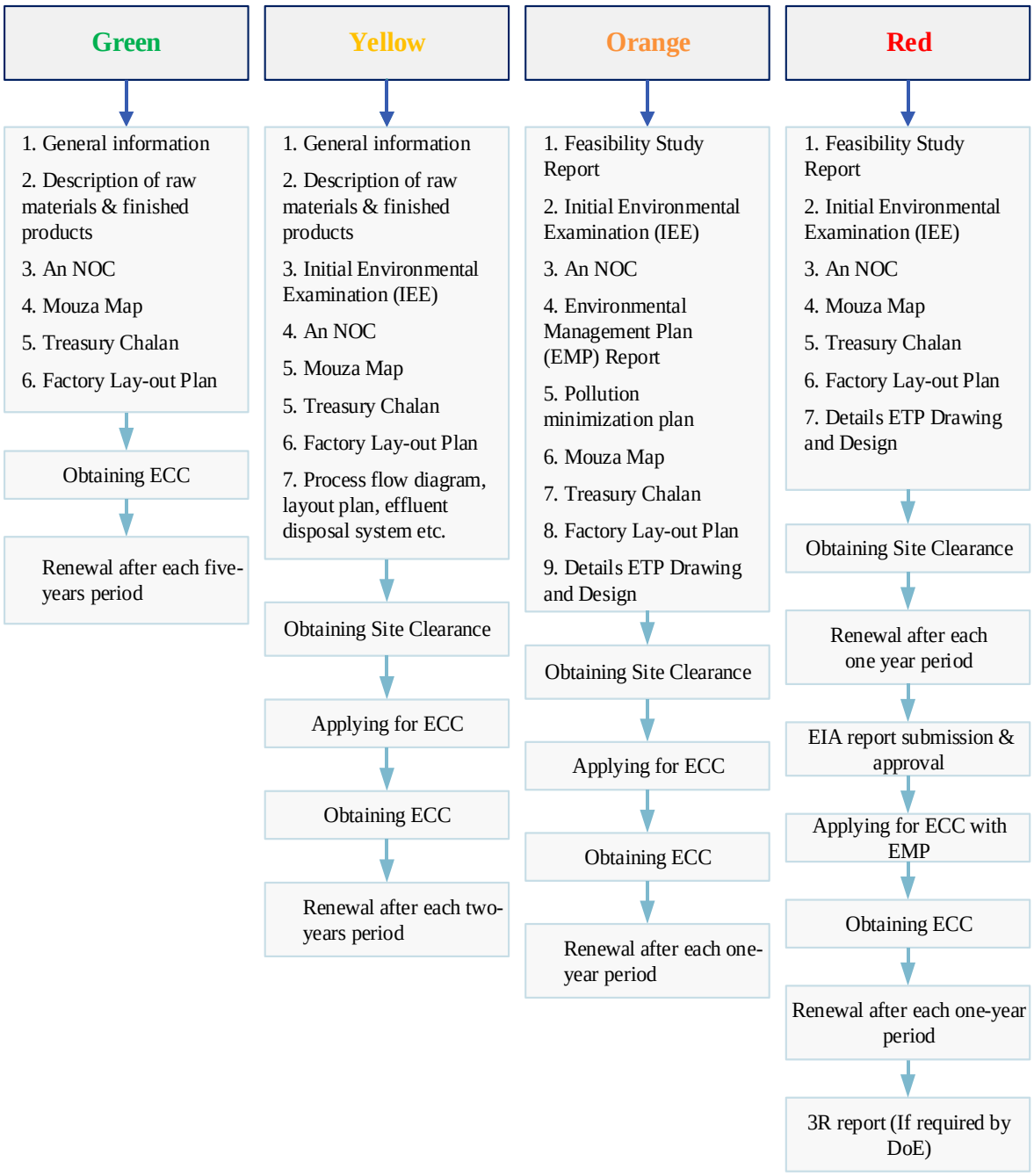
Red: Industries/development projects/activities which fall in RED category are those which may cause significant adverse environmental impacts and are therefore required to submit an EIA report. It should be noted that they might obtain an environmental site clearance on the basis of an IEE report, and subsequently submit an EIA report for obtaining environmental clearance along with other necessary papers.

2.6. Compliance with Legal Requirements

Depending on their applicability, the entrepreneur must adhere to and may require approvals of other previous and existing policies, ordinances, acts, and rules, including the ECA, 1995, and the ECR, 2023.

2.6.1. Obtaining Environmental Clearance

APPLICATION TO DOE FOR ENVIRONMENT CLEARANCE CERTIFICATE



N.B. If the industry/project locates inside EPZ, then IEE is not required

Figure 2.1: Process of Getting Environmental Clearance Certificates

2.6.2. Environmental Quality Standards

Bangladesh is one of the least developed countries with a low resource base, a burgeoning population with a very low land-man ratio, often threatened by both natural and anthropogenic stresses. Like all other nations of the world, Bangladesh also acted to the global call for the protection and conservation of the natural environment and ecology. Industrial development significantly contributes to the economic growth of a country. It brings along with it a host of environmental problems, too. It is increasingly being recognized in Bangladesh, as in other parts of the world, that for development to be meaningful and sustainable over a longer period, environmental concerns must be integrated into all development policies. The Ministry of Environment and Forest is the nodal ministry that supervises the implementation of environmental and forestry programs in Bangladesh. The Department of Environment (DoE) carries out policy analysis, planning and evaluation, program coordination, and monitoring and evaluation of the environmental programs. The Forest Department in the ministry deals with forestry programs.

In Bangladesh, the environmental aspects of any project are mainly governed by: The Environmental Conservation Act, of 1995, the Environmental Conservation Rules, of 1997, the Environmental Conservation Rules, of 2023, and the Forest Act, of 1927 (if forestland has been converted).

The requirement for undertaking environmental studies has been specified under the ECA, 1995, the ECR, 1997, and the ECR, 2023. Section 12 of ECA, 1995 stipulates that "No industrial unit or project shall be established or undertaken without obtaining environmental clearance from the Director General, Department of Environment (DG, DoE) in the manner prescribed by the rules".

2.6.2.1. Air Quality

Table 2.3: Ambient Air Quality Standards

Air Pollutant	Unit	Standards	Average Time
Carbon Monoxide (CO)	mg/m^3	5	8 hrs.
		20	1 hr.
Lead (Pb)	micro gm/m^3	0.25	Annual
		0.5	24 hrs.
Nitrogen di oxide (NO_2)	micro gm/m^3	40	Annual
		80	24 hrs.
Particulate Maters$_{10}$ (PM_{10})	micro gm/m^3	50	Annual
		150	24 hrs.
Particulate Maters $_{2.5}$ ($PM_{2.5}$)	micro gm/m^3	35	Annual
		65	24 hrs.
Ozone (O_3)	micro gm/m^3	180	1 hr.
		100	8 hrs.
Sulphur dioxide (SO_2)	micro gm/m^3	250	1 hr.
		80	24 hrs.
Ammonia (NH_3)	micro gm/m^3	100	Annual
		400	24 hrs.

Source: *Air Emission Control Rules, MOEF, 2022*

Note:

a. In this schedule, air quality means ambient air quality.

b. Average value shall not exceed more than once a year.

c. The target will be achieved when the annual average is within the prescribed standard.

2.6.2.2. Water Quality

Table 2.4: Standards for Inland Surface Water

Parameters													
SL. No.	**Best Practice Based Classification**	**pH**	**DO mg/L**	**BOD mg/L**	**NO_3-N mg/L**	**NH_4-N mg/L**	**PO_4-P mg/L**	**Total Cr mg/L**	**Pb mg/L**	**Hg mg/L**	**Total Coliform CFU/L**	**TDS mg/L**	**TDS mg/L**
1	Source of drinking water for supply only after disinfecting	6.5-8.5	6 or above	2 or less	7.0	0.1	0.1	0.02	0.03	0.001	100 or less	1000	10
2	Water usable for recreational activity	6.5-8.5	5 or above	3 or less	7.0	0.3	0.5	0.2	0.05	0.001	50 or less	1000	10
3	Source of drinking water for supply after conventional treatment	6-9	5 or above	5 or less	7.0	0.3	0.5	0.02	0.03	0.001	5000 or less	1000	25
4	Water usable by fisheries	6-9	5 or above	6 or less	7.0	0.3	0.5	0.05	0.1	0.004	5000 or less	1000	50
5	Water usable by various process and cooling industries	6.5-8.5	1 or above	12	-	2.7	-	0.1	0.1	0.05	-	1000	100
6	Water usable for irrigation	6.5-8.5	-	12 or less	5.0	1.5	2.0	0.1	0.1	0.002	50,000 or less	1000	100

Source: *Environmental Conservation Rules, 2023*

Notes:

a. Electrical conductivity for irrigation water – 2250 µmhoms/cm (at a temperature of 25°C); Sodium less than 26%; Boron less than 0.2%

Table 2.5: Standards for Drinking Water

Sl. No.	**Parameters**	**Unit**	**Standards**
1.	Fecal Coliform	CFU/100ml	0
2.	Total Coliform	"	0
3.	Free Residual Chlorine	mg/L	0.20
4.	Nitrate (NO3-)	"	45
5.	Arsenic (As)	"	0.05
6.	Turbidity	NTU	5
7.	Aluminum (Al)	"	0.20
8.	Ammonia (NH3)	"	1.50
9.	Barium (Ba)	"	0.70
10.	Benzine (C6H6)	"	0.01
11.	Boron (B)	"	1.0
12.	Cadmium (Cd)	"	0.003
13.	Calcium (Ca)	"	75
14.	Chloride (Cl)	"	250*
15.	Carbon tetra chloride	"	0.005
16.	1,1 Dichloroethane	"	0.03
17.	1,2 Dichloroethane	"	0.03

18.	Tetrachloroethane	"	0.04
19.	Trichloroethane	"	0.02
20.	Pentachlorophenol	"	0.009
21.	2,4,6 Trichlorophenol	"	0.20
22.	Chloroform	"	0.09
23.	Total Chromium	"	0.05
24.	Color	Hazen	15
25.	Copper (Cu)	mg/L	1.5
26.	Cyanide (CN)	"	0.05
27.	Fluoride	"	1.0
28.	Hardness as $CaCO_3$	"	500
29.	Ferrous (Fe)	"	0.3-1.0
30.	Total Kjeldahl Nitrogen	"	1.0
31.	Lead (Pb)	"	0.01
32.	Magnesium (Mg)	"	30-35
33.	Manganese (Mn)	"	0.4
34.	Mercury (Hg)	"	0.001
35.	Nicale (Ni)	"	0.05
36.	Nitrite (NO_2^-)	"	1.0
37.	Odor	-	Odorless
38.	Oil & Grease	mg/L	0.01
39.	pH	-	6.5-8.5
40.	Phenols	mg/L	0.002
41.	Potassium (K)	"	12
42.	Radioactive materials (gross alpha activity)	Bq/L	0.1
43.	Radioactive materials (gross beta activity)	"	1.0
44.	Selenium (Se)	mg/L	0.01
45.	Silver (Ag)	"	0.02
46.	Sodium (Na)	"	200
47.	Suspended Solid (SS)	"	10
48.	Sulfide as H2S	"	0.05
49.	Sulfate (SO_4^{2-})	"	250
50.	Total Dissolve Solids (TDS)	"	1000
51.	Temperature	0C	20-30
52.	Tin (Sn)	mg/L	2.0
53.	Zinc (Zn)	"	5.0
54.	Aldrin/Dieldrin	Micro-g/L	0.03
55.	Anionic detergents	mg/L	0.2

Source: *Environmental Conservation Rules, 2023*

Note: *1000 mg/L for Coastal Area

Table 2.6: Standards for Sewage Discharge

SL No.	Parameters	Unit	Standards
1	BOD_5	mg/l	30
2	Nitrate	,,	50
3	Phosphate	,,	15
4	Suspended solids (SS)	,,	100
5	Temperature	Degrees centigrade	30
6	Total Coliform	CFU/100 ml	1000
7	pH	mg/L	6-9
8	COD	,,	125
9	Oil & Grease	,,	10

Source: *Schedule 3, Environmental Conservation Rules, 2023*

Notes:

a. This limit shall be applicable to discharges into surface and inland water bodies.

b. Sewage shall be chlorinated before final discharge. Residual Chlorine cannot be more than 0.2 mg/L.

2.6.2.3. Noise

Table 2.7: Standards for Sound

SL. No.	Area Category	Standard Values (All values in dB)	
		Day	**Night**
1.	Silent Area	50	40
2.	Residential area	55	45
3.	Mixed area (basically residential and together used for commercial and industrial purposes)	60	50
4.	Commercial	70	60
5.	Industrial	75	70

Source: *Noise Control Rules, MOEF, 2006*

Note:

a. The time from 6 a.m. to 9 p.m. is counted as daytime.

b. The time from 9 p.m. to 6 a.m. is counted as night time.

2.6.3. The National Conservation Strategy

National Conservation Strategy (GoB/IUCN, 1992) was drafted in late 1991 and submitted to the Government in early 1992. For sustainable development in the industrial sector, the report offered various recommendations; some of which are as follows:

- Industries based on nonrenewable resources should be made to adopt technology that conserves raw materials, and existing industries should be given incentives to install technical fixes to reduce the wastage rate
- All industries, especially those based on imported raw materials, should be subjected to EIA and the adoption of pollution prevention/control technologies should be enforced.
- No hazardous or toxic materials/wastes should be imported for use as raw material.
- The import of appropriate and environmentally sound technology should be ensured.
- Complete dependence on imported technology & machinery for industrial development should gradually be reduced so that industrial development is sustainable with local skills and resources.

2.6.4. The National Environmental Management Plan (NEMAP), 1995

The National Environmental Management Plan (NEMAP) was developed as the framework of programs and interventions aimed at implementing NEP. Under this Plan, various program outlines were drawn up and activities incorporated. The main aims of the Plan were:

- Better management of scarce resources;
- Checking the rate of environmental degradation;
- Improving the natural and manmade environment;
- Conserving habitats and biodiversity;
- Promoting sustainable development; and
- Improving quality indicators of human life.

2.6.5. National Environmental Policy (NEP), 1992

In 1992 the National Environmental Policy (NEP) was drawn up to provide protection and sustainable environmental management. The objectives of the Policy include:

- Maintaining ecological balance and overall development through protection and improvement of the environment;
- Identifying and regulating polluting and environmentally degrading activities;
- Ensuring environmentally sound development;
- Ensuring sustainable and environmentally sound use of all-natural resources;
- Active association with all international environmental initiatives.

2.6.6. The Environment Court Act, 2010

In 2010, a new law, the Bangladesh Environment Court Act, 2010 was enacted, replacing the 2000 Act. The objective of the current Act is to establish Environment Courts in each district, presided over by a Joint District Judge. This Judge handles both regular cases and those falling under the jurisdiction of an Environment Court. Notably, the Act does not require the creation of entirely separate Environment Courts. Consequently, aside from the former three Courts and an Appellate Court, no additional Environment Courts have been set up. Similar to the prior Act, the 2010 Act also allows for the establishment of Special Magistrate Courts in each District, managed by first-class Magistrates or Metropolitan Magistrates. These courts handle cases with penalties of less than five years imprisonment or fines up to five lakh BDT. Furthermore, the Act involves Executive Magistrates who operate under the Mobile Court Act, of 2009. They can promptly address certain offenses and pass judgments based on the offender's admission of guilt. Environmental laws commonly incorporate provisions for the operation of Mobile Courts.

2.7. International Legal Obligations

2.7.1. The Convention on Biological Diversity (CBD), 1992

The Convention on Biological Diversity (CBD) is an international treaty that was adopted in 1992. The CBD has three main goals:

- Conservation of biological diversity
- Sustainable use of its components
- Fair and equitable sharing of benefits arising from genetic resources

The CBD applies to all types of biological diversity, including land-based ecosystems. Land development projects can have a significant impact on biological diversity, both positive and negative. The CBD provides a number of tools and mechanisms to help countries manage the impacts of land development projects on biological diversity. These tools include:

National Biodiversity Strategies and Action Plans (NBSAPs): NBSAPs are national plans that set out the goals and objectives for the conservation and sustainable use of biological diversity in a particular country.

The Prior Informed Consent (PIC) procedure: The PIC procedure requires countries to obtain the consent of the country providing genetic resources before using those resources in a land development project.

The Access and Benefit-sharing (ABS) regime: The ABS regime provides a framework for countries to share the benefits arising from the use of genetic resources.

The CBD is an important tool for protecting biological diversity and ensuring that land development projects are carried out in a sustainable manner. By following the CBD's guidelines and procedures, countries can minimize the negative impacts of land development projects on biological diversity and maximize the positive impacts.

Chapter Three: Project Description

3.1. Project Definition

GSM Industries Ltd. (GSMIL) will be a privately owned facility in Gutudia, Dumuria, Khulna, and begin operations in 2026. The facility will produce chemicals for both local and international markets, benefiting from its strategic location in Khulna, which provides easy access to essential infrastructure such as gas, electricity, telecommunications, and transportation networks. This positioning will enable GSMIL to serve the growing demand for high-quality, sustainable chemical processing.

The facility will provide integrated chemical services, emphasizing high-quality, seamless production for national and international clients. By utilizing advanced technology, GSMIL will enhance productivity while minimizing environmental impact. The factory will operate at a capacity of 100 tons of Sodium Sulphate, 100 tons of Sulfuric Acid, 90 metric tons of Poly Aluminum Chloride (PAC), and 10 tons of Hydrochloric Acid per day, ensuring the ability to fulfill large-scale orders. GSMIL will secure all necessary approvals from relevant municipal authorities and ensure compliance with industry requirements and regulatory standards.

In addition to its core operations, GSMIL will support the local workforce by offering training and development opportunities for technical and non-technical professionals. This initiative will foster employment growth and improve skill levels within the community, contributing to the region's economic development, particularly in the chemical industry.

GSMIL will implement measures to mitigate potential environmental impacts during construction and operational phases. The facility will collaborate with third-party organizations to manage solid waste and sludge disposal. Additionally, GSMIL will install an Effluent Treatment Plant (ETP) with a treatment capacity of 2 cubic meters per hour, ensuring the safe discharge of treated wastewater into a nearby drainage system leading to the Rupsha River.

By adhering to a comprehensive Environmental Management Plan (EMP), GSMIL will ensure compliance with national environmental standards and minimize negative environmental impacts while maintaining high production standards. Through its commitment to sustainability and regulatory compliance, GSMIL will establish itself as a leader in environmentally responsible chemical production, promoting a balance between industrial growth and ecological preservation.

Advanced Technology

GSM Industries Ltd. (GSMIL) aims to establish itself as a leader in high-quality chemical manufacturing by integrating cutting-edge technology and world-class infrastructure. The facility will be equipped with a comprehensive range of modern equipment, including Fluidized Bed Reactors, Crystallizers, Centrifugal Separators, Dryers, Sulfur Burners, Catalytic Converters, Absorption Towers, Concentration Units, Polymerization Vessels, Filtration Units, and Hydrogen Chloride Gas Generators. The plant will also feature Pumps and Piping Systems, Storage Tanks, Heat Exchangers, and advanced control systems (DCS/SCADA) to ensure efficient and consistent production. Additionally, specialized safety equipment will enhance operational safety and environmental compliance, including fire suppression systems, emission scrubbers, material handling systems, and gas detection and monitoring systems.

The design of GSMIL's factory will emphasize sustainability, with eco-friendly features that promote a healthy and safe work environment. The facility will operate 24/7 to meet local and international production demands, delivering superior chemical manufacturing solutions tailored to the needs of its customers.

GSMIL will also provide reliable, round-the-clock transport services to ensure the timely and secure delivery of products, reinforcing the company’s commitment to operational excellence.

As part of its commitment to environmental stewardship, GSMIL will implement an Effluent Treatment Plant (ETP) to treat wastewater generated during production, ensuring compliance with national environmental standards. This initiative underscores GSMIL’s dedication to reducing its ecological footprint and positioning itself as a benchmark for sustainable chemical manufacturing within the industry.

3.2. Project Location and Details

GSM Industries Limited is located at Gutudia, Dumuria, Khulna. The project site is about 11 km from the Khulna Zila bus stand. The location's geographical coordinates are Longitude: 89° 42' 64.5" E and Latitude: 22° 79' 72.7" N. The location map and navigation of the proposed Project site are presented in the following figures:

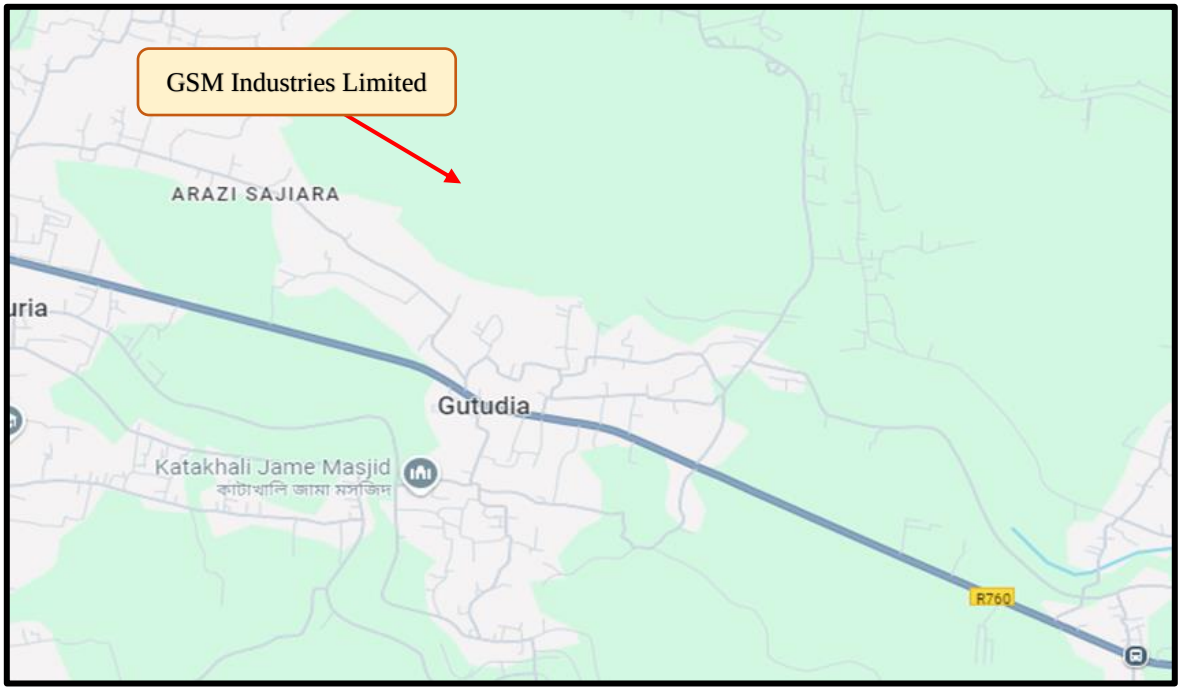


Figure 3.1: The location map of the project (Adopted from Google Maps)

Figure 3.2: The location map of the project (Adopted from Google Maps)

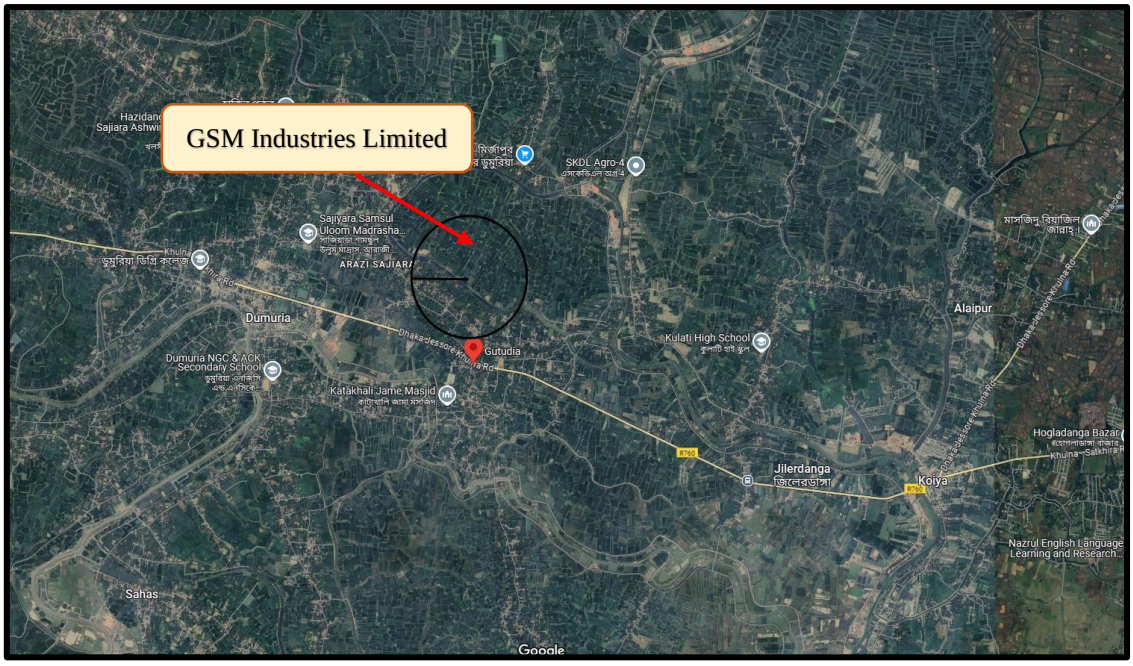


Figure 3.3: 500-meter surrounding area from project location (captured from Google Earth)

3.3. Basic Information of Project

The EIA Report for GSM Industries Ltd. (GSMIL) primarily addresses the factory's operation's environmental impacts on the surrounding environment.

Table 3.1: Basic Information of GSM Industries Ltd.

Basic Information of **GSM Industries Ltd.**		
S.N.	**Items**	**Description**
1.	**Name of the project**	GSM Industries Ltd.
2.	**Date of Commencement & Date of Completion**	01.03.2025 & 31.12.2025
3.	**Type of Factory**	Private Factory
4.	**Owner of the Project**	Kazi Hafizur Rahman
5.	**Designation of the Owner**	Chairman
6.	**Contact Detail Head Office**	Road No. 1, Avenue - 1, House – 147, Mirpur DOHS, Dhaka
7.	**Location of the Project**	Gutudia, Dumuria, Khulna.
8.	**Type of Project**	Chemical Production
9.	**Product (s)**	a. Sodium Sulphate b. Sulfuric Acid c. Poly Aluminum Chloride d. Hydrochloric Acid
10.	**Production Capacity per Day**	Total Production is around 300 Tons Per Day
11.	**Working Hour**	24 (12 hours per shift)
12.	**Total Manpower**	**100 persons** **Administrative:** 15 persons **Production Process:** 80 persons **Env. Management:** 5 persons
13.	**Project Area**	6,09,840 Square Feet
14.	**Constructed Area**	3,04,920 Square Feet
15.	**Green Area**	3,04,920 Square Feet
16.	**Project Cost**	600,00,00,000 BDT
17.	**Raw Material Quantity and Size, Weight**	a. Raw Salt b. Sulfur c. Other Catalyst & Cleaning Agents d. Aluminum Hydrochloride e. Aluminum Sulfide
18.	**Water Requirement**	100 m^3/Day
19.	**Source of Water**	Ground Water

Basic Information of **GSM Industries Ltd.**		
S.N.	**Items**	**Description**
20.	**Type of Waste Generation**	Empty Chemical Containers, Wastewater from Production Process, ETP Sludge, Paper and Plastic Waste
21.	**Wastewater Generation**	30 m^3/Day
22.	**Disposal Point for Liquid Waste**	Go to the Rupsha River through the local khal (After Treatment)
23.	**(Proposed) Wastewater Treatment Plant (WWTP)**	ETP Capacity 2 m^3/hr. Operating Time 20 hr. per day.
24.	**Solid Waste Generation**	25 - 40 Kg/Day
25.	**Solid Waste Disposal**	Third parties will manage solid waste and sludge from the ETP.
26.	**Connected Load**	500 kW
27.	**Generator**	Total 2 Nos. (420 kW and 240 kW)

3.4. Building Detail

GSM Industries Ltd. will operate on its land. The master layout plan is attached in the Annexure section of this report.

SL. No.	Description	Area
1.	Sulfuric acid process building with bridge crane sulfur storage	2898.95 sqm
2.	Two-storied utility building	576 sqm
3.	Single-storied DM water building	185.23 sqm
4.	Sodium sulfate process building including storage area	7782 sqm
5.	Six-storied baby care, medical, canteen, and admin building	397.8 sqm
6.	Sulfuric acid storage area	344 sqm
7.	Hydrochloric acid storage area	759 sqm
8.	Single-storied firefighting house	24.72 sqm
9.	Water reservoir	81.67 sqm
10.	Water treatment plant	232.50 sqm
11.	PAC Processing building and storage area	3800 sqm
12.	Six-storied worker dormitories	360 sqm
13.	Six-storied staff quarters	360 sqm
14.	Two storied bungalows for MD and Director	330 sqm

15.	Guard room	55 sqm

3.5. Factory Process Flow, List of Equipment and Reagent

3.5.1. Sulfuric Acid Production

3.5.1.1. Raw Materials:

- **Sulfur (S)**: Sulfur is the primary feedstock used in sulfuric acid production. It is available as a byproduct of various industrial processes such as refining petroleum.
- **Oxygen (O_2)**: Oxygen is necessary for the oxidation of sulfur-to-sulfur dioxide and sulfur trioxide.
- **Water (H_2O)**: Water is required for the final stage of sulfuric acid production where sulfur trioxide is absorbed.

3.5.1.2. Production Process:

a) **Sulfur Combustion**:

Sulfur is combusted with oxygen at high temperatures (around 1000°C) to produce sulfur dioxide (SO_2). This reaction occurs in a furnace and is the first step in the production of sulfuric acid.

- **Reaction**:

$$S + O_2 \rightarrow SO_2$$

b) **Conversion to Sulfur Trioxide (SO_3)**:

The sulfur dioxide (SO_2) gas is then passed through a catalytic converter where it reacts with excess oxygen in the presence of a vanadium oxide (V_2O_5) or platinum catalyst. The reaction occurs at temperatures of 400-600°C and forms sulfur trioxide (SO_3).

- **Reaction**:

$$2SO_2 + O_2 \xrightarrow{\text{Catalyst}} 2SO3$$

c) **Absorption of Sulfur Trioxide**:

Sulfur trioxide is absorbed into water or concentrated sulfuric acid (oleum) to form sulfuric acid (H_2SO_4). It is highly reactive and must be handled carefully to avoid its release into the environment.

- **Reaction**:

$$SO_3 + H_2O \rightarrow H_2SO_4$$

The final sulfuric acid product is then concentrated to the desired level (usually 93-98%).

3.5.2. Glauber Salt (Sodium Sulfate) Production

3.5.2.1. Raw Materials:

- **Sodium chloride (NaCl)**: A key raw material, sodium chloride is abundant and inexpensive. It reacts with sulfuric acid in the production process.

- **Sulfuric acid (H_2SO_4)**: Sulfuric acid initiates the reaction with sodium chloride to produce sodium bisulfate, which further reacts to form Glauber salt.

3.5.2.2. Production Process:

a) **Reaction Between Sodium Chloride and Sulfuric Acid**:

In the first step, sodium chloride (NaCl) is mixed with sulfuric acid (H_2SO_4) at high temperatures (around 250°C). This reaction forms sodium bisulfate ($NaHSO_4$) and hydrogen chloride (HCl).

- **Reaction**:

  $NaCl + H_2SO_4 \rightarrow NaHSO_4 + HCl$

b) **Formation of Glauber Salt**:

The sodium bisulfate ($NaHSO_4$) produced in the first step is then mixed with an additional amount of sodium chloride (NaCl) to form sodium sulfate (Na_2SO_4), commonly known as Glauber salt.

- **Reaction**:

  $NaHSO_4 + NaCl \rightarrow Na_2SO_4 + HCl$

c) **Crystallization**:

Glauber salt is purified by crystallization, where the reaction mixture is cooled, and sodium sulfate (Na_2SO_4) forms solid crystals. These crystals are then separated by filtration or centrifugation.

3.5.2.3. Byproducts:

- **Hydrochloric Acid (HCl)**: The hydrogen chloride gas produced in both stages of the reaction must be captured, neutralized, or recovered for further use.

3.5.3. Poly-Aluminum Chloride (PAC) Production

3.5.3.1. Raw Materials:

- **Aluminum Hydroxide ($Al(OH)_3$)**: The primary source of aluminum in PAC production.

- **Hydrochloric Acid (HCl)**: Used to produce aluminum chloride ($AlCl_3$) in the first stage of PAC production.

3.5.3.2. Production Process:

a) **Reaction of Aluminum Hydroxide with Hydrochloric Acid**:

In this step, aluminum hydroxide ($Al(OH)_3$) is reacted with hydrochloric acid (HCl) to produce aluminum chloride ($AlCl_3$) and water.

- **Reaction**:

  $Al(OH)_3 + 3HCl \rightarrow AlCl_3 + 3H_2O$

b) Polymerization to Form PAC:

The aluminum chloride ($AlCl_3$) solution is hydrolyzed with water under controlled conditions to produce poly-aluminum chloride (PAC). The polymerization is sensitive to the amount of water and the pH, resulting in varying polymer chain lengths that influence the performance of PAC.

- **Reaction**:

  $AlCl_3 + 3H_2O \rightarrow [Al(OH)_3] + 3HCl$

  The conditions of pH, temperature, and the rate of hydrolysis govern this reaction.

c) Control of PAC Properties:

PAC can be adjusted to create solutions with varying degrees of polymerization. The aluminum oxide content, which can vary from 10% to 40%, is the key factor affecting PAC's coagulant properties. The PAC produced can be used in water treatment, particularly for water purification and wastewater treatment.

3.5.3.3. Byproducts:

- **Hydrochloric Acid (HCl)**: The byproduct HCl can be neutralized or recovered, as it is also an important industrial chemical.

3.6.Utilities

3.6.1. Water Requirement and Wastewater Generation

SL No.	Particulates	Quantity	Unit
1.	Chemical Production Processes	5,000	Liter Per Day
2.	Equipment Cleaning	14,000	Liter Per Day
3.	Container Cleaning	5,000	Liter Per Day
4.	Chemical Storage Tank Cleaning	9,000	Liter Per Day
5.	Laboratory	1,000	Liter Per Day
6.	Floor washing	2,000	Liter Per Day
Total Wastewater generation		**36,000**	**Liters Per Day**
=		36	M^3 Per Day
Considering 10% Factor of Safety, total wastewater generation will be		39.6	M^3 Per Day
Selected Effluent Treatment Plant Capacity		40	M^3 Per Day
Considering 20 Hr. operation time, ETP Capacity		**2**	**M^3 Per Hour**

3.6.2. Power

GSM Industries Ltd. will be utilizing Electricity from two sources:

a. The BREB will supply the main grid power. The factory's connecting load will be 500 kW.
b. Two standby generators, one with a capacity of 420 kVA and the other with a capacity of 240 kVA, will be installed. On average, the generators will consume 1500 Liters of diesel per month.

3.6.3. Safety Provision

GSM Industries Ltd. will prioritize fire safety with a comprehensive system that includes fire extinguishers, fire hydrants, and an advanced fire detection system to safeguard against fire-related incidents. These safety measures will be strategically placed throughout the factory to ensure prompt and effective emergency response. Detailed information on these safety protocols is provided in Chapter Six.

The factory will be equally committed to the health and safety of its staff. Regular health screenings will be conducted for employees who also benefit from primary chemical manufacturing services and Group Health Insurance coverage. Certified first aid personnel will be available in the factory to provide immediate medical assistance. GSM Industries Ltd. will enforce strict safety protocols, mandating all employees in designated production areas. Hazard warnings and safety instructions will be posted in critical locations to enhance awareness and compliance. The factory will also conduct regular safety training sessions, facilitated by certified trainers, focusing on firefighting techniques, fall prevention, and the safe handling of heavy equipment and flammable materials.

3.6.4. Pollution Control and Waste Disposal

GSM Industries Ltd. will implement a comprehensive pollution control and waste disposal strategy to ensure environmentally responsible operations. The factory will enter into formal agreements with third-party organizations to manage the collection, treatment, and disposal of ETP (Effluent Treatment Plant) sludge and solid waste in full compliance with regulatory standards.

An advanced Effluent Treatment Plant (ETP) will be installed to effectively treat wastewater generated during operations, ensuring its safe discharge into the environment. In addition, third-party organizations will oversee the proper disposal of both ETP sludge and solid waste,

mitigating any potential environmental impacts and ensuring adherence to local and international environmental regulations. These proactive measures demonstrate GSM Industries Ltd.'s commitment to sustainable and responsible waste management practices.

3.7. Employment Opportunities

GSM Industries Ltd. (GSMIL) will significantly contribute to the local economy, generating numerous employment opportunities and fostering regional economic growth. The facility will employ approximately 100 individuals, skilled and unskilled.

Skilled roles at GSMIL will encompass technical professions, such as Plant Manager, Production Manager, Chemical Engineer, Quality Control (QC) Manager, Process Technician, Lab Technician, Environmental Health and Safety (EHS) Officer, Maintenance Engineer, Instrumentation and Control Engineer, and many more. These professionals will be crucial in delivering high-quality chemical manufacturing services and maintaining operational efficiency. They will receive targeted training to ensure expertise in their respective fields, which is essential for the smooth functioning of the factory and adherence to health and safety standards.

Unskilled positions at GSMIL will include administrative support, facility maintenance, and other essential support roles. These positions will provide entry-level employment opportunities, offering on-the-job training that equips employees with valuable skills. This not only aids in personal career development but also supports the factory’s operations.

The diverse GSMIL workforce will contribute to a collaborative and efficient environment. The factory’s employment practices also positively impact the community by providing stability and economic benefits. Additionally, GSMIL will be involved in community outreach and training programs to further enhance its workforce's skills and employability.

3.8. Effluent Treatment Plant (ETP)

Wastewater treatment encompasses the mechanisms and processes designed to address water contamination resulting from residential, institutional, industrial, or commercial activities before it is released into the environment or potentially reused. While many institutions have adopted measures to minimize or recycle wastewater, others continue to produce significant volumes.

GSM Industries Ltd. (GSMIL) is committed to minimizing its environmental impact through a state-of-the-art Effluent Treatment Plant (ETP). This advanced facility is crucial for treating wastewater generated from chemical manufacturing activities, ensuring compliance with stringent environmental standards before discharge. The ETP represents a key component of GSMIL's commitment to effective pollution control and environmental stewardship.

Table 3.3: Basic Details of Wastewater Treatment Plants

Name of Client	**:**	**GSM Industries Ltd.**
Location	**:**	Gutudia, Dumuria, Khulna, Bangladesh.
Type of Effluent	**:**	Chemical Manufacturing and Chemical Drum Washing
Quantity of Effluent	**:**	2 m^3/Hr. or 40 m^3/Day
Treatment Hours	**:**	20 Hr./Day
ETP Treatment Concept	**:**	Physico Chemical

Constructing ETP systems with a treatment capacity of 40 m^3/Day. will require a 4120 ft^2 area (approximately). ETP details, drawings, and design calculations are attached in **Annexure A**.

Chapter Four: Description of Existing Environmental and Social Baseline

4.1.General Aspects

Baseline environmental data is crucial for understanding the project study area's physical, biological, cultural, economic, and social characteristics. This information serves as the foundation for analyzing the potential impacts of project activities. The primary objectives of examining and defining the existing environment are:

a. To identify environmental and socioeconomic components that may be affected by project activities.
b. To recognize potential environmental impacts on these components.
c. To establish a baseline against which future project environmental conditions can be measured.

This Environmental Impact Assessment (EIA) study focuses on key environmental factors such as water, air, and noise quality within the study area. The assessment also considers the immediate and the ancillary regions that may be impacted.

4.2.Land Use

GSM Industries Ltd. will be on a dedicated 6,09,840-square-foot plot. Located at Gutudia, Dumuria, Khulna, the factory is strategically positioned to benefit from its proximity to a well-established infrastructure. Within a 5-kilometer radius, the area is a mix of agricultural and commercial buildings, local markets, and essential roadways, providing seamless access to power, skilled labor, and efficient transportation networks via road and water systems.

To the north of the factory is Mirzapur Bazar and agricultural land. To the south lies the Dhaka-Jessore-Khulna Road. The west side of the facility is agricultural land. To the east, the area features masque, along with roads and local stores. This strategic location allows for smooth operational logistics while also minimizing environmental disruption to the surrounding area.

4.3.Water Quality

Water can be categorized into two primary types: surface water and groundwater. Surface water refers to water found in natural or artificial reservoirs on the Earth's surface, such as rivers,

lakes, ponds, and canals. This water is directly exposed to the atmosphere and can be easily affected by environmental factors, including pollution and weather conditions.

Groundwater, on the other hand, is water that resides beneath the Earth's surface in soil pores and rock formations. It accumulates through rainwater infiltration and is typically accessed via wells or pumps. Groundwater is often used for drinking and irrigation and is less exposed to surface contaminants than surface water.

The area surrounding GSM Industries Ltd. features several small-scale surface water bodies, including ponds and canals. Additionally, the region benefits from substantial rainfall and a reliable groundwater supply via pumping for drinking and domestic purposes. The factory will source water from its deep tube well and is committed to reducing water consumption. The local conditions support the recharge of underground aquifers, ensuring that the water table remains stable and that there are no significant complaints regarding groundwater availability in the area.

GSM Industries Ltd. will treat wastewater using an Effluent Treatment Plant (ETP). The excess treated water will be discharged into the local khal system, which leads to the Rupsa River. This approach ensures that the factory's wastewater management aligns with environmental sustainability practices and minimizes the impact on local water bodies.

Key water quality parameters for the water quality indicate fluctuations in pH, dissolved oxygen (DO), biochemical oxygen demand (BOD), chemical oxygen demand (COD), total dissolved solids (TDS), and other metrics, reflecting the source’s vulnerability to pollution and the importance of effective wastewater management practices to protect the aquatic ecosystem.

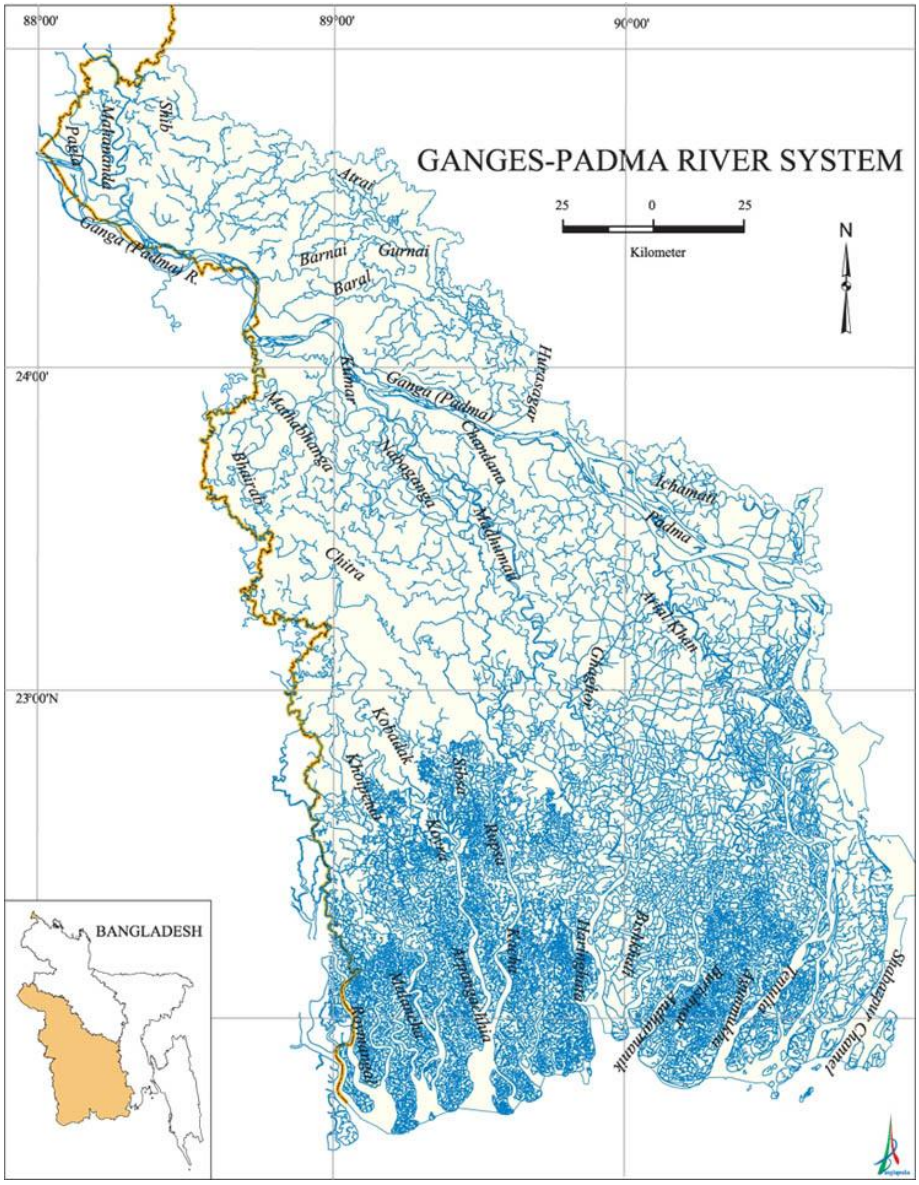


Figure 4.1: Ganges-Padma River System (Rupsa-Pasur RiverRiver Map)

4.3.1. Surface Water Quality

The surface water was collected and tested by ENVIRONMENTAL ALLIANCE BD LIMITED. The test report is attached below,

Table 4.1: Surface Water Test Report

SN	Parameters	Unit	Tested Value	Bangladesh Standard	Method of Analysis
1.	pH	-	7.4	6.5-8.5	pH Meter
2.	Total Dissolved Solids	mg/l	178	2100	Gravimetric
3.	Total Suspended Solids	mg/l	109	150	Gravimetric
4.	EC	µmohos/cm	328	1200	Multimeter
5.	Dissolved Oxygen	mg/l	6.2	4.5-8.0	Azide Modification
6.	Biological Oxygen Demand at 20 ^{0}C	mg/l	2.37	50	Dilution
7.	Chemical Oxygen Demand	mg/l	21.3	200	COD Refluction

4.3.2. Groundwater Quality

ENVIRONMENTAL ALLIANCE BD LIMITED collected and tested the groundwater. The test report results are attached below.

Table 4.2: Groundwater Test Report

SN	Parameters	Unit	Tested Value	Bangladesh Standard	Method of Analysis
1.	pH	-	7.3	6.5-8.5	pH Meter
2.	Total Dissolved Solids	mg/l	215	1000	Gravimetric
3.	Iron	mg/l	0.79	0.3-1	1,10 Penantholine UV-visible Spectrophotometer
4.	Alkalinity	mg/l	57	NYS	Buret Method 8221
5.	Hardness	mg/l	41	200-500	Complexometric titration by EDTA
6.	Chloride	mg/l	30.4	150-600	Silver Nitrate- Mohr Method
7.	Arsenic	mg/l	0.002	0.05	Silver DDTC UV-visible Spectrophotometer

4.4.Air Quality

Air quality is determined by the concentration of substances in the atmosphere that can adversely affect human health, animal and plant life, and property. Key pollutants include gases such as sulfur dioxide (SO_2), nitrogen oxides (NO_x), carbon monoxide (CO), and carbon dioxide (CO_2), as well as suspended particulate matter (SPM) like smoke, dust, and fumes. Elevated levels of these pollutants can harm the environment and public health.

Environmental Alliance BD Limited inspected and monitored the project's air quality. The Report is attached below,

Table 4.3: Test Result of Ambient Air Quality Analysis

Sampling Location Name	Concentration Present of Different Parameters in Ambient Air (µg/m³)						
	SPM	$PM_{2.5}$	PM_{10}	SO_2	NO_2	CO	O_3
In front of the Project Main Gate	62	22	36	7.3	9.7	0.21	BDL
Units	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
Duration (Hours)	8	24	24	24	24	8	8
Method of Analysis	Gravimetric			West-Gaeke	Jacob and Hochheiser	Electro-chemical Sensor	Spectro-photometric Method
Bangldesh (DoE) Standard for Ambient Air	200	65	150	80	80	5	100
IFC/WB Standard	NF	75 (24H)	150 (24H)	125 (24H)	120 (24H)	7 (24H)	160 (8H)
Remark		**Good**	**Good**	**Good**	**Good**	**Good**	**Good**

4.5.Noise Quality

Environmental Alliance BD Limited inspected and monitored the project's air quality. The Report is attached below,

Table 4.4: Test Result of Ambient Noise Level

Location	Concentration Present (dB)						Category
	Day Time			Night Time			
	L_{eq}	L_{max}	L_{min}	L_{eq}	L_{max}	L_{min}	
Project East Side	39.23	46.1	36.2	33.14	40.2	32.3	Silent
Project West Side	40.85	48.3	32.5	34.21	42.6	32.1	Silent
Project North Side	37.12	45.2	31.9	33.11	39.2	31.2	Silent
Project South Side	38.02	40.1	32.3	32.07	35.4	31.1	Silent

4.6.Climate and Meteorological Condition of the Project Area

In Khulna, the wet season is oppressive and overcast, the dry season is humid and mostly clear, and it is hot year-round. Over the year, the temperature typically varies from 57°F to 94°F and is rarely below 52°F or above 100°F.

Based on the beach/pool score, the best times of year to visit Khulna for hot-weather activities are from late February to early April and from late October to mid-November.

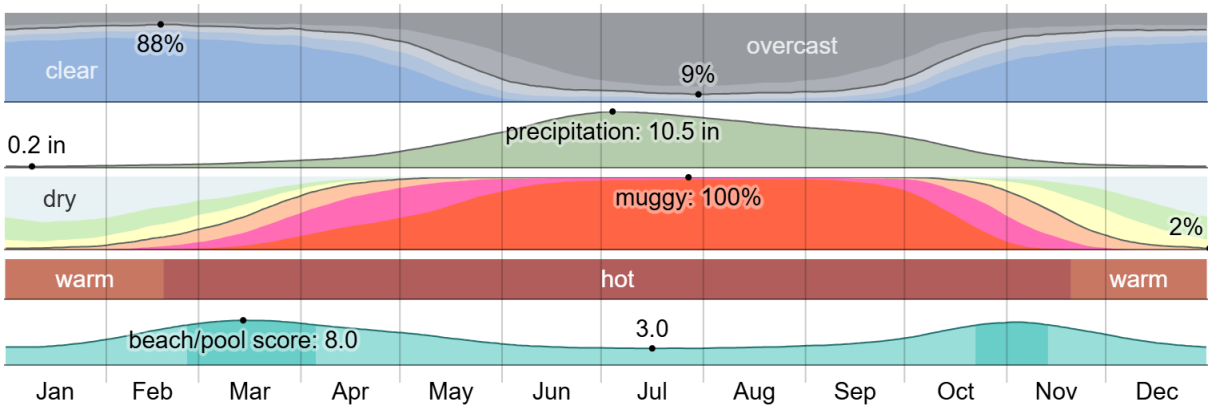


Figure 4.1: Climate graphs of Khulna Division

The hot season lasts for 3.0 months, from March 12 to June 12, with an average daily high temperature above 91°F. The hottest month of the year in Khulna is May, with an average high of 93°F and a low of 79°F. The cool season lasts for 1.5 months, from December 12 to January 30, with an average daily high temperature below 81°F. The coldest month of the year in Khulna is January, with an average low of 57°F and a high of 78°F.

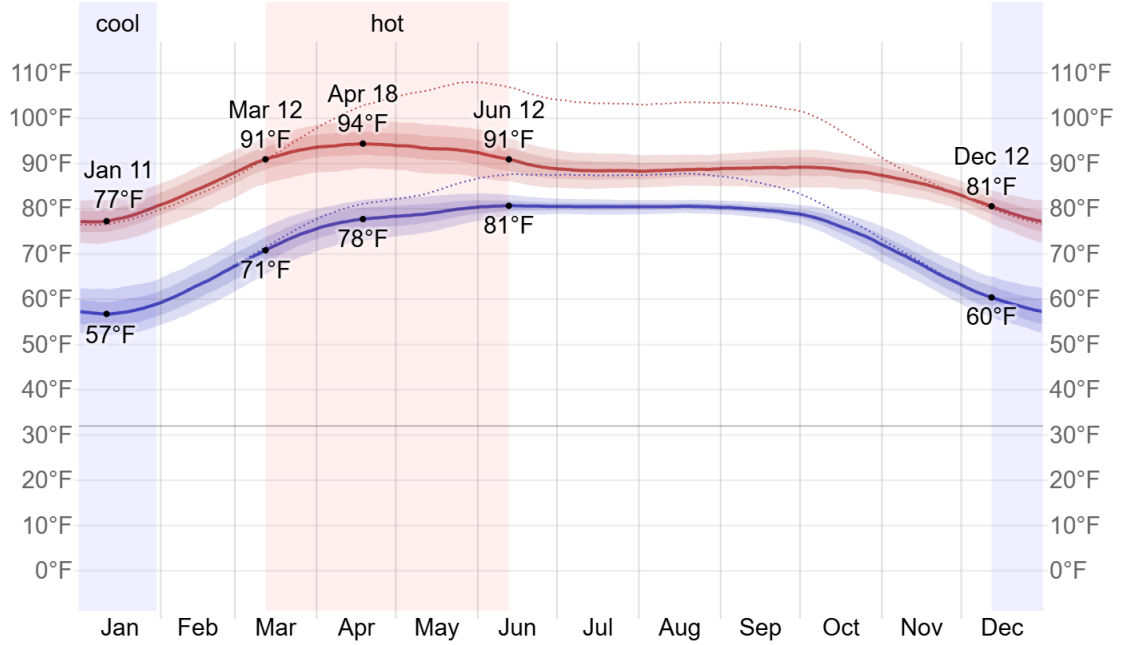


Figure 4.2: Average High and Low Temperature in Khulna

Average	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
High	78°F	84°F	92°F	94°F	93°F	90°F	88°F	89°F	89°F	88°F	85°F	80°F
Temp.	66°F	73°F	81°F	85°F	86°F	85°F	84°F	84°F	84°F	82°F	76°F	68°F
Low	57°F	63°F	72°F	77°F	79°F	81°F	80°F	80°F	80°F	76°F	67°F	60°F

The figure below shows you a compact characterization of the entire year of hourly average temperatures. The horizontal axis is the day of the year, the vertical axis is the hour of the day, and the color is the average temperature for that hour and day.

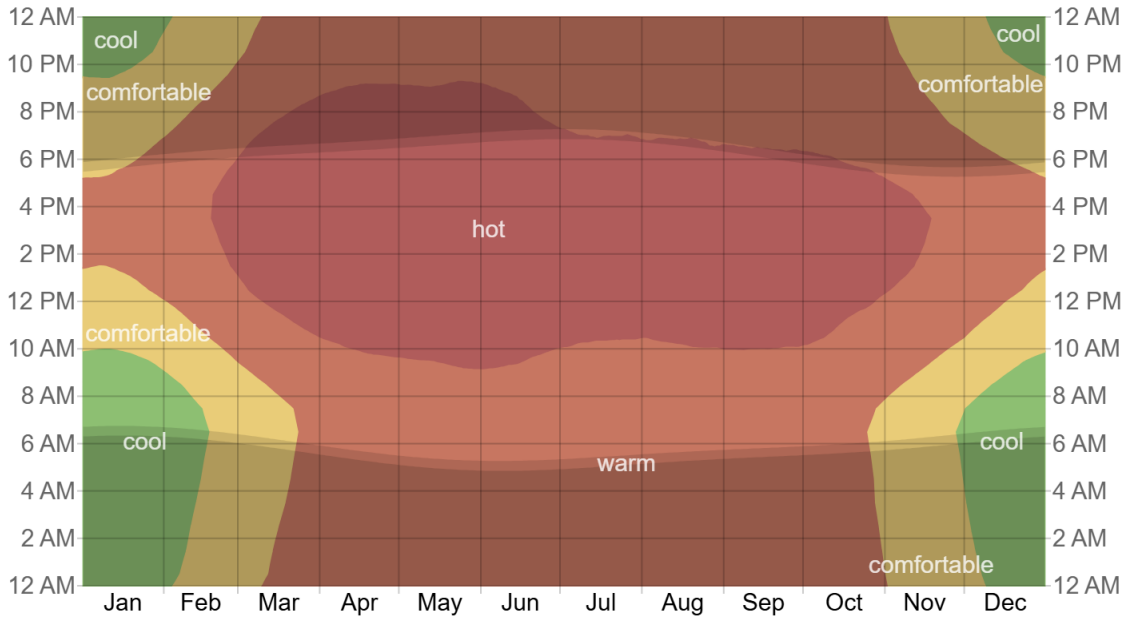


Figure 4.3: Average Hourly Temperature in Khulna

In Khulna, the average percentage of the sky covered by clouds experiences extreme seasonal variation over the year. The clearer part of the year in Khulna begins around October 13 and lasts for 7.1 months, ending around May 16. The clearest month of the year in Khulna is February, during which on average the sky is clear, mostly clear, or partly cloudy 87% of the time. The cloudier part of the year begins around May 16 and lasts for 4.9 months, ending around October 13. The cloudiest month of the year in Khulna is August, during which on average the sky is overcast or mostly cloudy 90% of the time.

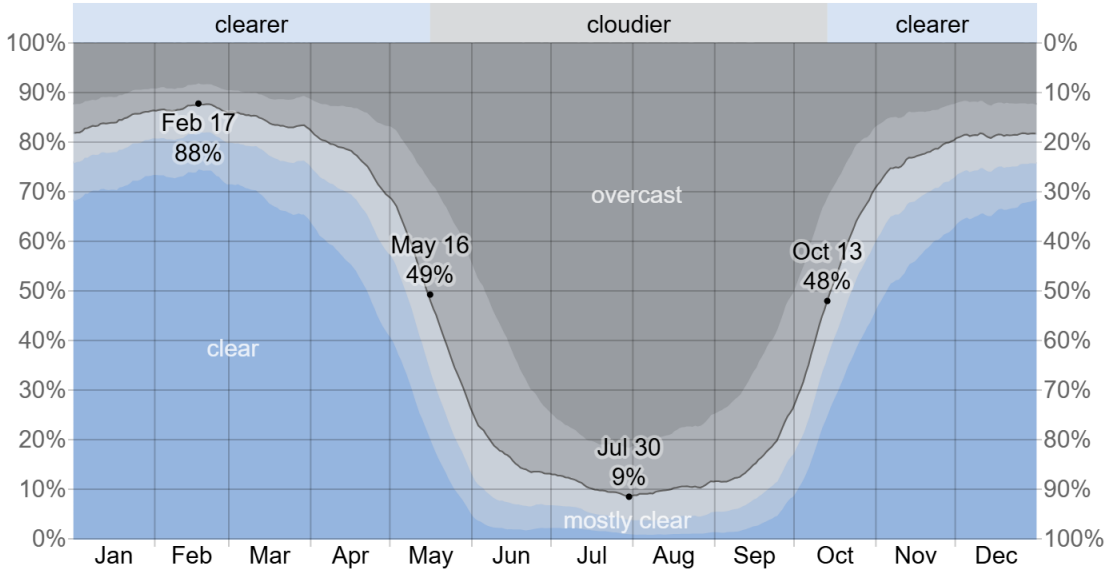


Figure 4.4: Cloud Cover Categories in Khulna

A wet day is one with at least 0.04 inches of liquid or liquid-equivalent precipitation. The chance of wet days in Khulna varies very significantly throughout the year. The wetter season lasts 5.1 months, from May 6 to October 10, with a greater than 38% chance of a given day being a wet day. The month with the most wet days in Khulna is July, with an average of 22.5 days with at least 0.04 inches of precipitation. The drier season lasts 6.9 months, from October 10 to May 6. The month with the fewest wet days in Khulna is December, with an average of 0.9 days with at least 0.04 inches of precipitation. Among wet days, we distinguish between those that experience rain alone, snow alone, or a mixture of the two. The month with the most days of rain alone in Khulna is July, with an average of 22.5 days. Based on this categorization, the most common form of precipitation throughout the year is rain alone, with a peak probability of 74% on July 8. To illustrate the variation in rainfall throughout the year, we present data accumulated over a sliding 31-day period centered on each day of the year.

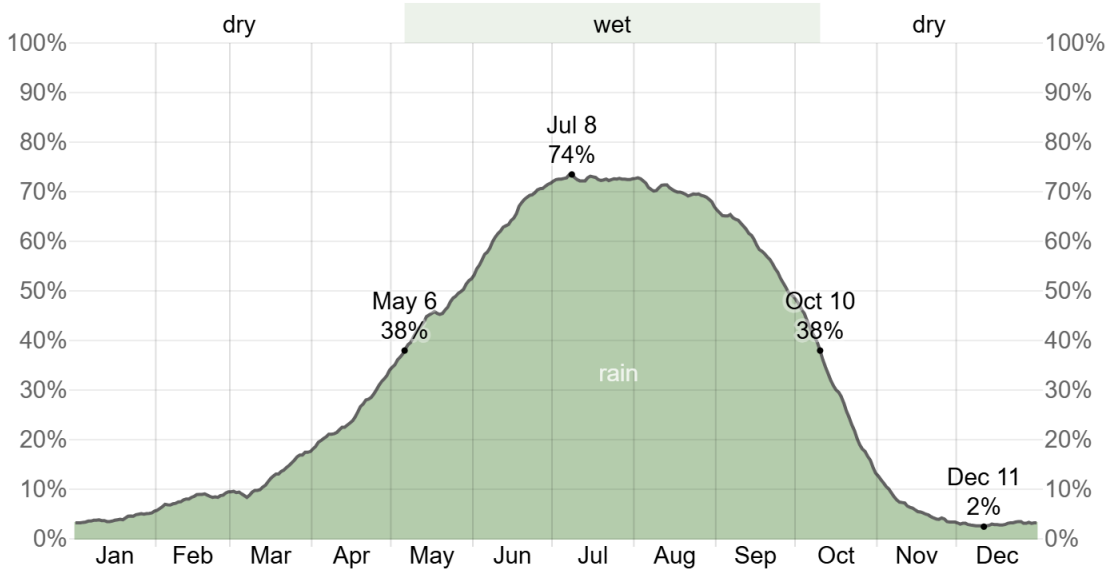


Figure 4.5: Daily Chance of Precipitation in Khulna

To show variation within the months and not just the monthly totals, we show the rainfall accumulated over a sliding 31-day period centered around each day of the year. Khulna experiences extreme seasonal variation in monthly rainfall. The rainy period of the year lasts for 9.6 months, from February 14 to December 1, with a sliding 31-day rainfall of at least 0.5 inches. The month with the most rain in Khulna is July, with an average rainfall of 10.2 inches. The rainless period of the year lasts for 2.4 months, from December 1 to February 14. The month with the least rain in Khulna is January, with an average rainfall of 0.3 inches.

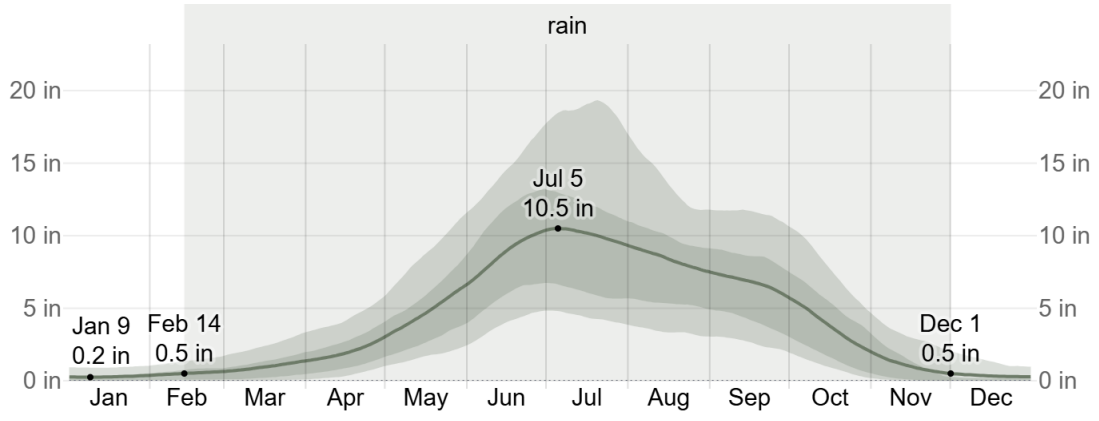


Figure 4.6: Average Monthly Rainfall in Khulna

The length of the day in Khulna varies over the course of the year. In 2025, the shortest day is December 21, with 10 hours, 44 minutes of daylight; the longest day is June 21, with 13 hours, 32 minutes of daylight.

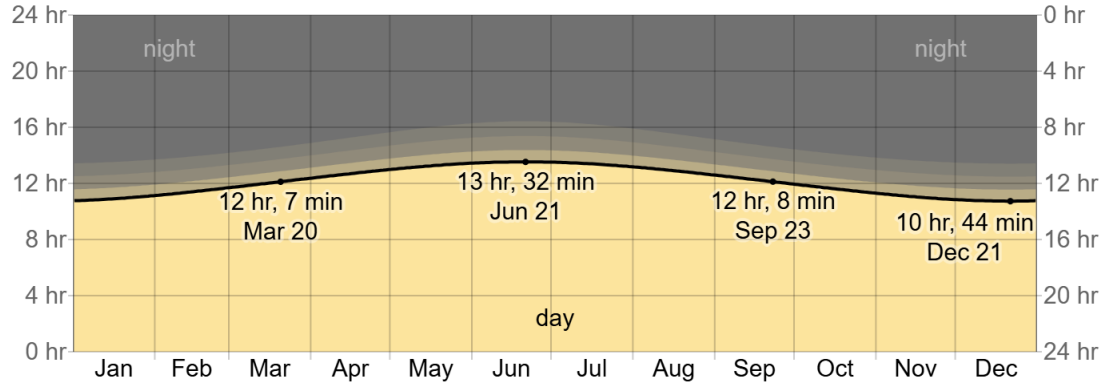


Figure 4.7: Hours of Daylight and Twilight in Khulna

The earliest sunrise is at 5:15 AM on June 8, and the latest sunrise is 1 hour, 29 minutes later at 6:44 AM on January 14. The earliest sunset is at 5:15 PM on November 28, and the latest sunset is 1 hour, 35 minutes later at 6:51 PM on July 3. Daylight saving time (DST) is not observed in Khulna during 2025.

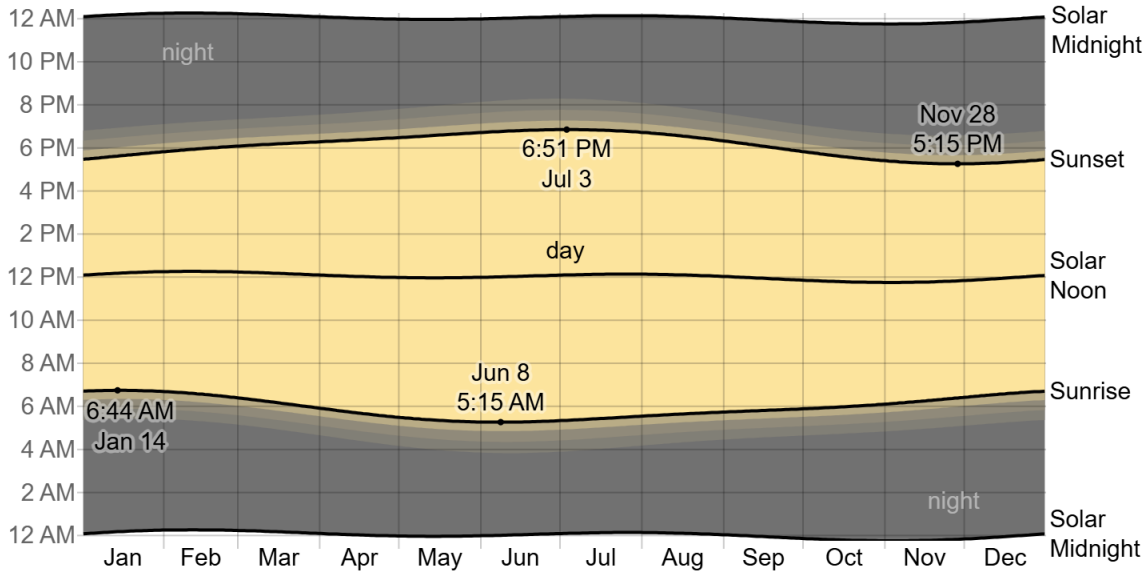


Figure 4.8: Sunrise and Sunset with Twilight in Khulna

The figure below presents a compact representation of the sun's elevation (the angle of the sun above the horizon) and azimuth (its compass bearing) for every hour of every day in the reporting period. The horizontal axis is the day of the year and the vertical axis is the hour of the day. For a given day and hour of that day, the background color indicates the azimuth of the sun at that moment. The black isolines are contours of constant solar elevation.

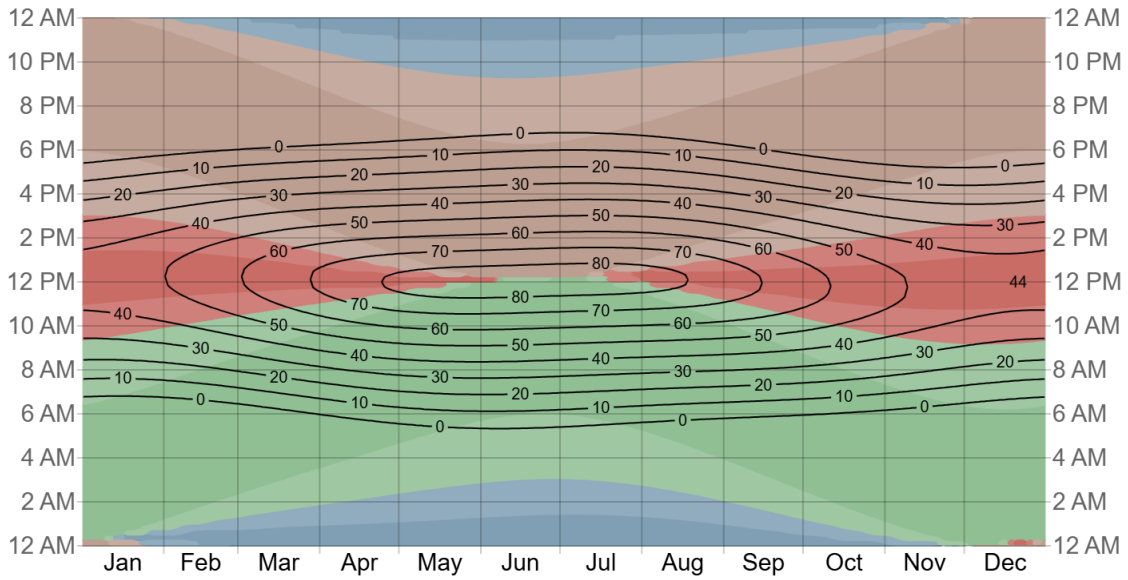


Figure 4.9: Solar Elevation and Azimuth in Khulna

We base the humidity comfort level on the dew point, as it determines whether perspiration will evaporate from the skin, thereby cooling the body. Lower dew points feel drier and higher dew points feel more humid. Unlike temperature, which typically varies significantly between night and day, dew point tends to change more slowly, so while the temperature may drop at night, a muggy day is typically followed by a muggy night. Khulna experiences extreme seasonal variation in the perceived humidity. The muggier period of the year lasts for 9.0 months, from February 27 to November 26, during which time the comfort level is muggy, oppressive, or miserable at least 26% of the time. The month with the fewest muggy days in Khulna is January, with 0.9 days that are muggy or worse.

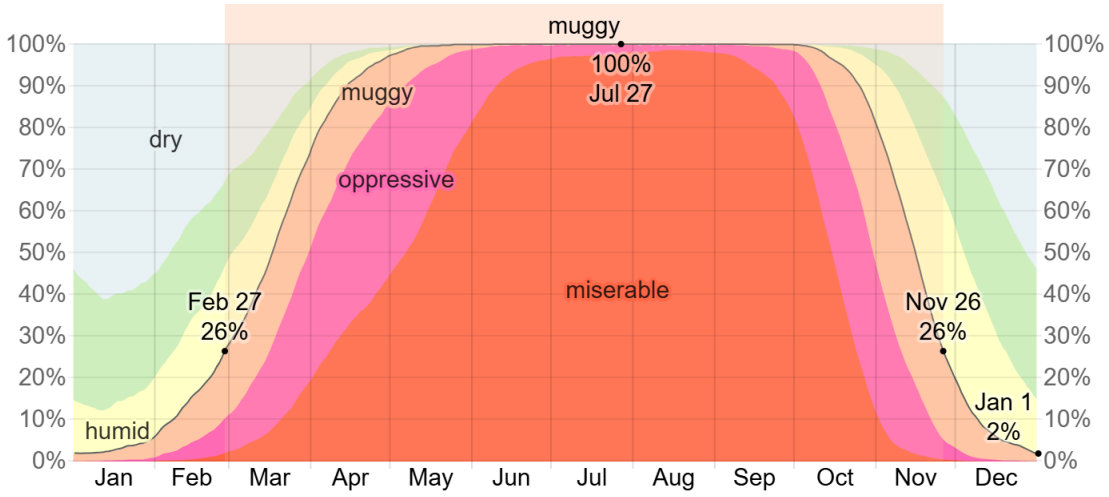


Figure 4.10: Humidity Comfort Levels in Khulna

This section discusses the wide-area hourly average wind vector (speed and direction) at 10 meters above the ground. The wind experienced at any given location is highly dependent on

local topography and other factors, and instantaneous wind speed and direction vary more widely than hourly averages. The average hourly wind speed in Khulna experiences significant seasonal variation over the year. The windier part of the year lasts for 5.3 months, from March 25 to September 3, with average wind speeds of more than 6.9 miles per hour. The windiest month of the year in Khulna is June, with an average hourly wind speed of 8.9 miles per hour. The calmer time of year lasts for 6.7 months, from September 3 to March 25. The calmest month of the year in Khulna is October, with an average hourly wind speed of 4.7 miles per hour.

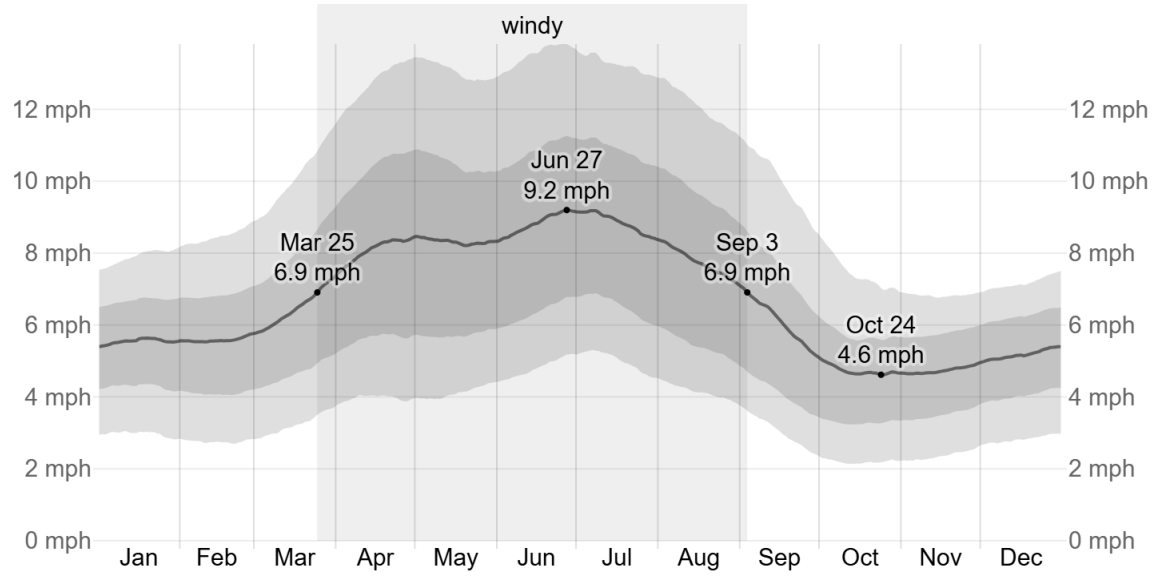


Figure 4.11: Average Wind Speed in Khulna

The predominant average hourly wind direction in Khulna varies throughout the year. The wind is most often from the west for 1.0 months, from February 19 to March 20, with a peak percentage of 48% on March 11. The wind is most often from the south for 6.7 months, from March 20 to October 11, with a peak percentage of 87% on May 25. The wind is most often from the north for 4.3 months, from October 11 to February 19, with a peak percentage of 75% on January 1.

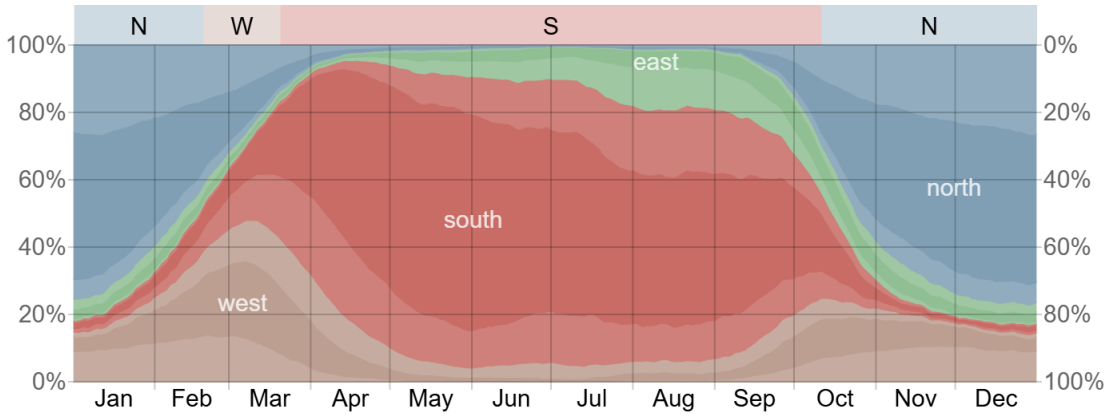


Figure 4.12: Wind Direction in Khulna

Khulna is located near a large body of water (e.g., ocean, sea, or large lake). This section reports on the wide-area average surface temperature of that water. The average water temperature experiences some seasonal variation over the course of the year. The time of year with warmer water lasts for 6.4 months, from April 22 to November 4, with an average temperature above 81°F. The month of the year in Khulna with the warmest water is June, with an average temperature of 84°F. The time of year with cooler water lasts for 2.0 months, from December 20 to February 22, with an average temperature below 73°F. The month of the year in Khulna with the coolest water is January, with an average temperature of 71°F.

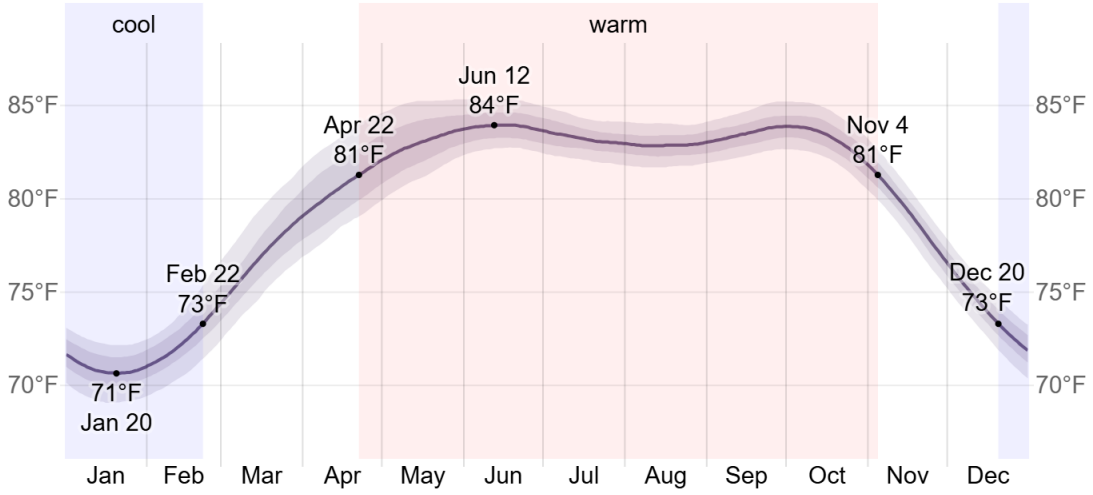


Figure 4.13: Average Water Temperature in Khulna

For each hour between 8:00 AM and 9:00 PM of each day in the analysis period (1980 to 2016), independent scores are computed for perceived temperature, cloud cover, and total precipitation. Those scores are combined into a single hourly composite score, which is then aggregated into days, averaged over all the years in the analysis period, and smoothed. Our cloud cover score is 10 for fully clear skies, falling linearly to 9 for mostly clear skies, and to

1 for fully overcast skies. Our precipitation score, which is based on the three-hour precipitation centered on the hour in question, is 10 for no precipitation, falling linearly to 9 for trace precipitation, and to 0 for 0.04 inches of precipitation or more. Our tourism temperature score is 0 for perceived temperatures below 50°F, rising linearly to 9 for 65°F, to 10 for 75°F, falling linearly to 9 for 80°F, and to 1 for 90°F or hotter. Our beach/pool temperature score is 0 for perceived temperatures below 65°F, rising linearly to 9 for 75°F, to 10 for 82°F, falling linearly to 9 for 90°F, and to 1 for 100°F or hotter.

Definitions of the growing season vary throughout the world, but for the purposes of this report, we define it as the longest continuous period of non-freezing temperatures (≥ 32°F) in the year (the calendar year in the Northern Hemisphere, or from July 1 until June 30 in the Southern Hemisphere). Temperatures in Khulna are sufficiently warm year round that it is not entirely meaningful to discuss the growing season in these terms. We nevertheless include the chart below as an illustration of the distribution of temperatures experienced throughout the year.

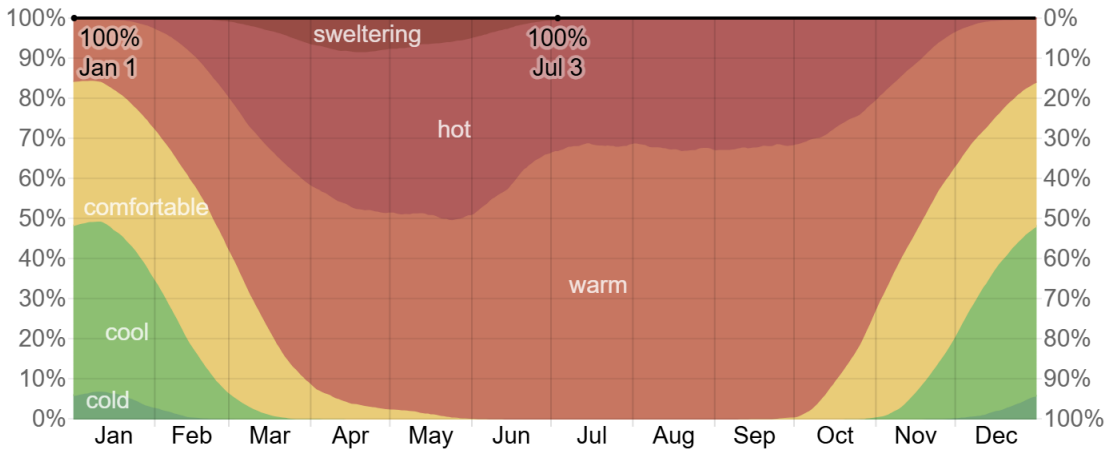


Figure 4.14: Time Spent in Various Temperature Bands and the Growing Season in Khulna

Growing degree days are a measure of yearly heat accumulation used to predict plant and animal development, and defined as the integral of warmth above a base temperature, discarding any excess above a maximum temperature. In this report, we use a base of 50°F and a cap of 86°F.

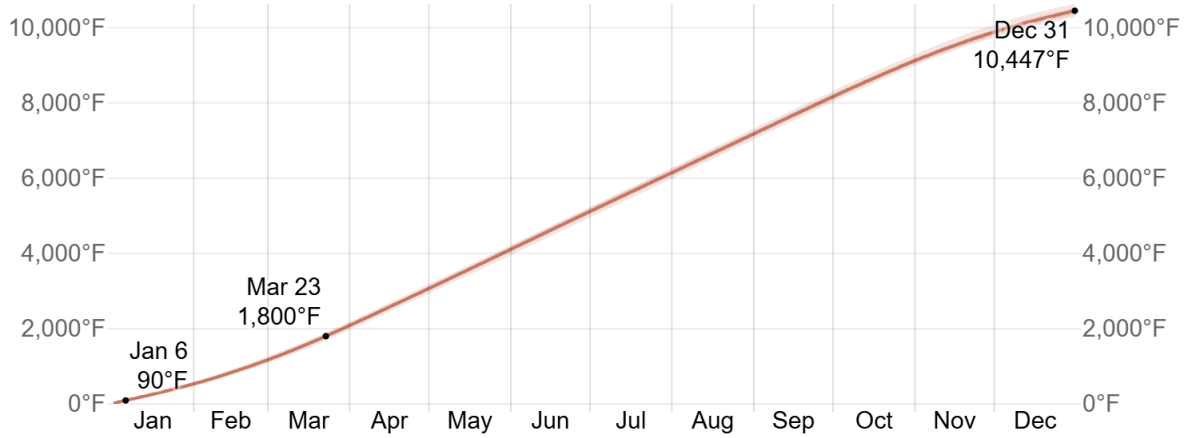


Figure 4.15: Growing Degree Days in Khulna

The topography within 2 miles of Khulna is essentially flat, with a maximum elevation change of 52 feet and an average elevation above sea level of 20 feet. Within 10 miles is essentially flat (108 feet). Within 50 miles also contains only modest variations in elevation (167 feet). The area within 2 miles of Khulna is covered by grassland (34%), cropland (34%), water (21%), and artificial surfaces (11%), within 10 miles by grassland (44%) and cropland (42%), and within 50 miles by cropland (42%) and grassland (38%).

4.7.Archeological Heritage

There are no historical sites or structures of archaeological, paleontological, or architectural significance near the project or factory areas.

4.8.Life Pattern

The life pattern in the vicinity of the project site and factory area is generally positive, as the region is experiencing gradual development and increased job opportunities for the local population.

4.9.Settlement and Housing

Currently, there are limited settlements and housing in the project area. As the project progresses, the influx of workers from various sectors will necessitate additional housing, leading to the rapid development of settlements around the project site. This will also result in increased socio-economic activities due to the influx of capital and the economic contributions of the newly settled workforce. Consequently, the demand for infrastructure and services, such as water supply, garbage collection, sanitation, electricity, roads, and drainage, will rise. To meet these needs, the relevant local authorities, in collaboration with the project proponents,

will work to enhance and expand service facilities in the area. Therefore, the project does not require the evacuation of existing settlements or housing in the project vicinity.

4.10. Traffic and Transport

The project is strategically located adjacent to a well-maintained road network and is connected to the Dhaka-Jessore-Khulna Road. Existing traffic and transport facilities are adequate to support the project's operations. However, establishing this factory is expected to increase traffic and transport activities in the area, likely leading to a rise in socio-economic activities around the project site.

4.11. Terrestrial and Aquatic Flora and Fauna

Khulna's climate and location favor the growth and development of various tree species. Despite being a bustling city, Khulna district retains significant vegetation and diverse ecosystems, intersected by several rivers. The area boasts a rich array of flora and fauna, contributing to terrestrial and aquatic ecosystems. Key ecological features include the five major rivers (Rupsa-Pasur, Bhairab, Shibsha, Dharla, Bhadra, Ball, and Kobadak), natural and social forestry initiatives, gardens, and institutions, all contributing to the ecological balance.

However, increasing industrialization and urban development pose significant threats to these ecosystems. Ecosystems provide essential goods and services crucial for human well-being and must be managed with care (Graham, 2004). In the past, many areas in Khulna served as sanctuaries for avifauna, wildlife, and fisheries, contributing to rich faunal biodiversity and a well-functioning ecosystem. However, extensive land, including low-lying areas and wetlands, is being encroached upon for residential and industrial development. This trend is driven by Khulna's attractive living conditions and excellent connectivity to the rest of the city (Hossain et al., 2008).

4.11.1. Flora

The Khulna District, located in the southwestern part of Bangladesh, is home to a diverse range of flora due to its proximity to the Sundarbans, the world’s largest mangrove forest. The district's vegetation is influenced by its tropical climate, coastal environment, and riverine ecosystems, supporting a mix of mangroves, freshwater wetland plants, and terrestrial vegetation.

1. Mangrove Vegetation

Khulna is renowned for its extensive mangrove forests, particularly in the Sundarbans region. The dominant mangrove species include:

- **Sundari (Heritiera fomes):** The most prevalent tree in the Sundarbans, valued for its timber.
- **Gewa (Excoecaria agallocha):** A salt-tolerant species, often found in degraded mangrove areas.
- **Goran (Ceriops decandra):** Common in tidal areas, forming dense thickets.
- **Keora (Sonneratia apetala):** Important for coastal stabilization and habitat for wildlife.
- **Golpata (Nypa fruticans):** A palm species used for thatching and handicrafts.

2. Freshwater Wetland Plants

The numerous rivers, canals, and wetlands of Khulna support a rich aquatic and semi-aquatic flora, including:

- **Shapla (Nymphaea nouchali):** The national flower of Bangladesh, commonly found in freshwater bodies.
- **Kachuripana (Eichhornia crassipes):** A floating aquatic plant, often considered invasive.
- **Hogla (Typha angustifolia):** Used for making mats and thatching.
- **Pani Kata (Polygonum spp.):** Grows along riverbanks and wetland edges.

3. Terrestrial and Agricultural Plants

Beyond the mangrove and wetland ecosystems, Khulna supports a variety of terrestrial plants, including:

- **Mahogany (Swietenia mahagoni) and Rain Tree (Albizia saman):** Commonly planted for timber and shade.
- **Bamboo (Bambusa spp.):** Widely used for construction and crafts.
- **Coconut (Cocos nucifera) and Date Palm (Phoenix sylvestris):** Important for livelihoods in rural areas.
- **Paddy (Oryza sativa):** The dominant crop in agricultural lands.
- **Jute (Corchorus capsularis):** A significant cash crop in the region.

Khulna's flora plays a crucial role in the region’s ecosystem, supporting biodiversity, preventing coastal erosion, and sustaining local livelihoods. However, threats such as deforestation, salinity intrusion, and climate change pose challenges to its preservation.

Conservation efforts, particularly in the Sundarbans, are essential to maintain this rich biodiversity. A detailed list of common tree species in the area is provided below.

Table 4.5: Common Trees in the Project Area

Local Name	English Name	Scientific Name	Family
Lichu	Litchi	*Litchi chinensis Sonn.*	Sapindaceae
Am	Mango	*Mangifera indica L.*	Anacardiaceae
Kathal	Jackfruit	*Artocarpus heterophyllus Lamk.*	Moraceae
Pepe	Papaya	*Carica papaya L.*	Caricaceae
Golap	Rose	*Rosa centifolia L.*	Rosaceae
Beli	Arabian Jasmine	*Jasminum sambac Ait.*	Oleaceae
Narikel	Coconut	*Cocos nucifera L.*	Arecaceae
Chameli	Jasmine	*Jasminum grandiflorum L.*	Oleaceae
Patabahar	Croton	*Codiaeum variegatum*	Euphorbiaceae
Peyara	Guava	*Psidium guajava L.*	Myrtaceae
Kola	Banana	*Musa paradisiaca*	Musaceae
Rangan	Jungle Geranium	*Ixora rosea Will.*	Rubiaceae
Gashpul	Rain Lily	*Zephyranthes tubispatha Herb.*	Amaryllidaceae
Sajina	Drumstick Tree	*Moringa oleifera Lamk.*	Moringaceae
Supari	Betel Nut	*Areca catechu L.*	Arecaceae
Jam	Black Plum	*Syzygium cumini Skeels.*	Myrtaceae
Shimul	Silk Cotton Tree	*Bombax ceiba L.*	Malvaceae
Kamranga	Starfruit	*Averrhoa carambola*	Oxalidaceae
Sofeda	Sapodilla	*Manilkara zapota*	Sapotaceae
Kadbel	Wood Apple	*Feronia limonia (L.)*	Rutaceae
Bel	Bael	*Aegle marmelos (L.)*	Rutaceae
Tal	Palmyra Palm	*Borassus flabellifer L.*	Arecaceae
Krishnachura	Flame Tree	*Delonix regia (Boj.) Raf.*	Fabaceae
Bot	Banyan Tree	*Ficus benghalensis L.*	Moraceae
Pakur	White Fig	*Ficus infectoria*	Moraceae
Madar	Coral Tree	*Erythrina variegata L.*	Fabaceae
Jaba	Hibiscus	*Hibiscus rosa-sinensis L.*	Malvaceae
Man Kochu	Giant Taro	*Alocasia indica*	Araceae
Kachu	Taro	*Colocasia esculenta (L.)*	Araceae
Jambura	Pomelo	*Citrus grandis*	Rutaceae
Dumur	Cluster Fig	*Ficus hispida*	Moraceae
Koroi	Indian Coral Tree	*Derris robusta Benth.*	Fabaceae
Lebu	Lemon	*Citrus aurantifolia*	Rutaceae
Mehogini	Mahogany	*Swietenia mahagoni*	Meliaceae
Kowa Nim	Chinaberry	*Melia sempervirens*	Meliaceae

Local Name	English Name	Scientific Name	Family
Pui Shak	Malabar Spinach	*Basella alba L.*	Basellaceae
Rain Tree	Rain Tree	*Samanea saman*	Fabaceae
Dol Kolmi	Water Spinach	*Ipomoea fistulosa*	Convolvulaceae
Bansh Pata	Fern Pine	*Podocarpus neriifolius*	Podocarpaceae
Mankata	Spine Apple	*Xeromphis spinosa*	Rubiaceae
Babla	Babul Acacia	*Acacia nilotica*	Fabaceae
Ulatkambal	Devil's Cotton	*Abroma augusta*	Malvaceae
Basak	Malabar Nut	*Adhatoda zeylanica*	Acanthaceae
Muktajhuri	Indian Hemp	*Abroma augusta*	Malvaceae
Rashun	Garlic	*Allium sativum*	Amaryllidaceae
Shatamuli	Shatavari	*Asparagus racemosus*	Asparagaceae
Neem	Neem Tree	*Azadirachta indica*	Meliaceae
Nayantara	Madagascar Periwinkle	*Catharanthus roseus*	Apocynaceae
Thankuni	Indian Pennywort	*Centella asiatica*	Apiaceae
Kalo Dhutra	Thorn Apple	*Datura metel*	Solanaceae
Mehedi	Henna	*Lawsonia inermis*	Lythraceae
Ashoke	Ashoka Tree	*Saraca asoca*	Fabaceae
Arjun	Arjuna Tree	*Terminalia arjuna*	Combretaceae
Methi	Fenugreek	*Trigonella foenum-graecum*	Fabaceae
Ashwagondha	Indian Ginseng	*Withania somnifera*	Solanaceae
Ada	Ginger	*Zingiber officinale*	Zingiberaceae

4.11.2. Fauna

A study conducted on the faunal diversity of Khulna District documented a wide range of species, including 35 species of birds, 20 species of migratory birds, 9 species of reptiles, 4 species of amphibians, 18 species of mammals, and 40 species of fish. The relative abundance of these species was assessed, revealing that the Common Myna (*Acridotheres tristis*) was the most abundant among the bird species, while the Black Baza (*Aviceda leuphotes*), Masked Finfoot (*Heliopais personata*), White-rumped Vulture (*Gyps bengalensis*), Pallas's Fish Eagle (*Haliaeetus leucoryphus*), and Indian Skimmer (*Rynchops albicollis*) were classified as rare. The relative abundance of migratory birds could not be determined due to their seasonal movement.

Among the reptiles, the Bengal Monitor (*Varanus bengalensis*) and Common Krait (*Bungarus caeruleus*) were observed to be common, whereas the Indian Flapshell Turtle (*Lissemys*

punctata) and Yellow Monitor (*Varanus flavescens*) were recorded as endangered. For amphibians, the Indian Bullfrog (*Hoplobatrachus tigerinus*) was found to be abundant, while the Ganges Frog (*Euphlyctis cyanophlyctis*) was rare. In the mammalian category, the Indian Pipistrelle (*Pipistrellus coromandra*) and Small Indian Mongoose (*Herpestes auropunctatus*) were abundant, while the Fishing Cat (*Prionailurus viverrinus*), Smooth-coated Otter (*Lutrogale perspicillata*), and Ganges River Dolphin (*Platanista gangetica*) were noted as rare.

Regarding fish species, Rohu (*Labeo rohita*), Catla (*Catla catla*), and Hilsa (*Tenualosa ilisha*) were abundant. In contrast, species such as Gangetic Ailia (*Ailia coila*), Climbing Perch (*Anabas testudineus*), and Bagrid Catfish (*Bagridae spp.*) were rare. The study identified several major threats to the faunal diversity of the Khulna District, including habitat destruction due to shrimp farming, salinity intrusion, deforestation, poaching, industrial pollution, and overfishing using harmful nets.

Terrestrial Fauna

A survey within a 1 km radius of the project site identified a total of 46 species of terrestrial animals, including 10 species of mammals, 31 species of birds, 2 species of reptiles, and 36 species of amphibians. Among these, the 2007 IUCN Red List classified two mammalian species and two bird species under the *Least Concern (LC)* category.

Mammals:

- **Jungle Cat** (*Felis chaus kutas*) – LC
- **Fishing Cat** (*Felis viverrinus*)
- **Cat** (*Felis catus*)
- **Dog** (*Canis familiaris*)
- **Fox** (*Vulpes vulpes*) – LC
- **Goat** (*Capra hircus*)
- **Sheep** (*Ovis aries*)
- **Cow** (*Bos taurus*)
- **Squirrel** (*Sciurus spp.*)
- **Rabbit** (*Leporidae cuniculas*)

Birds:

- **House Sparrow** (*Passer domesticus*)

- **House Crow** (*Corvus splendens*)
- **Indian Myna** (*Acridotheres tristis*)
- **Oriental Magpie Robin** (*Copsychus saularis*)
- **Rock Pigeon** (*Columba livia domestica*) – LC
- **Pariah Kite** (*Milvus migrans*) – LC
- **Black Drongo** (*Dicrurus macrocercus*)
- **Intermediate Egret** (*Mesophoyx intermedia*)
- **White-throated Kingfisher** (*Halcyon smyrnensis*)
- **Common Tailorbird** (*Orthotomus sutorius*)
- **Woodpecker** (*Picoides pubescens*)
- **Hoopoe** (*Upupa epops*)
- **Spotted Dove** (*Streptopelia chinensis*)
- **Pond Heron** (*Ardeola grayii*)
- **Green Bee-eater** (*Merops orientalis*)
- **Asian Openbill Stork** (*Anastomus oscitans*)
- **Red-whiskered Bulbul** (*Pycnonotus jocosus*)
- **Asian Koel** (*Eudynamys scolopacea*)
- **Goose** (*Anser spp.*)
- **Domestic Duck** (*Anatidae spp.*)
- **Owl** (*Strigiformes spp.*)

Reptiles:

- **Common Lizard** (*Lacertidae spp.*)
- **Bezi Snake** (*Unknown species*)

Amphibians:

- **Canyon Treefrog** (*Hyla arenicolor*)
- **Scorpion** (*Scorpionidae spp.*)
- **Common Frog** (*Ranidae spp.*)

4.12. Socio-Economic Status

The area surrounding Gutudia hosts diverse socio-economic activities, with residents engaged in agriculture, trade, small-scale industries, transportation, and other commercial sectors. The population comprises individuals from various cultural and religious backgrounds, coexisting harmoniously. The establishment of industries and infrastructure projects in the region is expected to stimulate economic activities, create business opportunities, and provide employment for both skilled and unskilled workers.

The primary sources of income in Gutudia include agriculture (55.23%), business (16.75%), non-agricultural labor (5.62%), transport and communication (4.18%), employment in government and private sectors (10.21%), remittances (3.79%), and other economic activities (4.22%) (Bangladesh Bureau of Statistics, 2022). The presence of industrial projects in the area has contributed to economic growth, improving livelihoods and increasing access to essential services.

Employment opportunities generated by industrial and commercial establishments benefit local residents directly and indirectly. Local businesses, transportation services, and other support sectors experience growth as a result of industrial development. Additionally, improved infrastructure and economic activities reduce the need for long-distance commutes to major urban centers like Khulna City for employment and essential services.

The region's socio-economic growth has been achieved while maintaining environmental integrity. The land in and around Gutudia does not contain extensive wetlands, and no significant displacement of communities has occurred due to industrialization. Sustainable development efforts ensure that economic progress aligns with environmental conservation, contributing to the long-term well-being of the local population.

Chapter Five: Identification and Mitigation of Potential Impacts

5.1. General Consideration

In the case of most industrial or development projects, potential negative impacts are far more numerous than beneficial. Chapter three of this report identifies several project activities during the operation of GSM Industries Ltd. (GSMIL) or construction at the project site. This chapter identifies potential positive and negative impacts that may be generated from those project activities, which is the first step in forming this EIA report. Though regional and national economic benefits associated with implementing any development project fall outside the scope of an EIA, they are also considered here. It is recognized that the long-term benefits will ultimately improve the quality of life in the project area.

5.2. Impacts Identification and Mitigation Measures

Identification of potential impacts due to the plant location and operation has been done using Checklist. Checklists are comprehensive lists of environmental effects and impact indicators designed to stimulate the analysis to think broadly about possible consequences of contemplated actions *(Munn, 1979)*. To prepare the checklist and further analyze the associated environmental impacts of the project, a multi-disciplinary team from the consultant's side visited the existing project site. It closely identified the project activities and significant environmental components that may be affected by the project. The project officials were interviewed during each visit to assess their understanding of the project activities, the interrelation of the project activities, and significant environmental impacts. The visitors to the project site were also randomly interviewed to assess their knowledge about the general responsibilities of conserving the overall environment of this recreational spot. These were done mainly to identify the significant environmental components of the project and, at the same time, stimulate thinking about the environmental conservation of all the groups associated with the project. This process identifies the water quality of the project and its surroundings as the most significant environmental components. Overall project environment, erosion, sewage and stormwater management, solid waste management, sound and air quality management, maintenance practices, and overall environmental management systems are the major environmental issues identified from the consultant's side.

However, as the project is new, the environmental management of the operation and construction phases of the facilities has been emphasized to develop the EIA. An outline of

management issues in case of any future construction and development has also been included in the management plan so that the GSM Industries Ltd. authority can take proactive approaches to minimize environmental and socio-economic impacts to the lowest possible extent. Table -5.1 represents the checklists developed for GSM Industries Ltd. This checklist shows major activities that create the Significant Environmental Impacts (SEIs). The terms none, minor, moderate primary, short-termed, and long-termed are used in checklists to classify the magnitude and duration of probable SEI.

5.2.1. Environmental Aspects Process Model

a. **Identification of Environmental Aspects:** Organizations identify and list the various activities, products, or services that interact with the environment. These are known as environmental aspects.
b. **Evaluation of Environmental Impacts:** Organizations assess the potential environmental impacts for each identified aspect. These impacts can affect air, water, soil, biodiversity, energy consumption, etc.
c. **Significance Determination:** The significance of each impact is determined based on criteria such as regulatory requirements, potential harm, frequency, and reversibility.
d. **Legal and Other Requirements:** Organizations identify applicable legal requirements and other obligations related to significant environmental aspects.
e. **Objectives and Targets:** Environmental objectives and targets are established to address the significant aspects and comply with legal requirements. These objectives are specific, measurable, achievable, relevant, and time-bound (SMART).
f. **Operational Controls:** Procedures and controls are implemented to ensure that operations are conducted in line with environmental objectives and legal requirements.
g. **Monitoring and Measurement:** Monitoring processes are established to track environmental performance and ensure compliance. This may involve regular inspections, sampling, and data analysis.
h. **Review and Continuous Improvement:** Periodic reviews are conducted to assess the effectiveness of the EMS. The findings are used to improve, update objectives, and enhance environmental performance continually.

Table 5.1 Checklist for identification of probable Environmental Impact of GSM Industries Ltd. (Project Location).

Project Phase	Action Affecting Environmental Resources and Values		SEIs without Mitigation Measures				Impact Type				Duration	
			None	Minor	Moderate	Major	Adverse	Beneficial	Reversible	Irreversible	Short Term	Long Term
Factory Location	a	Loss of and displacement from homestead land	√									
	b	Overland Drainage and Impact on Surface Water		√			√			√		√
	c	Change in Landscape		√			√			√		√
	d	Loss of and displacement from agricultural land and house	√									
	e	Disruption of Earth's Surface		√			√			√		√
	f	Inadequacy of Buffer Zone		√			√		√			√

Table 5.2 Checklist for identification of probable Environmental Impact of GSM Industries Ltd. (Project Location).

Project Phase	Action Affecting Environmental Resources and Values		SEIs without Mitigation Measures				Impact Type				Duration	
			None	Minor	Moderate	Major	Adverse	Beneficial	Reversible	Irreversible	Short Term	Long Term
Construction	a	Air pollution		√			√			√	√	
	b	Noise Pollution and vibration affect.		√			√			√	√	
	c	Spreading diseases		√			√			√		√
	d	Accidents		√			√			√		√

Table 5.3 Checklist for identification of probable Environmental Impact of GSM Industries Ltd. (Operation of the Factory).

Project Phase	Action Affecting Environmental Resources and Values		Effect on Environment and Economy	SEIs without Mitigation Measures				Impact Type				Duration	
				None	Minor	Moderate	Major	Adverse	Beneficial	Reversible	Irreversible	Short Term	Long Term
Factory Operation	Operation of GSM Industries Ltd.												
	a	Noise Pollution	Noise Generated from Electromechanical machinery and transports			√		√		√			√

Project Phase	Action Affecting Environmental Resources and Values		Effect on Environment and Economy	SEIs without Mitigation Measures				Impact Type				Duration	
				None	Minor	Moderate	Major	Adverse	Beneficial	Reversible	Irreversible	Short Term	Long Term
	b	Water Pollution	Untreated liquid wastewater discharge can pollute the environment.				√	√			√		√
	c	Air pollution from the generator and factory production			√			√			√	√	
	d	Solid Wastes from daily activities as well as from routine maintenance work				√		√			√		√
	e	Accidental and Natural Hazard				√		√			√		√
	f	Employment- Recruitment of new staffs and operators					√		√				√

The checklist identifies the Impacts likely to occur in the different phases of the project. The following sections evaluate these impacts, mentioning their origin and characteristics, actual site condition implemented mitigation measures, and possible enhancement of mitigation/enhancing measures. At the end of each sub-section, the status of residual impact will also be mentioned.

5.3. Evaluation of Predicated Adverse Impacts and Mitigation

Unjustified and unplanned operations of any project can significantly impact the quality of life and the surrounding environment. Such operations may lead to increased air, noise, and water pollution, the generation of hazardous waste, and pollution from spillage or surface runoff. Additionally, they can disrupt local flora and fauna, resulting in the loss of trees due to increased access, elevate land values, and threaten agricultural activities. These environmental disturbances can have far-reaching consequences, affecting the natural ecosystem and the health and well-being of human populations.

5.4. Impacts on Topography

5.4.1. Disruption of Earth Surface

6.4.1.1. Impact Origin

As mentioned earlier, a part of the landfilling and cutting would be required to develop the site to protect against floods and create an underground basement. This landfilling and cutting will not disrupt the earth's natural surface or obstruct the area's drainage system.

6.4.1.2. Mitigation Measure

According to the plan, GSM Industries Ltd. will not create any water logging and drainage problems as the authority collects the soil to develop the area by carrying sand to and from different places. Cross-drainage works should be constructed to bypass the surface water and other discharges.

6.4.1.3. Residual Impact

If the mitigation measures above are implemented, the residual impact will be very insignificant.

5.4.2. Change in Landscape

6.4.2.1. Impact Origin

A landscape is a subjective concept that cannot be precisely quantified. However, in general, any project that is not designed to consider the local landscape creates visual intrusion for the people. The project may change the local landscape to some extent.

6.4.2.2. Mitigation Measure

Any part of the project should be designed to consider key landscape criteria like coherence, readability, hierarchy, and stability. It is understood that the project will have a modern

architectural view, which does not provide any significant visual intrusion. One simple way the altered green area can be turned into its original visual quality is to plant trees around the project area.

6.4.2.3. Residual Impact

Provided the mitigation measures above are fully implemented, the residual impact will be very insignificant.

5.5. Impact on Climate

5.5.1. Impact Origin

The potential climate impact associated with the operations of GSM Industries Ltd. Factory can be attributed to several key sources:

- **Greenhouse Gas Emissions:** The factory's operations generate greenhouse gas emissions, contributing to the overall carbon footprint.
- **Combustion of Fossil Fuels:** Using natural gas and other fossil fuels for heating, electricity, and backup power supply systems contributes to carbon dioxide and other greenhouse gas emissions.
- **Energy Consumption:** Factory operations, including chemical manufacturing equipment, lighting, HVAC systems, and IT infrastructure, require a high energy level, resulting in substantial greenhouse gas emissions if the energy is sourced from non-renewable resources.
- **Intensive Water Use:** Water consumption for factory activities, including sanitation, cleaning, and cooling systems, can indirectly impact climate change if water management is inefficient, leading to energy-intensive water supply and treatment processes.
- **Solid Waste Generation:** The generation of solid and general waste, if not appropriately managed, can lead to methane emissions from waste decomposition in landfills.
- **Transportation:** Transporting supplies, staff, patients, and waste, which uses fuel-powered vehicles, contributes to carbon emissions.
- **Use of Chemicals:** Chemicals utilized in chemical manufacturing, domestic cleaning, and disinfection can have indirect environmental impacts, potentially contributing to climate change if not handled and disposed of properly

5.5.2. Mitigation Measure

- **Transition to Renewable Energy Sources:** Utilize solar panels or other renewable energy technologies to power factory operations, reducing reliance on fossil fuels.
- **Promote Sustainable Resource Use:** Support responsible sourcing practices for all materials, including raw material supplies, and engage in local afforestation projects to offset carbon emissions.
- **Water Management and Conservation:** Implement water recycling to reduce water usage and minimize the energy footprint associated with water supply and wastewater treatment.
- **Invest in Energy Efficiency:** Upgrade to energy-efficient equipment and appliances, conduct regular energy audits, and promote conservation practices among staff to reduce overall energy consumption.
- **Waste Management Strategies:** Develop comprehensive waste reduction, recycling, and disposal plans, focusing on minimizing solid and general waste and exploring options for the circular economy. Solid waste can also be disposed of through an authorized third-party contractor.
- **Optimize Transportation and Logistics:** Use fuel-efficient and low-emission vehicles for factory operations and consider regional sourcing to minimize transportation distances and associated emissions.
- **Environmentally Friendly Chemical Use:** Substitute harmful chemicals with eco-friendly alternatives, implement best practices in chemical handling, and adopt closed-loop systems to prevent chemical runoff and contamination.

5.5.3. Residual Impacts

- **Minimal Residual Impacts:** Implementing these measures will significantly reduce the factory's carbon footprint, contributing to lower greenhouse gas emissions.
- **Reduced Impact on Biodiversity and Ecosystems:** Responsible sourcing and afforestation efforts will help protect local biodiversity and maintain healthy ecosystems.
- **Reduced Water Stress and Pollution:** Water recycling and conservation measures will decrease the factory's water usage, lowering stress on local water resources and minimizing pollution.
- **Lower Energy Consumption:** Investing in energy-efficient technologies will decrease overall energy demand, reducing greenhouse gas emissions.

- **Minimized Landfill Contribution:** Effective waste management will reduce the amount of waste sent to landfills, promoting resource conservation.
- **Reduced Carbon Footprint in the Supply Chain:** Optimizing logistics and adopting eco-friendly transport modes will lower emissions associated with the factory's supply chain.
- **Minimized Chemical-Related Environmental Harm:** The use of eco-friendly chemicals and closed-loop systems will reduce the environmental impact of hazardous substances.

5.6. Impact on Water Use & Wastewater Discharge on Environment

5.6.1. Impact Origin

GSM Industries Ltd. utilizes approximately 1150 m^3 of water daily. This water is distributed among factory operations, including utility services and other factory-related purposes. The total volume of liquid wastewater generated by GSMIL is around 36 m^3 per day, with the chemical oxygen demand (COD) levels expected to be relatively high. To manage this, an Effluent Treatment Plant (ETP) with a treatment capacity of 2 m^3 per hour will be constructed to treat all the wastewater produced by chemical manufacturing processes.

Untreated factory wastewater can have several adverse effects on agricultural land, including:

- **Soil Contamination:** The presence of hazardous chemicals and heavy metals residues in untreated wastewater can contaminate the soil, making it toxic for plant growth and accumulating harmful substances in the food chain.
- **Water Pollution:** When untreated wastewater enters agricultural water sources, it can pollute irrigation water, spreading contaminants across fields and negatively affecting crop health and yield.
- **Nutrient Imbalance:** Factory wastewater often contains high levels of sulfur and salts, leading to nutrient imbalances in the soil. This may cause an imbalance in nearby water bodies, leading to eutrophication and oxygen depletion.
- **Pathogen Spread:** Untreated wastewater may carry pathogens, including bacteria, viruses, and parasites, which can contaminate crops and soil and pose health risks to humans and animals consuming these crops.
- **Soil Salinity:** Certain chemicals in untreated wastewater can increase soil salinity, adversely affecting plant health, reducing soil fertility, and leading to poor crop yields.

- **Plant Toxicity:** Exposure to certain chemicals and pharmaceuticals present in factory wastewater can cause direct toxicity to plants, leading to stunted growth, poor development, or even plant death.
- **Reduction in Soil Microbial Activity:** Toxic substances in untreated wastewater can harm beneficial soil microorganisms, reducing soil fertility and its ability to support healthy plant growth.
- **Impact on Groundwater Quality:** Percolation of untreated wastewater into the soil can contaminate groundwater reserves, affecting agricultural activities and drinking water sources.

5.6.2. Mitigating Measure

Water quality issues are significant for industries due to the generation of liquid and solid wastes, especially in factories that deal with chemical production processes. At GSM Industries Ltd., wastewater will be treated using an Effluent Treatment Plant (ETP). Wastewater from the factory will be directed to the Effluent Treatment Plant (ETP) for treatment. Cooling water will be used in a closed-loop system, and treated water will be used for gardening and process reuse, with any excess safely discharged. Makeup water will be added to the system as needed.

The project includes a planned drainage system to manage surface runoff. The surface drainage network will be connected to an interceptor before discharge into natural water bodies. This interceptor will capture any oily substances present in the water. While liquid waste disposal poses a significant challenge, particularly in industrial contexts like chemical manufacturing factories, the current measures ensure that wastewater from the factory, estimated at around 40 m^3 per day, is effectively managed to minimize environmental impact.

5.6.3. Residual Impact

It is clear from the above study that factory wastewater needs proper treatment before discharging into the environment. Accordingly, the project proponent has adopted necessary treatment options suitable to their needs, meeting the national standards and being cost-effective, easy to maintain, and operate. Adaptation of measures set out above may not provide total mitigation. So, in this case, to maintain national standards, GSM Industries Ltd. will discharge some residual pollutants, which can affect the environment in the long run. So, this situation can be overcome by determining the exact level of treatment and proper monitoring, which is required to maintain the standard water quality of the receiving body.

5.7. Impact Due to Solid Waste Generation

5.7.1. Impact Origin

At GSM Industries Ltd., solid waste generation arises from a variety of operational activities, which can be categorized as follows:

- **ETP Sludge**: The primary source of solid waste will be the sludge generated from the Effluent Treatment Plant (ETP). The ETP processes the wastewater from chemical production operations, producing sludge containing organic and inorganic substances. This sludge requires proper disposal to prevent environmental contamination.
- **General Industrial Waste**: The factory will generate general waste, including packaging materials, cardboard, paper, and other non-hazardous office waste from routine operations. This type of waste will also include by-products such as fabric scraps, cartons, and empty chemical containers used in chemical manufacturing processes.
- **Maintenance Waste**: Intermittent waste from maintenance activities, including used air filters, worn-out machine parts, and cleaning rags, will be produced. While not hazardous, these items need appropriate disposal methods to avoid clutter and potential contamination.
- **Miscellaneous Domestic Waste**: Small quantities of domestic waste generated by factory staff, such as food waste, plastic, and packaging from daily activities, will also contribute to the overall waste profile. Though limited, these wastes will need proper disposal to maintain hygiene and environmental standards.

5.7.2. Mitigation Measures

Sludge To effectively manage the solid waste generated at GSM Industries Ltd. and minimize its environmental impact, the following mitigation measures will be implemented:

- **Waste Segregation**: Implement a robust waste segregation system to separate hazardous and non-hazardous waste at the point of generation. Clearly labeled bins and color-coded bags will be provided throughout the facility to ensure proper waste segregation, such as ETP sludge, fabric scraps, office waste, and maintenance waste.
- **ETP Sludge Management**: Sludge generated from the Effluent Treatment Plant (ETP) will be treated using dewatering and other appropriate techniques to reduce its volume and toxicity. If feasible, options for sludge recycling will be explored, or a third party will safely dispose of it.

- **Hazardous Waste Management**: Chemicals and hazardous materials used in chemical production will be carefully managed. Designated secure storage areas will be established for hazardous waste, and certified waste disposal contractors will be engaged to ensure safe and compliant disposal by environmental regulations.
- **Recycling of Non-Hazardous Waste**: Recyclable waste such as fabric scraps, paper, and cardboard will be segregated and sold to secondary markets or recycling facilities. This will minimize the volume of waste requiring disposal and promote resource recovery.
- **Maintenance Waste Disposal**: Used air filters, cleaning rags, and other maintenance-related waste will be collected and disposed of properly. Any secondary-value materials will be recycled, while non-recyclable items will be disposed of at safe landfill sites.
- **Training and Awareness**: All factory staff will receive regular training on proper waste management practices, emphasizing the importance of waste segregation, handling, and disposal procedures. This will ensure that all personnel are equipped to maintain a safe and environmentally sustainable workplace.
- **Monitoring and Auditing**: A waste management monitoring and auditing system will be established to track waste generation, handling, and disposal processes. Regular audits will be conducted to ensure compliance with regulatory standards and identify opportunities for improvement.
- **Community Awareness**: GSM Industries Ltd. will engage with the surrounding community to raise awareness about its waste management practices and emphasize the importance of maintaining environmental health and safety standards. This will foster a positive relationship with local stakeholders and contribute to community well-being.

5.7.3. Residual Impact

If the mitigation measure above is implemented, the residual impact will be very insignificant.

5.8. Impact on Air Quality

5.8.1. Impact Origin

The operation of GSM Industries Ltd. may influence air quality through various sources and activities associated with factory operations. The primary origins of air quality impact include:

- **Combustion Processes**: The use of backup generators and boilers, powered by fossil fuels such as diesel, may release combustion by-products into the atmosphere. These

emissions include nitrogen oxides (NOx), sulfur oxides (SOx), carbon monoxide (CO), particulate matter (PM), and volatile organic compounds (VOCs), all of which contribute to air pollution and can negatively affect the surrounding environment.

- **Chemical Usage in Chemical Manufacturing**: Various chemicals used in the production processes may release volatile organic compounds (VOCs) into the air. These emissions can affect both indoor and outdoor air quality**,** posing potential respiratory risks to factory workers and impacting the local air quality around the facility.
- **Boilers and Heating Systems**: Boilers that generate steam for chemical manufacturing processes can release pollutants, mainly when operating on fossil fuels. These emissions include CO2, NOx, and other particulate matter, which may contribute to localized air pollution and greenhouse gas emissions.
- **Vehicle Emissions**: Transport vehicles used for logistics, deliveries, and employee commuting will contribute to air emissions such as SO_x, CO_2, NO_x, PM, and VOCs. These vehicle emissions can impact air quality within and around the factory premises, particularly during peak operational hours.
- **Dust and Particulate Matter from Dry Processes**: Some dry processes involved in chemical processing can generate dust and particulate matter. If not properly controlled, this can lead to localized air pollution, affecting both the workers inside the facility and the external environment.
- **Construction Activities**: During future expansions or renovations, dust generated from construction work and emissions from construction machinery and vehicles may temporarily degrade air quality in and around the factory site.

5.8.2. Mitigation Measure

To address and mitigate the impact on air quality from GSM Industries Ltd., the following measures will be implemented:

- **Adoption of Clean Energy Sources**: The factory will transition to cleaner energy sources, such as natural gas or renewable energy (e.g., solar or wind), for its backup generators and boilers. This will significantly reduce emissions of nitrogen oxides (NOx), sulfur oxides (SOx), carbon monoxide (CO), and particulate matter (PM) associated with the combustion of fossil fuels.
- **Air Filtration Systems**: High-efficiency air filtration and extraction systems will be installed in areas where chemical processes are conducted. These systems will help

capture VOCs and other airborne pollutants emitted during chemical production, reducing the factory's contribution to localized air pollution.

- **Boiler and Generator Maintenance**: Regular maintenance of boilers, generators, and other combustion-based equipment will ensure they operate efficiently and comply with emissions standards. Advanced pollution control technologies like scrubbers will further minimize air pollutants.
- **Dust Control in Dry Finishing**: The factory will implement dust control measures for processes that generate dust and particulate matter. These include using extraction systems, water spraying, or dust suppressants to limit airborne particulates inside the factory and in the surrounding environment.
- **Use of Low-VOC Chemicals**: The factory will prioritize using low-VOC (Volatile Organic Compounds) chemicals and catalyst agents to minimize harmful emissions during chemical manufacturing. Safe storage and handling procedures will be followed to prevent accidental releases of chemicals into the air.
- **Vehicle Emissions Reduction**: To minimize emissions from transport vehicles used in logistics, deliveries, and employee commutes, the factory will implement regular maintenance schedules for all vehicles. Additionally, adopting fuel-efficient or electric vehicles and promoting carpooling or shuttle services will help reduce the overall number of vehicles and associated air emissions.
- **Dust Control during Construction or Expansion**: In future construction or expansion activities, dust suppression measures such as water spraying or dust suppressants will be employed to minimize particulate matter emissions. All construction equipment will undergo regular maintenance to reduce exhaust emissions.
- **Monitoring and Reporting**: The factory will establish an air quality monitoring program to regularly assess the levels of pollutants emitted from its operations. The results will be evaluated to ensure compliance with national and local air quality standards. Corrective actions will be implemented as needed to address any issues or exceedances.

5.8.3. Residual Impact

After the implementation of the proposed mitigation measures, the residual impacts on air quality at GSM Industries Ltd. are expected to be:

- **Reduced Emission Levels**: The transition to cleaner energy sources and the adoption of advanced waste management practices will significantly lower emissions of

nitrogen oxides (NOx), sulfur oxides (SOx), carbon monoxide (CO), particulate matter (PM), and volatile organic compounds (VOCs). This reduction will enhance air quality within the factory premises and the surrounding community.

- **Minimized Air Pollutants**: Regular maintenance of HVAC systems, along with the utilization of low-VOC chemical and catalyst agents, will decrease indoor air pollutants. This will contribute to a healthier work environment for employees and improve indoor air quality.
- **Lower Environmental Impact**: Efficient management of transport vehicles and implementing dust control measures during production and construction activities will further decrease emissions. This proactive approach will help minimize the overall environmental footprint of factory operations.
- **Enhanced Compliance**: A continuous air quality monitoring and reporting program will ensure emissions remain within regulatory limits. This ongoing assessment will facilitate promptly identifying and resolving any air quality concerns, thereby maintaining compliance with applicable environmental standards.

5.9. Impacts on Acoustic Environment

5.9.1. Impacts and Origin

The operation of GSM Industries Ltd. may impact the acoustic environment through the following sources:

- **Factory Equipment**: The operation of heavy machines and other processing equipment generates continuous noise, which could affect nearby residents and factory staff.
- **HVAC Systems**: Heating, ventilation, and air conditioning (HVAC) systems, including air handling units and cooling systems, contribute to ambient noise levels inside and outside the factory premises.
- **Construction Activities**: During any construction or renovation phases, noise from machinery, excavation, and building activities can temporarily disrupt the surrounding area. This includes noise from construction equipment, drilling, and transporting construction materials.
- **Transportation Activities**: The movement of transport vehicles for raw materials and finished products can increase noise levels, especially during loading and unloading operations.

- **Waste Management**: Noise generated from waste collection and disposal activities, including the operation of waste compactors and the movement of vehicles, can also affect the acoustic environment.
- **Staff Activity**: General noise from factory staff and operations, including conversations and machinery operation, contributes to the overall acoustic environment within the facility.

5.9.2. Mitigation Measures

To address and minimize the impacts on the acoustic environment at GSM Industries Ltd., the following mitigation measures will be implemented:

- **Soundproofing and Noise Insulation**: Install soundproofing materials and noise insulation in areas with high noise levels, such as processing areas and HVAC equipment rooms. This will help reduce noise transmission within the factory and surrounding areas.
- **Noise Control for Equipment**: Ensure all machinery operates within acceptable noise limits. Implement regular maintenance schedules to minimize noise from malfunctioning or outdated equipment.
- **Construction Noise Management**: Develop and enforce a construction noise management plan that includes limiting construction activities to designated hours, utilizing quieter machinery, and employing noise barriers or enclosures around high-noise equipment.
- **Transport Protocols**: Implement protocols to optimize transport vehicle operations, ensuring that loading and unloading are conducted in a manner that reduces noise disturbance.
- **Waste Management Procedures**: Schedule waste collection and disposal activities to avoid peak noise. Utilize quieter waste collection equipment and vehicles and implement noise reduction measures during waste handling.
- **Staff Training**: Train factory staff on noise management practices and maintaining a quiet environment, particularly in sensitive factory areas.
- **Acoustic Monitoring**: Conduct regular acoustic monitoring to assess noise levels and ensure compliance with acceptable limits. Adjust mitigation measures based on monitoring results and community and factory staff feedback.

5.9.3. Residual Impact

Following the implementation of the proposed mitigation measures, the residual impacts on the acoustic environment at GSM Industries Ltd. are expected to be:

- **Minimized Noise Pollution**: The measures will significantly lower noise levels from factory operations and construction activities, ensuring that any remaining noise is within acceptable limits and does not adversely affect the surrounding community.
- **Reduced Disruption**: The impact on nearby residential and commercial areas will be minimized, with noise levels managed to prevent significant disturbance. Ongoing monitoring and adjustment of noise control practices will help maintain a low level of acoustic disruption.
- **Improved Acoustic Comfort**: Enhanced soundproofing and noise management within the factory will create a more comfortable environment for employees, promoting better overall productivity and well-being.
- **Sustained Compliance**: Continuous acoustic monitoring and adherence to noise control measures will ensure compliance with relevant regulations and standards, reducing the risk of potential conflicts with local noise ordinances.

5.10. Impact on Health and Safety, Natural & Accidental Incidents

5.10.1. Health and Safety

6.10.1.1. Impact Origin

The operation of GSM Industries Ltd. may present various health and safety impacts, originating from:

- **Chemical Management**: If not managed properly, the handling, storage, and disposal of chemicals used in the production processes pose risks of exposure and contamination. This includes potential spills, leaks, or improper handling that may endanger staff and the environment.
- **Infection Control**: Although the primary focus is on chemical processing, ineffective hygiene measures can spread contaminants and potential health risks, mainly if staff contact used items that may harbor biological hazards.
- **Occupational Hazards**: Working in a chemical manufacturing facility involves various risks, such as repetitive strain injuries, ergonomic issues, and exposure to high temperatures and chemical substances.

- **Emergency Response**: Effective emergency response protocols are critical. Potential incidents, such as chemical spills, fires, or equipment malfunctions, require preparedness to minimize health and safety impacts.
- **Construction and Maintenance Activities**: During any construction or maintenance phase, risks associated with heavy machinery, construction materials, and site activities could pose safety hazards to workers and nearby residents.

6.10.1.2. Mitigation Measures

To address health and safety impacts at GSM Industries Ltd., the following mitigation measures will be implemented:

- **Chemical Management:**
  - **Segregation and Safe Disposal:** Implement strict protocols for storing, handling, and disposing of chemicals used in the chemical manufacturing processes to minimize risks. Use clearly labeled containers and ensure compliance with safety regulations.
  - **Training and PPE:** Provide comprehensive training for staff on chemical management practices and ensure using personal protective equipment (PPE) to protect against exposure.
- **Infection Control:**
  - **Enhanced Hygiene Practices:** Establish and enforce strict hygiene protocols, including regular cleaning and sanitization of shared spaces and equipment.
  - **Staff Training:** Provide ongoing training for staff on proper hygiene practices and protocols to minimize the risk of contamination.
- **Occupational Health and Safety:**
  - **Ergonomic Assessments:** Conduct ergonomic assessments to minimize risks of repetitive strain injuries and provide appropriate ergonomic tools and adjustments.
  - **Safety Training:** Offer regular occupational health and safety training, including topics on manual handling, safe work practices, and emergency procedures.

- **Emergency Response:**
    - **Emergency Preparedness Plans:** Develop and regularly update comprehensive emergency response plans for various scenarios, including chemical spills and fires.
    - **Drills and Training:** Conduct regular emergency drills and training exercises for staff to ensure preparedness and effective response during actual emergencies.
- **Construction and Maintenance Activities:**
    - **Safety Protocols:** Implement strict safety protocols for construction and maintenance activities, including the use of safety barriers, personal protective equipment (PPE), and adherence to construction safety regulations.
    - **Regular Inspections:** Conduct regular inspections and audits of construction sites and maintenance activities to ensure compliance with safety standards and promptly address potential hazards.

6.10.1.3. Residual Impact

After implementing the mitigation measures for health and safety at GSM Industries Ltd., the residual impacts are expected to be:

- **Minimized Risk of Exposure**: Effective chemical management practices will significantly reduce the risk of exposure to hazardous substances, ensuring a safer working environment for staff.
- **Improved Hygiene Standards**: Enhanced hygiene practices will decrease the risk of contamination, contributing to a healthier environment for employees.
- **Improved Occupational Health**: Ergonomic improvements and comprehensive safety training will reduce the likelihood of occupational injuries and strain-related disorders, promoting overall staff well-being.
- **Enhanced Emergency Preparedness**: Well-developed emergency response plans and regular training will ensure that staff are adequately prepared for emergencies, thereby reducing the impact of such incidents on health and safety.
- **Controlled Environmental Risks**: Adherence to safety protocols during construction and maintenance will mitigate risks associated with these activities, ensuring a safer working environment for all employees and minimizing potential hazards.

5.10.2. Natural and Accidental Incidents

6.10.2.1. Impact Origin

The potential impacts of natural and accidental incidents at GSM Industries Ltd. can originate from the following sources:

- **Natural Disasters:**
  - **Flooding:** Heavy rainfall or natural flooding events could disrupt factory operations, damage infrastructure, and pose safety risks to staff and equipment.
  - **Earthquakes:** Seismic activity could compromise the structural integrity of the factory, leading to safety risks and potential damage to machinery and facilities.
  - **Cyclones and Storms:** High winds and severe weather conditions could physically damage the factory structure and disrupt essential services, affecting production capabilities.
- **Accidental Incidents:**
  - **Fire:** Potential fire hazards include electrical faults, flammable materials, and improper chemical storage, which could jeopardize safety and disrupt factory operations.
  - **Chemical Spills:** Accidental spills of hazardous substances used in manufacturing processes could pose significant risks to employee health, safety, and the environment.
  - **Equipment Failure:** Malfunctions or breakdowns in critical factory equipment could disrupt production processes and impact operational efficiency.
  - **Human Error:** Mistakes or lapses in staff adhering to safety protocols could lead to accidents, affecting personnel and operational continuity.
- **Construction Phase Accidents:**
  - **Site Safety Hazards:** During the construction phase, risks such as falls from heights, accidents involving heavy machinery, and exposure to hazardous materials can pose serious threats to construction workers and nearby residents.
  - **Structural Failures:** Inadequate construction practices or failure to follow safety standards could result in structural collapses or accidents, impacting ongoing construction activities and future factory operations.
  - **Traffic and Equipment Accidents:** Increased vehicle traffic and construction equipment operation could lead to accidents, posing risks to workers and the general public around the construction site.

- **Material Handling:** Improper handling and storage of construction materials could lead to accidents or injuries, affecting the safety of construction workers and nearby individuals.

6.10.2.2. Mitigation Measures

To manage impacts from natural and accidental incidents, including those during construction, the following measures will be implemented:

Natural Disasters

- **Flooding:** Implement flood-resistant designs and effective drainage systems. Regularly update flood management plans to enhance readiness for potential flooding events.
- **Earthquakes:** Adhere to seismic design standards and conduct regular structural inspections to ensure the factory's integrity during an earthquake.
- **Cyclones and Storms:** Design the factory structure for weather resilience and develop comprehensive cyclone response plans to ensure operational continuity during severe weather.

Accidental Incidents

- **Fire:** To reduce fire hazards, install advanced fire safety systems, conduct regular fire drills, and ensure proper storage protocols for flammable materials.
- **Chemical Spills:** To mitigate the risks associated with chemical spills, implement strict safe handling protocols and spill response plans and maintain adequate containment equipment.
- **Equipment Failure:** Conduct regular maintenance and inspections of critical machinery and establish backup systems to minimize operational disruptions.
- **Human Error:** Provide comprehensive safety training for all staff and foster a strong safety culture to enhance adherence to safety protocols.

Construction Phase Accidents

- **Site Safety Hazards:** Ensure safety training for all construction workers, mandate using personal protective equipment (PPE), and conduct regular site inspections to identify and mitigate risks.
- **Structural Failures:** Enforce stringent quality control measures and structural monitoring practices to ensure adherence to safety standards during construction.
- **Traffic and Equipment Accidents:** To minimize accidents, implement traffic management plans for construction sites and ensure comprehensive training for construction machinery operators.

- **Material Handling:** Establish safe handling procedures for construction materials and conduct regular audits to ensure compliance and identify potential safety improvements.

5.11. Socio-Economic Impacts

5.11.1. Positive Impacts

- **Employment Opportunities:** The operation of GSM Industries Ltd. will generate a significant number of jobs, both skilled and unskilled, across various roles such as chemical manufacturing technicians, administrative staff, and support services. This will contribute to local workforce development and skill enhancement.
- **Economic Growth:** The factory's operations will increase local spending and stimulate business opportunities, benefiting local suppliers, contractors, and service providers. This economic activity will contribute to the region's overall economic vitality.
- **Access to Chemical manufacturing Services:** By establishing local chemical manufacturing facilities, the factory will enhance access to these services, improving convenience for the community and reducing the need for travel to distant providers.
- **Infrastructure Development:** The project is expected to improve local infrastructure, including roads, utilities, and public services. These enhancements will provide long-term benefits to residents and contribute to the area's overall development.

5.11.2. Potential Negative Impacts

- **Increased Cost of Living:** The influx of factory staff and the associated economic activity may lead to a higher demand for housing and services, potentially increasing living costs in the area and making affordability a concern for existing residents.
- **Traffic Congestion:** The factory's operation could increase traffic, impacting local transportation systems and potentially causing congestion, especially during peak operational hours.
- **Cultural and Social Changes:** Rapid development and increased population density may alter the area's social and cultural dynamics, which could affect community cohesion and local traditions.

5.11.3. Mitigation Measures

- **Community Engagement:** Establish ongoing communication channels with residents to address concerns, gather feedback, and incorporate community input into project planning and operations.

- **Traffic Management:** Develop and implement comprehensive traffic management plans to minimize congestion, enhance road safety, and ensure smooth transportation around the factory.
- **Affordable Housing Initiatives:** Collaborate with local authorities and developers to explore partnerships to provide affordable housing options. This will manage any potential increases in living costs and ensure the local community remains accessible to all residents.
- **Cultural Sensitivity Programs:** Promote cultural awareness and inclusivity in factory policies and community interactions. Implement initiatives that respect local traditions and foster social harmony, helping to mitigate potential cultural disruptions.

5.12. Overland Drainage and Impact on Surface Water

5.12.1. Impact Origin

- **Altered Drainage Patterns:** The construction and operation of GSM Industries Ltd. may modify the area's natural drainage patterns, potentially resulting in increased runoff and localized flooding during heavy rain events.
- **Surface Water Pollution:** The increased runoff from the site could carry pollutants, including oils, chemicals, and sediments, leading to the contamination of nearby surface water bodies, which could affect local ecosystems and water quality.
- **Erosion:** Construction activities and land disturbance can result in soil erosion, contributing to sedimentation in local water sources and negatively impacting aquatic habitats.
- **Reduced Natural Absorption:** The installation of impervious surfaces, such as pavements and building foundations, decreases the natural absorption of water into the ground. This leads to increased surface runoff volume and velocity, further exacerbating the potential for flooding.

5.12.2. Proposed Mitigation Measures

- **Stormwater Management Plan:** Develop and implement a comprehensive plan incorporating features like detention basins, retention ponds, and permeable surfaces to effectively manage runoff and reduce peak flow rates during rainfall events.
- **Erosion Control:** Employ erosion control measures, such as silt fences, sediment basins, and vegetation cover, to minimize soil erosion and sedimentation both during and after the construction phase.

- **Pollutant Management:** Utilize best management practices (BMPs) to control and treat pollutants in runoff, including the installation of oil-water separators and ensuring regular maintenance of drainage systems to prevent blockages and contamination.
- **Regular Monitoring:** Establish a routine surface water quality monitoring program to ensure that runoff and discharges from the facility comply with environmental regulations and do not adversely impact nearby water bodies or ecosystems.

5.12.3. Residual Impact

- **Managed Runoff:** With the implementation of an effective stormwater management plan and erosion control measures, the residual impact on surface water quality and flooding is expected to be significantly minimized.
- **Reduced Pollution:** The application of effective BMPs will substantially lower the risk of surface water contamination, helping maintain compliance with environmental standards and protecting local ecosystems.
- **Minimal Erosion:** Ongoing erosion control practices will continue to limit soil erosion and sedimentation, thereby preserving the health and quality of local water bodies and ensuring the stability of the surrounding environment.

5.13. Increase in Vehicular Traffic in The Area

5.13.1. Impact Origin

- **Increased Traffic Volume:** The establishment and operation of GSM Industries Ltd. are expected to significantly increase vehicular traffic due to increased employee commutes, supplier deliveries, and client visits.
- **Congestion:** The influx of vehicles will likely cause traffic congestion, particularly during peak operational hours, adversely affecting local roadways and overall transportation efficiency.
- **Increased Emissions:** Higher traffic volumes will contribute to elevated air pollutants, such as particulate matter and greenhouse gases, potentially impacting local air quality and public health.
- **Parking Demand:** The growing number of vehicles will elevate the demand for parking spaces, which may result in inadequate parking facilities and increased roadside parking, leading to further congestion and safety concerns.

5.13.2. Mitigation Measures

- **Traffic Management Plan:** Develop and implement a comprehensive traffic management plan that includes strategies for managing peak traffic times, optimizing traffic flow, and reducing congestion around the factory. This plan should involve coordination with local traffic authorities.
- **Public Transport Options:** Encourage the use of public transportation by providing information about available transit options and considering partnerships with local transit agencies to improve service frequency and routes.
- **Parking Solutions:** Design and construct sufficient on-site parking facilities to meet the needs of patients, staff, and visitors, thereby minimizing the reliance on roadside parking and reducing congestion.
- **Emission Controls:** Promote low-emission vehicles among staff and delivery services. Consider implementing incentives for carpooling and providing facilities for electric vehicle charging to reduce overall emissions and improve air quality.

5.13.3. Residual Impact

- **Managed Traffic Flow:** Effective traffic management strategies and adequate parking solutions can significantly minimize congestion and traffic-related issues, leading to smoother transportation routes around the factory.
- **Reduced Emissions:** Implementing emission controls and promoting public transportation will improve air quality and minimize the negative environmental impacts of increased traffic.
- **Improved Accessibility:** Adequate parking and efficient traffic management will enhance accessibility to GSM Industries Ltd. while reducing potential adverse effects on the local transportation network, benefiting both the factory and the surrounding community.

5.14. Impacts During Construction

5.14.1. Disruption of Earth Surface-Site Preparation and Clearing and Earthworks

6.14.1.1. Impact Origin

- **Land Disturbance:** Site preparation and clearing activities for GSM Industries Ltd. will involve removing vegetation and topsoil to create a suitable foundation for the chemical manufacturing factory. This can lead to soil erosion and sedimentation in nearby water bodies.

- **Soil Compaction:** Heavy machinery used during earthworks may compact the soil, negatively affecting its permeability and potentially impacting groundwater recharge and soil fertility needed for landscaping.
- **Erosion and Sedimentation:** Disturbing the earth's surface increases the likelihood of erosion, resulting in sediment runoff into nearby water bodies. This can degrade water quality and harm aquatic habitats.
- **Habitat Destruction:** Clearing land for construction may destroy local habitats and affect native flora and fauna, leading to potential biodiversity loss in the factory area.

6.14.1.2. Mitigation Measures

- **Erosion Control Measures:** Implement erosion control practices such as silt fences, sediment basins, and establishing vegetation cover to prevent soil erosion and manage sediment runoff effectively.
- **Minimize Land Disturbance:** To reduce the environmental impact, limit the area disturbed during construction activities. Avoid unnecessary vegetation clearing to help preserve the local ecosystem.
- **Soil Management:** Use techniques to minimize compaction effects, such as employing lighter machinery and ensuring proper handling and storage practices to maintain soil quality.
- **Habitat Preservation:** Conduct pre-construction environmental assessments to identify and protect sensitive habitats and species in the vicinity. Implement measures to minimize habitat destruction and ensure the preservation of local biodiversity.

6.14.1.3. Residual Impact

- **Controlled Erosion:** Effective erosion control measures will significantly reduce soil erosion and sedimentation, helping to maintain water quality and protect aquatic ecosystems in the area.
- **Managed Soil Quality:** Soil management practices will help mitigate compaction effects, support groundwater recharge, and maintain overall soil health, which is essential for landscaping and surrounding environments.
- **Minimized Habitat Impact:** By prioritizing habitat preservation and minimizing land disturbance, the impacts on local flora and fauna will be reduced, contributing to biodiversity conservation in the area around GSM Industries Ltd.

5.14.2. Impacts on Air Environment

6.14.2.1. Impact Origin

- **Dust Generation:** Construction activities at GSM Industries Ltd., such as excavation, grading, and land clearing, can produce significant amounts of dust, increasing particulate matter in the air. This poses potential respiratory issues for nearby residents and workers.
- **Vehicle Emissions:** The operation of construction vehicles and machinery, including trucks, bulldozers, and cranes, emits exhaust gases such as nitrogen oxides (NOx), carbon monoxide (CO), and particulate matter (PM). These emissions contribute to local air pollution and degrade air quality in the surrounding area.
- **Machinery Emissions:** Construction equipment like generators and compressors releases pollutants and particulate matter, further impacting local air quality.
- **Material Handling:** Transportation and handling of construction materials, such as sand, gravel, and cement, can generate dust and particulate matter, contributing to airborne pollution around the factory site.
- **Site Preparation:** Activities associated with site preparation, including land clearing and soil disturbance, can release dust and particulate matter into the atmosphere, affecting local air quality.

6.14.2.2. Mitigation measures

To address the impacts on the air environment during construction, the following mitigation measures should be implemented:

- **Dust Suppression:** Regularly apply water or dust suppressants to construction sites and unpaved access roads to minimize airborne dust. Use soil stabilizers where appropriate to further reduce dust emissions.
- **Road Maintenance:** Maintain construction and access roads in good condition by filling potholes and smoothing surfaces to prevent dust generation and reduce vehicle emissions.
- **Vehicle Management:** Enforce speed limits on construction and access roads to minimize dust generation. Ensure all construction vehicles are well-maintained and equipped with proper emission control devices.

- **Erosion Control:** Implement erosion control measures, such as silt fences and sediment barriers, to prevent soil erosion and minimize dust and particulate matter release.
- **Air Quality Monitoring:** Conduct regular air quality monitoring to assess dust and emissions levels. Based on the monitoring results, adjust mitigation strategies as necessary to ensure compliance with air quality standards.
- **Public Communication:** Keep local communities informed about construction activities, dust control measures, and any potential impacts on air quality to proactively manage expectations and address concerns.

6.14.2.3. Residual Impact

Even with mitigation measures, some residual impacts on the air environment may remain. These include:

- **Minor Dust Emissions:** Even with dust suppression efforts, occasional dust emissions from construction activities and unpaved surfaces may still occur.
- **Increased Vehicle Emissions:** Construction vehicles and machinery will likely continue contributing to localized air pollution, although maintaining and regulating these vehicles will minimize the overall effect.
- **Temporary Air Quality Degradation:** Short-term increases in particulate matter and other pollutants may be experienced, particularly during peak construction periods or adverse weather conditions.

Overall, while the proposed mitigation measures will significantly reduce the impacts on air quality, occasional residual effects are anticipated. Regular monitoring and prompt adjustments to mitigation strategies will be essential to manage and minimize these residual impacts effectively.

5.15. Gains to The Economy

5.15.1. During Operation Phase

6.15.1.1. Impact Origin

The operation phase of the GSM Industries Ltd. factory will bring several economic benefits, including:

- **Job Creation:** The factory will create numerous employment opportunities for various roles, including skilled technicians, administrative staff, maintenance workers, and support personnel. This will help reduce local unemployment rates and enhance household incomes within the community.
- **Boost to Local Economy:** Increased employment and factory operations will stimulate local businesses, including suppliers, vendors, and service providers. This economic activity can lead to the growth of ancillary businesses, such as laundry services, clothing retailers, and transportation services, further enhancing the overall economic vitality of the area.
- **Chemical Manufacturing Services:** By providing high-quality and accessible chemical manufacturing services, the factory will not only improve the productivity of local chemical production businesses but also enhance the well-being of residents, contributing to the broader economic stability of the community.
- **Training and Development:** The factory will offer training programs and skill development opportunities for chemical manufacturing professionals, boosting the expertise of the local workforce and increasing their employability in the chemical manufacturing sector.
- **Increased Property Values:** Establishing a major chemical manufacturing facility is expected to increase property values in the surrounding area, as improved services and job opportunities make the locality more attractive to residents and businesses.

6.15.1.2. Benefit Enhancement Measure

To amplify economic gains during the operation phase of the GSM Industries Ltd. factory, the following benefit enhancement measures will be implemented:

- **Local Employment:** Emphasize hiring residents for both skilled and unskilled positions, creating job opportunities within the community, reducing unemployment, and supporting local economic growth.

- **Local Procurement:** Whenever feasible, source materials, supplies, and services from local vendors. This strategy will support local businesses, stimulate the economy, and help mitigate potential supply chain disruptions.
- **Staff Training and Development:** Invest in continuous training and professional development for factory employees. Enhanced skills will improve service quality, boost job satisfaction, and aid in employee retention while also elevating the overall professionalism of the chemical manufacturing sector in the area.
- **Community Engagement Programs:** Launch initiatives that involve community participation, such as health education programs, wellness workshops, and preventive health check-ups. These efforts will raise public health awareness and foster goodwill within the community.
- **Collaborative Partnerships:** Establish partnerships with local educational institutions to facilitate internships, training, and research opportunities. This collaboration will enhance educational outcomes and create a talent pipeline of qualified chemical manufacturing professionals for the factory.
- **Infrastructure Support:** Contribute to developing local infrastructure, including roads, public transport access, and utility services. These improvements will benefit both the factory operations and the local community, enhancing overall accessibility and quality of life for residents.

5.15.2. During Construction

6.15.2.1. Impact Origin

During the construction phase of the GSM Industries Ltd. factory, several economic benefits are anticipated, which include:

- **Job Creation:** Construction activities will create direct employment opportunities for local workers, including engineers, architects, construction laborers, and support staff. This influx of jobs will significantly enhance the local job market.
- **Local Business Opportunities:** The demand for construction materials, equipment, and services will benefit local suppliers and vendors. This stimulation will benefit local hardware stores, equipment rental companies, and other service providers, fostering economic growth.
- **Increased Demand for Services**: Construction workers will require various amenities, such as food and accommodation, leading to increased business for local restaurants, grocery stores, hotels, and transportation services, thus supporting local enterprises.

- **Skill Development:** The construction project will offer training and hands-on experience for local laborers and contractors, enhancing their skills and improving their employability for future projects in the construction and chemical industries.
- **Boost to Local Economy:** The overall increase in economic activity from the construction process will result in higher spending and circulation of money within the local economy, supporting overall economic growth and stability.

6.15.2.2. Benefit Enhancement Measure

To maximize the economic gains during the construction phase of the GSM Industries Ltd. factory, the following benefit enhancement measures should be implemented:

- **Prioritize Local Hiring:** Develop policies prioritizing hiring local workers and contractors. This approach ensures that employment opportunities directly benefit the local community, enhancing local economic support and fostering goodwill.
- **Support Local Businesses:** Encourage the procurement of construction materials, equipment, and services from local suppliers and vendors. This strategy will stimulate the local market, reduce transportation costs, and minimize the environmental impact of sourcing materials from distant locations.
- **Provide Training Programs:** Implement training programs for local workers to enhance their skills in construction and related fields. This initiative will improve the workforce's employability, ensuring they acquire valuable skills and experience applicable to future projects.
- **Engage with Community Stakeholders:** Maintain open communication with community leaders and stakeholders to understand their needs and concerns. Involving the community in the planning process will better align the project with local economic development goals and promptly resolve any issues.
- **Encourage Local Entrepreneurship:** Support initiatives that promote local entrepreneurship, such as small business grants or partnerships with local startups. This support can provide the services and products needed during construction and help build a more diverse and resilient local economy.
- **Monitor Economic Impact:** Regularly assess the economic impacts of the construction project to ensure that benefits are being realized. This may involve conducting surveys or collaborating with local economic development agencies to track relevant economic indicators and adjust strategies as necessary.

5.16. Job Opportunities

5.16.1. Impact Origin

The construction and operation phases of the GSM Industries Ltd. factory will create many job opportunities, positively impacting local employment levels. During the construction phase, a wide range of positions will be available, including skilled labor roles such as engineers, architects, and project managers and unskilled labor positions for site preparation, materials handling, and general construction work.

Once operational, the factory will provide diverse employment opportunities for chemical manufacturing professionals, including Quality Control Inspectors, Environmental Compliance Officers, and many more, alongside administrative, maintenance, and support staff. The increased demand for chemical manufacturing services is also expected to spur growth in related industries, such as Textile Manufacturing, Apparel and Garment Production, Chemical Manufacturing, and Laundry Services, further enhancing job creation within the community.

5.16.2. Benefit Enhancement Measures

To maximize the job opportunities created by the project, the following measures should be implemented:

- **Local Employment Policies:** Develop and enforce policies prioritizing hiring residents for construction and operational roles. This approach ensures that the economic benefits of job creation remain within the local community, fostering local economic growth.
- **Skills Training Programs:** Offer training and apprenticeship programs designed to equip residents with the necessary skills for employment during the construction and operational phases. This will enhance the employability of the local workforce and ensure a steady supply of qualified personnel.
- **Partnerships with Educational Institutions:** Collaborate with local colleges, universities, and vocational training centers to develop programs tailored to the factory's needs. These partnerships will help prepare students and job seekers for chemical manufacturing, and construction roles.
- **Career Development Opportunities:** Provide ongoing career development and training opportunities for employees to advance within the organization. This will

improve job satisfaction and retention rates while building a more skilled and capable workforce in the chemical manufacturing industry.

- **Fair Wage and Labor Practices:** Ensure that all employees receive fair wages and benefits, whether directly hired or contracted. Ethical labor practices will foster a positive work environment and enhance the factory's reputation as an employer.
- **Monitoring and Evaluation:** Regularly monitor employment levels and the effectiveness of training and development programs. Adjust strategies as needed to address gaps and optimize job creation and employee development, ensuring the long-term success of the workforce initiatives.

Chapter Six: Environmental Management Plan (EMP)

6.1. General

The Environmental Management Plan (EMP) for the GSM Industries Ltd. factory project is a comprehensive framework designed to mitigate adverse environmental impacts and enhance beneficial outcomes throughout the project's implementation and operational phases. The EMP aims to ensure that all environmental measures comply with Bangladesh's Environmental Quality Standards (EQS), thereby safeguarding the project's long-term sustainability.

1. **Mitigation Plan:** This component focuses on identifying and implementing measures to minimize or offset the potential adverse environmental impacts of the project. By adhering to strict mitigation strategies, the project can reduce its environmental footprint to acceptable levels per Bangladesh's regulatory standards.
2. **Enhancement Plan:** The enhancement plan aims to maximize the project's positive environmental and social benefits. This includes promoting green practices, improving community health outcomes, and supporting local economic development through job creation and resource optimization.
3. **Monitoring Plan:** Continuous monitoring is essential to ensure that the environmental management measures are effective and that the project complies with environmental regulations. The monitoring plan outlines the procedures for regular assessment and reporting, enabling timely adjustments to the EMP as needed.

The project proponent has proactively implemented several policies and measures to prevent environmental degradation. The project authority is dedicated to environmental stewardship, ensuring that every pollution sector—water, soil, air, or noise—is addressed through the EMP. The following specific management plans are integral to the overall EMP and are either already in place or will be activated during the project:

- **Occupational Health & Safety Management Plan (OHSMP):** Adheres to best practices in occupational health and safety to ensure the safety and well-being of all employees and stakeholders.
- **Emergency Response and Fire Management Plan (EFMP):** This plan prepares the factory to effectively manage emergencies, including fires, by establishing clear protocols and training programs.

- **Factory Waste Management Plan (HWMP):** This plan focuses on the proper disposal and treatment of ETP sludge and general solid waste generated by the factory to prevent environmental contamination.
- **Air Management Plan (AMP):** This plan aims to control and reduce factory emissions, ensuring air quality remains within acceptable limits.
- **Noise Management Plan (NMP):** This plan addresses noise pollution by implementing measures to minimize noise levels and their impact on the surrounding environment.

Implementing the EMP will reduce the project's environmental impact to levels acceptable under Bangladesh government regulations. Additionally, the EMP will enhance the project's positive effects, contributing to the overall well-being of the environment and the community. GSM Industries Ltd.'s proactive approach in developing and executing the EMP reflects its commitment to environmental responsibility and sustainability.

6.2. Occupational Health & Safety Management Plan

Occupational health and safety are critical concerns in today's industrial landscape, particularly in facilities like GSM Industries Ltd. Prioritizing health and safety is paramount, as the value of life cannot be quantified. According to the World Health Organization (WHO), "Occupational health deals with all aspects of health and safety in the workplace and has a strong focus on the primary prevention of hazards." This multi-disciplinary field emphasizes the importance of workplace safety, health, and welfare.

Factories, including chemical manufacturing facilities, can face various emergencies such as fires, natural disasters, and accidents, leading to hazardous environments that pose significant health risks. To address these challenges, GSM Industries Ltd. has already implemented several measures to ensure the health and safety of all stakeholders.

6.2.1. Future Implementation

GSM Industries Ltd. will implement numerous health and safety measures to protect its employees. These measures include the availability of first aid kits, the deployment of trained medical personnel, and regular health check-ups for workers.

For future improvements, the factory management plans to implement additional measures to enhance the safety and well-being of all stakeholders. These measures include:

- **Formation of a Health and Safety Committee:** A dedicated committee will be established in compliance with the Bangladesh Labor Act (Amendment) 2013. This committee will oversee, execute, and plan health and safety protocols for all factory personnel, including medical and administrative staff.
- **Pre-job Risk Assessment:** A comprehensive risk assessment will be conducted before assigning new or hazardous tasks. This will be followed by issuing work permits that outline specific risks and management strategies and designate responsible individuals for corrective actions.
- **Provision of Personal Protective Equipment (PPE):** Adequate PPE such as gloves, safety goggles, masks, and helmets will be supplied to all staff engaged in potentially risky activities within the factory, ensuring protection against workplace hazards.
- **Training Programs:** Employees will undergo training to raise awareness about the hazardous nature of chemicals and other risks associated with their roles. This training will emphasize minimizing exposure and ensuring safe handling practices.
- **Job Rotation:** Workers will be rotated through different tasks to mitigate prolonged exposure to high noise levels and other hazards. This practice will reduce exposure duration and associated health risks.
- **Regular Medical Examinations:** All employees will receive periodic health check-ups. If any significant occupational health issues are identified, management will take necessary corrective action.
- **Implementation of Management Procedures:** Comprehensive management procedures will be established, including process safety protocols, ongoing training, management of change procedures, incident investigation processes, and employee participation in safety initiatives.
- **Incident Reporting and Investigation:** All incidents will be promptly reported and investigated using root cause analysis. This approach will facilitate the development of action plans for continuous improvement and ongoing monitoring to ensure safety standards are upheld.

These proactive measures will help GSM Industries Ltd. maintain a safe and healthy environment for its workers and staff, ensuring compliance with local regulations and international best practices.

6.3. Emergency Response and Fire Management Plan (ERFMP)

6.3.1. General

In the event of a fire at GSM Industries Ltd., the following guidelines should be strictly adhered to ensure the safety of all personnel and an effective emergency response:

- **Evacuate Immediately:** If a small fire cannot be controlled using a portable extinguisher or fixed extinguishing system, or if smoke poses a risk to the operator, evacuate the area without delay.
- **Notify Authorities:** Contact the fire department immediately. Personnel should proceed to a designated safe area until the fire department arrives.
- **Voluntary Fire Extinguishing:** Attempting to extinguish a fire is voluntary. Only trained individuals who feel confident using a portable extinguisher should consider attempting to extinguish the fire.
- **Prioritize Safety:** Recognizing that improper use of portable extinguishers can lead to severe injury or fatalities is crucial. Untrained personnel should focus on evacuation and alerting emergency services, as safety is the top priority.

These procedures aim to protect the safety of all personnel and ensure a coordinated response to fire incidents.

6.3.2. Types of Fire

There are five types of fire such as

Class A – Ordinary combustibles (wood, paper, plastics, etc.)
Class B – Combustible liquids (oils, gas, cooking oil, etc.)
Class C – Electrical (energized equipment – appliances, wiring, etc.)
Class D – Combustible metals (aluminum, magnesium, zinc, etc.)
Class E – Commercial cooking equipment (Cooking oils, Animal fats, Vegetable fats)

It is extremely important to choose the properly rated fire extinguisher for the class of fire that is burning.

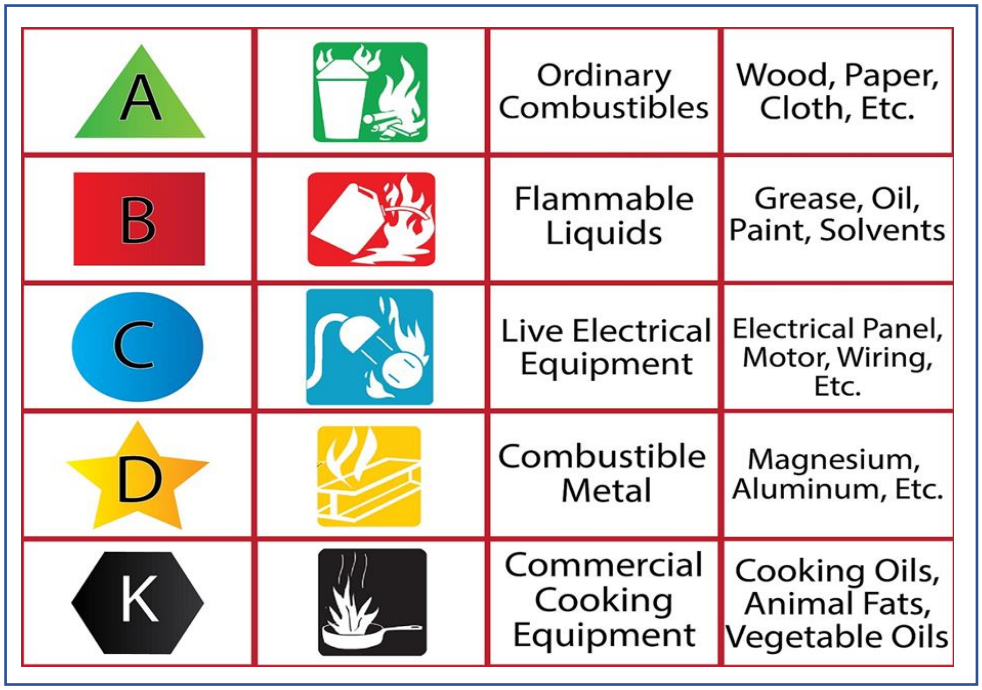


Figure 6.1: Pictorial view of different types of fire

6.3.3. Fire Safety Risk Assessment

A fire safety risk assessment is essential for ensuring the safety of personnel and minimizing potential harm caused by fire hazards. This organized and methodical evaluation focuses on identifying fire risks, assessing their potential impact, and implementing effective control measures. Below is the detailed fire risk assessment process for GSM Industries Ltd., which should be executed twice a year.

Table 6.1: Fire Safety Risk Assessment

	Fire Risk Assessment
Step	**Description**
1. Identify Fire Hazards	Identify sources of ignition (e.g., electrical equipment, open flames), sources of fuel (e.g., chemicals, reagents, catalysts), and sources of oxygen (e.g., air ventilation).
2. Identify People at Risk	Identify individuals in and around the premises, including employees, visitors, and contractors, with special attention to those particularly at risk (e.g., people with disabilities and those working in high-risk areas).
3. Evaluate, Remove, Reduce,	- Evaluate the risk to people from fire. - Remove or reduce risks to people through appropriate measures.

	Fire Risk Assessment
Step	**Description**
and Protect from Risk	- Ensure adequate detection and warning systems (e.g., smoke detectors). - Establish fire-fighting measures (e.g., fire extinguishers, water sprayers). - Maintain clear escape routes with proper lighting, signs, and notices. - Ensure regular maintenance of safety equipment and systems.
4. Record, Plan, Inform, Instruct, and Train	- Record significant findings and actions taken during the assessment. - Prepare an emergency plan detailing evacuation routes and procedures. - Inform and instruct relevant personnel on fire safety protocols. - Coordinate with emergency services and provide training on fire safety and response procedures.
5. Review	- Keep the assessment under review to adapt to any changes in the premises or operations. - Revise the assessment and associated plans where necessary, ensuring continuous improvement in fire safety measures.

In addition to the above measures, GSM Industries Ltd. would make provisions for firefighting equipment throughout the facility, ensuring readiness for any fire incident. The following equipment and services will be available:

- **Firefighting Equipment**:
    - Water sprayers for immediate suppression of small fires.
    - Fire extinguishers strategically placed in accessible locations, categorized based on the type of fire (Class A, B, C, D, E).
    - Sand buckets are for use in oil and electrical fires.
- **First Aid Medical Services**:
    - Fully equipped first aid kits available at various locations within the facility.
    - Designated personnel trained in first aid and emergency medical response.
    - Regular health check-ups for all employees to monitor well-being and address any potential health issues.

6.3.4. Measures for Emergency Response and Fire Management

To ensure fire safety and effective emergency response at GSM Industries Ltd., the following measures will be implemented:

1. **Comprehensive Firefighting Systems**:
    - Installation of **fire lines and hose pipes** throughout the facility to facilitate immediate firefighting efforts.
    - Availability of **fire extinguishers** strategically placed in key areas for quick access.
2. **Health and Safety Training**:
    - Regular training sessions will be conducted to educate staff on emergency procedures, fire safety protocols, and the correct use of firefighting equipment.
3. **First Aid Facilities**:
    - Adequate first aid kits and medical supplies will be made available at multiple locations throughout the factory to address any injuries that may occur during emergencies.
4. **Personal Protective Equipment (PPE)**:
    - The use of PPE, including masks, aprons, ear plugs, and ear muffs, will be mandated, when necessary, especially in areas with potential exposure to hazardous materials.
5. **Restroom Facilities**:
    - Separate restrooms will be provided for men and women, enhancing convenience and hygiene for all employees.
6. **Valid Fire License**:
    - The factory will maintain a valid fire license, ensuring compliance with local regulations and safety standards.
7. **Emergency Evacuation Plan**:
    - An emergency evacuation plan will be developed and clearly communicated to all staff members.
8. **Designated Emergency Staircase**:
    - The building will feature a designated emergency staircase to facilitate safe evacuation during critical situations.

6.3.5. Proposed Future Measures

To further enhance fire safety and emergency preparedness at GSM Industries Ltd., the following measures will be implemented:

- **Marked Evacuation Paths**:
  - Common evacuation paths will be clearly marked and located near stairwells for easy access, ensuring that all personnel can quickly find their way out during an emergency.
- **Safety Markings**:
  - All floors and staircases will have **safety markings** to guide occupants during an evacuation, providing visual cues that enhance the speed of response.
- **Obstruction-Free Evacuation Routes:**
  - Emergency evacuation paths will be kept free from any obstacles at all times to ensure unobstructed movement during emergencies.
- **Dual-Opening Doors**:
  - Doors will be equipped to open from both the inside and outside, facilitating quick and easy exit during emergencies.
- **Regular Drills**:
  - Fire and evacuation drills will be conducted regularly to ensure that all staff and visitors are familiar with the emergency procedures and know how to respond appropriately.
- **Emergency Lighting**:
  - Sufficient lighting will be installed along evacuation routes to ensure visibility during power outages or low-light situations, enhancing safety during an evacuation.
- **Drinking Water Quality Testing**:
  - The quality of drinking water will be tested at least twice a year to ensure it meets safety standards, contributing to the overall health and well-being of staff.
- **Hygienic Facilities**:
  - Adequate numbers of toilets will be provided, stocked with necessary supplies such as soap and water, ensuring proper hygiene and accessibility.

- **Electrical Inspections**:
    - Electrical wires, cables, and connections will undergo monthly inspections to identify and rectify potential fire hazards, ensuring all electrical systems are safe and compliant.
- **Advanced Fire Detection Systems**:
    - A more advanced fire detection system, including alarms or whistles, will be installed to provide early warning in the event of a fire, allowing for a quicker response and evacuation.

6.4. Factory Waste Management Plan

According to the US EPA, "Industrial waste is a subset of wastes generated at chemical manufacturing facilities, including factories, chemical production units, and related processing operations." This waste is typically categorized as hazardous or toxic, potentially harming the environment and public health. At GSM Industries Ltd., the different types of industrial waste generated during operations include:

- **Raw Material Residues:** Leftover raw chemicals from the manufacturing process can be harmful if not properly managed.
- **Chemical Solvents:** Solvents used in cleaning and processing production that can be hazardous to health and the environment.
- **Contaminated Water:** Effluents containing chemicals, dyes, and other pollutants released during manufacturing processes.
- **Used PPE:** Personal protective equipment, such as gloves and masks, that may be contaminated with chemicals or dyes.
- **Waste Packaging Materials:** Cardboard, plastic, and other packaging materials used for shipping and storing raw materials and finished products.
- **Cleaning Agents:** Residual cleaning agents and detergents used in maintaining equipment and facilities.
- **Sludge:** Residue from wastewater treatment processes, which may contain concentrated pollutants.

The categorization of industrial waste at GSM Industries Ltd. aligns with the guidelines set out in the Bangladesh Environmental Conservation Act and relevant regulations regarding waste management and environmental protection. Proper management and disposal of this waste are crucial to minimize environmental impact and comply with local regulations. The following

table outlines the categorization and management strategies for each type of waste generated at the facility.

Table 6.2: Category and Treatment Facilities of Different Waste

Waste Type	Description	Management Strategy
Raw Material Residues	Leftover raw materials from the production process	Recycling or safe disposal according to regulatory guidelines.
Chemical Solvents	Solvents used in cleaning and production	Hazardous waste collection and disposal by licensed contractors.
Contaminated Water	Effluents with chemicals	Treatment in accordance with wastewater treatment standards before discharge.
Used PPE	Contaminated personal protective equipment	Disposal as hazardous waste according to local regulations.
Waste Packaging Materials	Cardboard and plastic packaging	Recycling programs for recyclable materials.
Cleaning Agents	Residual cleaning agents	Proper disposal as per hazardous waste regulations.
Sludge	Residue from wastewater treatment	Safe disposal in compliance with environmental regulations.

By implementing effective waste management practices, GSM Industries Ltd. aims to minimize its environmental footprint and ensure compliance with national regulations, contributing to sustainable industrial operations

6.4.1. Waste Treatment and Disposal Plan for Solid and Liquid Waste

GSM Industries Ltd. will establish a waste management agreement with third-party contractors responsible for handling solid waste and Effluent Treatment Plant (ETP) sludge management. The waste treatment process will consist of several stages, ensuring compliance with health and environmental regulations.

Solid Waste Management

1. **Waste Generation and Collection**: Waste will be generated from various factory activities and collected in separately marked bins. Color-coded bins, aligned with waste management guidelines, will be strategically placed on different floors to facilitate proper sorting and collection.

2. **Accumulation and Segregation**: Solid waste will accumulate in designated areas once collected. The waste will be carefully sorted where necessary, with specific attention to hazardous materials, ensuring that non-hazardous waste is kept separate.

3. **Secondary Waste Storage**: The factory will maintain a secondary waste storage area for temporarily holding accumulated waste. This area will allow for safe storage until the third-party contractor collects the waste.

4. **Collection and Disposal**: A designated waste collection vehicle will transport all solid waste, except liquid waste, from the secondary storage facilities to approved disposal sites. The contractors will ensure proper disposal following environmental regulations.

Liquid Waste Management

1. **Effluent Treatment Plant (ETP)**: Liquid wastewater will be managed by a dedicated Effluent Treatment Plant (ETP) with a treatment capacity of 2 m^3/hr. The ETP will be equipped with advanced Physicochemical technology to treat wastewater generated by the factory.

2. **Treatment Process**: The ETP will employ various treatment processes, including physical and advanced chemical processes, to ensure that the treated water meets all environmental standards. The wastewater treatment plant's detailed specifications will be provided in the Annexure.

3. **Reuse and Discharge**: Treated water will be suitable for reuse within the factory, minimizing water consumption and supporting sustainable practices. Any excess treated water that cannot be reused will be discharged into the local drainage system, ultimately flowing into the Rupsa River. This discharge will comply with local environmental standards to prevent pollution and protect water quality.

The following schematic diagram gives the total management plan of factory waste.

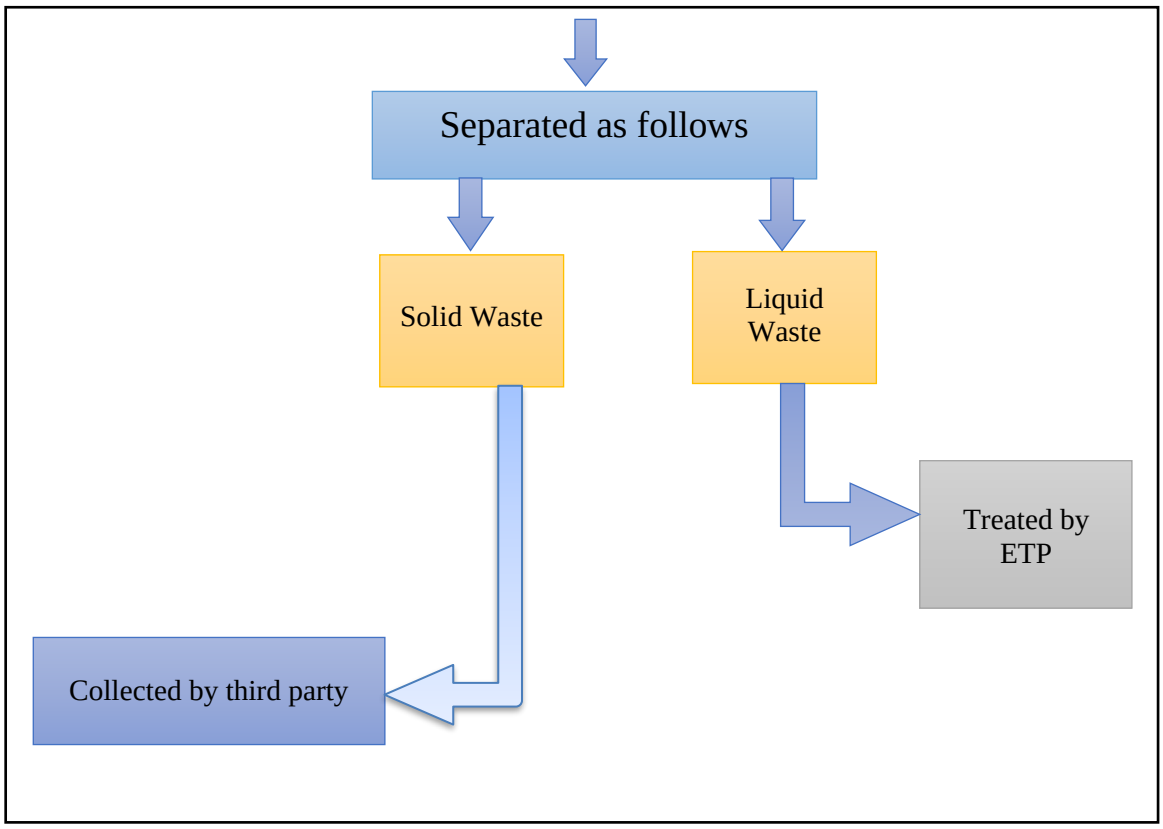


Figure 6.4: The proposed Waste Management plan of the Factory

6.4.2. Air Pollution Management Plan

GSM Industries Ltd. is committed to minimizing air pollution from chemical manufacturing operations. While the factory may have some emissions due to processes such as drying, and the operation of machinery, these sources are carefully managed to ensure that air quality remains unaffected and complies with the Environmental Conservation Rules (ECR), 2023. To further mitigate air pollution, GSM Industries Ltd. will implement the following measures:

1. **Use of Low-Emission Equipment:** The factory will utilize low-emission machines and equipment designed to minimize air pollutants. Regular maintenance and timely upgrades of these machines will ensure efficient operation and reduce harmful gas emissions.
2. **Emission Control Systems:** Appropriate emission control systems, such as scrubbers and filters, will be installed to capture and reduce volatile organic compounds (VOCs) and other harmful emissions generated during the production process. Regular checks and maintenance will ensure their optimal performance.

3. **Regular Cleaning and Maintenance:** The factory's floors and common areas will be cleaned regularly to reduce dust and odor accumulation. This practice will help maintain a hygienic environment and diminish potential air quality issues.
4. **Vehicle Management:** Efficient management of vehicles, including those used for delivery and logistics, will be enforced. Regular maintenance will be carried out to ensure compliance with emission standards and minimize their impact on air quality.
5. **Greenery and Vegetation:** The factory premises will incorporate greenery and vegetation, which will help absorb dust and filter airborne particles. This natural landscaping will serve as a buffer, improving air quality within the facility.
6. **Regular Water Sprinkling:** Water sprinkling will be conducted routinely around the factory premises to suppress dust levels. This practice will help settle the dust and prevent it from becoming airborne, contributing to cleaner air.
7. **Odor Control Measures:** Effective waste management practices will be implemented to prevent odor accumulation, particularly from dye and chemical residues. Adequate ventilation systems will be established to promote air circulation, reducing odor issues in sensitive areas.
8. **Employee Training:** Training programs will be established to educate employees on best practices for minimizing emissions and maintaining a clean environment. Employees will be encouraged to report any air quality issues promptly.

By implementing these measures, GSM Industries Ltd. will ensure compliance with air quality standards and actively work to minimize air pollution, safeguarding the health and well-being of its employees, visitors, and the surrounding community.

6.5. Noise Management Plan

At GSM Industries Ltd., noise levels will be monitored to ensure compliance with the Environmental Conservation Rules (ECR), 2023. Current measurements average around 60 dBA. The Noise Management Plan outlines strategies to effectively manage and minimize noise pollution within the chemical manufacturing operations.

Sources of Possible Noise Pollution:

1. **Chemical Production Machines:** Equipment used in the production process can generate significant noise.
2. **Drying Machines:** Industrial drying machines increase noise levels during operation.
3. **Generators:** Used for power backup, generators can emit considerable noise.

4. **Ventilation Systems:** Exhaust fans and air conditioning units in the factory can be noisy.
5. **Transportation Facilities:** Vehicles and loading equipment contribute to overall noise levels.

Mitigation Measures:

1. **Manufacturing Equipment Management**
    - **Noise-Reducing Equipment:** Invest in modern production and drying machines designed for quieter operation.
    - **Regular Maintenance:** Ensure all machines are regularly serviced to minimize noise caused by wear and tear.
    - **Noise Barriers:** Install sound-absorbing materials around high-noise machinery to dampen sound transmission.
2. **Generator Management**
    - **Enclosure:** The generator room will be fully enclosed to contain and reduce noise emissions.
    - **Protective Gear:** Staff working near generators will receive ear protection as necessary.
    - **Low-Noise Generators:** Use generators specifically designed to operate quietly.
3. **Ventilation Systems**
    - **Maintenance:** Regularly maintain exhaust fans and air conditioning units to reduce noise levels.
    - **Noise Barriers:** Implement soundproofing materials around high-noise ventilation equipment.
4. **Transportation Facilities**
    - **Vehicle Management:** Establish maintenance schedules to ensure vehicles operate quietly.
    - **Loading and Unloading Zones:** Designate specific areas for vehicle idling and loading/unloading to minimize noise impact on the work environment.
5. **General Factory Operations**
    - **Noise Protection:** Utilize sound-absorbing materials in areas prone to high noise levels.

- **Door and Window Management:** Keep doors and windows closed when not in use to limit external noise intrusion.

6. **Additional Measures**
    - **Regular Monitoring:** Conduct periodic noise level assessments to ensure ongoing compliance with ECR standards.
    - **Staff Training:** Train staff on noise reduction practices and maintaining a quiet work environment.

By implementing these measures, GSM Industries Ltd. aims to effectively manage and reduce noise pollution, thereby enhancing the comfort and well-being of employees and visitors within the factory premises.

6.6. Other Environmental Management Plan

6.6.1. Disaster Management Plan

To ensure comprehensive emergency preparedness and response, GSM Industries Ltd. has established a Disaster Management Program tailored to the unique needs of a chemical manufacturing factory. This program includes training staff and volunteers, installing and maintaining emergency equipment, and establishing a command center. The following sections outline the strategies and measures to mitigate disaster risks specific to our operations.

7.6.1.1. Objectives

- **Enhance Preparedness:** Equip staff and volunteers with the skills and knowledge needed for effective emergency response in the context of factory operations.
- **Reduce Risk:** Implement measures to minimize risks associated with potential disasters, particularly those relevant to the chemical industry.
- **Ensure Continuity:** Maintain factory operations and safety during and after emergencies, minimizing downtime and disruptions.
- **Promote Awareness:** Foster a culture of safety and preparedness among staff and the community surrounding the factory.

7.6.1.2. Current Measures to Reduce Disaster Risk

1. **Building Design and Infrastructure**
    - **Structural Integrity:** The factory will be designed with robust construction practices to withstand various emergencies, including fires and floods.
    - **Land Improvement:** Engineering solutions will prevent waterlogging and flooding in the factory area, ensuring operational continuity during heavy rains.

- **Electrical Safety:** Adherence to strict electrical safety standards will minimize the risk of electrical hazards in machinery and lighting.
- **Engineering Expertise:** Qualified engineers will be involved in designing and assessing factory infrastructure to reduce disaster risks.
- **Firefighting Measures:** Comprehensive firefighting equipment will be installed throughout the facility to mitigate fire risks effectively.

7.6.1.3. Future Measures to Further Reduce Disaster Risk

1. **Fire Risk Assessment**
   - **Regular Assessments**: Conduct comprehensive fire risk assessments annually, following established guidelines to identify and mitigate potential hazards.
2. **Fire Drills and Training**
   - **Drills**: Execute at least two fire drills annually involving firefighters, security personnel, the compliance team, and support from the district fire service and civil defense.
   - **Training**: Provide disaster risk reduction training for campus staff and students.
3. **Disaster Management Team**
   - **Formation**: Establish a dedicated disaster management team responsible for overseeing preparedness and response efforts.
4. **Seasonal Monitoring**
   - **Seasonal Vigilance**: Monitor weather conditions closely during the monsoon and cyclone seasons and prepare for potential impacts.
5. **Awareness and Education**
   - **Community Awareness**: Implement awareness programs for students and staff to increase understanding of disaster risks and preparedness strategies.
   - **Training Programs**: Conduct disaster risk reduction training sessions for all campus members.

7.6.1.4. Implementation and Review

- **Training and Equipment**: Ensure ongoing training for all staff and volunteers, and regularly inspect and maintain emergency equipment.
- **Command Center**: Operate a command center to coordinate emergency response activities effectively.
- **Plan Review**: Review and update the Disaster Management Plan regularly based on new risks, lessons learned from drills, and staff feedback.

GSM Industries Ltd. is committed to maintaining a robust Disaster Management Plan to safeguard the well-being of employees, visitors, and the surrounding community while ensuring the continuity of factory operations during emergencies.

6.7. Sequential Elements of Environmental Management Plan

The Environmental Management Plan (EMP) for GSM Industries Ltd. adopts a structured approach to effectively manage the environmental impacts of chemical manufacturing operations throughout the project lifecycle. The EMP process consists of three sequential elements:

1. **Identification of Impacts**
    - **Positive and Negative Impacts**: Identify all potential environmental impacts from the factory's operations, including beneficial and adverse effects on the natural and human environment. This encompasses air quality, water resources, noise levels, solid waste management, and community health, particularly chemical use and wastewater discharge from chemical processing.
2. **Evaluation and Assessment of Impacts**
    - **Quantification and Analysis**: To understand their significance, evaluate and quantify the identified impacts. This involves assessing these impacts against baseline environmental conditions, mainly focusing on emissions, effluent quality, and waste generation. Understanding how these impacts affect various environmental aspects and the surrounding community aids in determining the need for specific mitigation strategies.
3. **Preparation and Implementation of Management Plans**
    - **Mitigation and Protection Measures**: Develop and implement management plans to reduce or offset potentially significant adverse impacts of chemical manufacturing operations to acceptable levels. These plans may involve modifications to operational processes, implementation of specific environmental protection measures (such as effluent treatment protocols), and adoption of best practices to minimize adverse effects on air and water quality.

Monitoring and Review

- **Monitoring Plan**: Establish a monitoring plan to track the effectiveness of the implemented mitigation measures. Regular monitoring is essential to ensure that environmental protection strategies function as intended and allow for timely

adjustments based on observed performance and environmental changes, particularly concerning wastewater treatment and emissions.

- **Review Process**: Conduct periodic reviews of the EMP to address any emerging environmental concerns or changes in factory operations. This ongoing review process is crucial for maintaining compliance with environmental regulations and adapting to evolving environmental conditions, particularly to regulatory standards for chemical manufacturing.

GSM Industries Ltd. is dedicated to integrating these sequential elements into its Environmental Management Plan, promoting environmental sustainability, ensuring regulatory compliance, and enhancing the overall positive impact of the factory's chemical manufacturing operations on the community and environment.

Table 6.3: Environmental Management Action Plan for Operation Phases

Environmental Impact	Mitigation Measures	Time Frame	Location	Responsibility
Air pollution	➢ Provide adequate ventilation and exhaust fan in the workplace; ➢ Maintain open air exhaust for generator and set catalytic converter and faulty engine would be repaired as soon as possible; ➢ Plant tree near the boundary line or in the green area; ➢ Monitoring Air every 06 Months;	Throughout Operation phase	Project site	Representative of project proponent
Water pollution	➢ Per day, 2000 cubic meters of wastewater will be generated during factory operations, and an Effluent Treatment Plant will treat Wastewater. After treatment, the water is reused, and excess treated water is discharged through the drainage system.	Throughout Operation phase	Project site	Representative of project proponent
Solid waste	➢ Apply the 3R method for waste management of the project (per day waste produces around 40 KG); ➢ Trained employees on waste control and disposal procedures; ➢ Segregates wastes at source and stores in demarcated places and disposed of by **third-party contractors**.	Throughout Operation phase	Project site	Representative of project proponent

Environmental Impact	Mitigation Measures	Time Frame	Location	Responsibility
Noise and Vibration	➢ Air plugs will be provided to workers while near to noise generating equipment or working in noise areas; ➢ Procure and use low noise generating machinery; ➢ Conduct periodic maintenance of equipment, replace warn-out parts, lubricate rotating parts; ➢ Will procure noise monitoring device and monitor noise conditions in and outside the project premises; ➢ Monitoring noise condition every 06 months;	Throughout Operation phase	Project site	Representative of project proponent
Impact on soil or land	➢ Maintain Cleanliness of the Factory and store solid waste in a waste collection bin; ➢ Green belt development for enhancing the natural aesthetic of the site;	Throughout Operation phase	Project site	Representative of project proponent
Impact on traffic volume	➢ Control vehicle movement in an organized way and follow local traffic instructions;	Throughout Operation phase	Project site	Representative of project proponent
Fire/Explosion	➢ Explosion does not apply to the said project; ➢ Establish own firefighting system and maintain collaboration with government firefighting and civil defense departments locally; ➢ Organize fire drills and training for construction staff;	Throughout Operation phase	Project site	Representative of project proponent

Environmental Impact	Mitigation Measures	Time Frame	Location	Responsibility
Occupational health and safety risk	➢ Conduct job safety analysis; ➢ Use of personal protective equipment such as hard helmet, musk, boot, general glass, etc.; ➢ Aware and train employees on using safety devices;	Throughout Operation phase	Project site	Representative of project proponent
Statutory requirements	➢ Meet all statutory requirements with DoE within the time frame;	Throughout Operation phase	Project site	Representative of project proponent

Table 6.4: Environmental Management Action Plan

Issue/Concern	Potential Negative Environmental Impacts	Mitigation Measures	Environmental Monitoring	Responsible Actors	Time Frame
Water Pollution	- Surface and groundwater pollution -Occupational illness	- An Effluent Treatment Plant - Water recycling	-Monitoring of water quality	-Authority & workers - Health and safety officer	- monitoring half-yearly
Solid waste	- Air, water, and soil pollution -Poorly disposed waste may block drainage	- Proper solid waste management system - Solid waste collection, storage, and transportation system - Awareness and training campaign	- Regular monitoring of the solid waste management facilities	-Authority & workers - Health and safety officer - Prism Bangladesh Foundation	-Must be kept daily register for solid waste - Quarterly reporting

Issue/Concern	Potential Negative Environmental Impacts	Mitigation Measures	Environmental Monitoring	Responsible Actors	Time Frame
Air Pollution	- Deterioration of indoor air quality -Occupational illness/health impact	- Proper stack height for the generator -Regular maintenance of Generators -Use of PPE	-There is a negative amount of gaseous from the generator (**420 kVA and 240 KVA**). -Monitoring of Air Quality.	-Authority & workers - Health and safety officer	- monitoring half-yearly
Noise Pollution	- Hearing loss -Reduced productivity and efficiency -Fatigue, headache, nervousness, irritability, and high pretension resulting in accidents at the workplace	- Implementation of an effective noise control and hearing conservation program -Noise measurement -Providing suitable hearing protection to all workers -Training of workers	-Determine Noise levels from time to time. -Negligible sound produced by the generators.	-Authority & workers - Health and safety officer - Neighbors and - The General Public	- Half yearly Noise level monitoring

Issue/Concern	Potential Negative Environmental Impacts	Mitigation Measures	Environmental Monitoring	Responsible Actors	Time Frame
Occupational hazards	- Injury to employees on site -Injury to visitors - Reduced productivity - Plant and equipment damage -Negative corporate image	- Good and sound housekeeping practices -Provision of appropriate working tools and equipment -Use of PPE -Timely repair and maintenance of equipment -Employee training -Use appropriate elevators and other machinery	-Accident and incident records -Record of employee training	-Authority & workers - Health and safety officer	- The mitigation measures proposed should be put in alongside project implementation and daily operations, continuously improved on and sustained throughout the operation life of the factory.

Chapter Seven: Environmental Management Policy and Monitoring Plan

7.1.Issues of Environmental Management Policy

7.1.1. Issues of Environmental Management Policy

GSM Industries Ltd. will implement a comprehensive environmental management policy to meet future environmental challenges and uphold sustainability. This policy will be regularly reviewed and updated to ensure that all operations meet high environmental responsibility standards and efficient resource use. The key areas the policy will address include:

- **Compliance with Legislation**: All factory activities will comply with relevant national environmental regulations and industry standards, ensuring legal adherence in water usage, wastewater treatment, air quality control, and waste disposal specific to the chemical manufacturing industry.
- **Continuous Improvement**: The factory will promote ongoing environmental enhancements by introducing advanced monitoring systems and regularly evaluating processes. It will mainly focus on reducing water consumption, improving energy efficiency, and minimizing waste generation.
- **Resource Utilization**: Natural resources will be used efficiently, emphasizing conservation practices to ensure their availability for future generations. Water recycling and energy-efficient technologies will be prioritized in the factory's operations.
- **Balanced Approach**: GSM Industries will strive to balance industrial growth and environmental sustainability by integrating economic development with responsible resource use and environmental protection efforts.

The environmental management program will include both management responsibilities and individual employee roles to support these objectives. The following actions will be implemented to ensure the success of the program:

- **EHSMS Maintenance**: GSM Industries will maintain and continuously improve the Environment, Health, and Safety Management System (EHSMS) throughout the organization.

- **Employee Training:** All employees will receive regular training to ensure they understand their environmental responsibilities and can contribute to the effective functioning of the EHSMS framework.
- **Objectives and Targets:** Annual environmental objectives and targets will be set, and programs will be developed to achieve these goals, focusing on areas such as waste reduction, energy savings, and emissions control.
- **Legal Compliance:** The factory will ensure compliance with all applicable environmental laws and regulations, including future legal requirements that may arise due to changes in environmental policy.
- **Resource Allocation:** Resources and expertise will be allocated to meet environmental commitments and ensure GSM Industries can achieve its sustainability goals.
- **Performance Appraisal:** Environmental performance will be incorporated into the annual appraisal of employees and contractors, and recognition will be given to those who contribute to environmental improvements.
- **Monitoring and Reporting:** Regular environmental monitoring, auditing, and performance reviews will be conducted, with annual reports on progress toward achieving environmental goals and meeting EHSMS requirements.

By implementing these forward-thinking measures, GSM Industries Ltd. will establish itself as a leader in sustainable production, ensuring a minimal environmental footprint while maintaining operational excellence.

7.1.2. Occupational Health and Safety Policy

GSM Industries Ltd. will be committed to implementing a comprehensive Occupational Health and Safety (OHS) Policy as part of its broader environmental and social responsibility framework. This policy will be regularly reviewed and updated to ensure it addresses the health, safety, and welfare of all employees and the surrounding community. The policy will focus on the following key areas:

- **Safety Measures:** The factory will implement rigorous safety protocols for all machinery and equipment used in chemical manufacturing operations. Regular inspections will ensure that all equipment operates safely.
- **Emergency Procedures:** GSM Industries will develop and enforce robust procedures to minimize risks and manage accidents that could affect employees, the community, or the environment. Emergency drills will be conducted to ensure preparedness.

- **Training and Maintenance:** Proper maintenance schedules will be established, and comprehensive safety training programs will be provided for all machine operators to ensure they are fully proficient in handling the equipment safely.
- **Personal Protective Equipment (PPE):** The factory will ensure that all employees working in high-risk areas, including those handling chemicals or operating heavy machinery, have access to and consistently use appropriate PPE, such as masks, gloves, aprons, and safety goggles.

To promote best practices in health and safety management, GSM Industries Ltd. will undertake the following actions:

- **EHSMS Improvement:** The factory will continuously improve its Environment, Health, and Safety Management System (EHSMS), ensuring all health and safety protocols are up to date and effective in protecting workers.
- **Health and Safety Focus:** Efforts will be balanced between managing employee health, ensuring personal safety, and addressing process safety within the factory, with a strong emphasis on safe chemical handling and machinery operation.
- **Hazard Identification:** Proactive measures will be taken to identify potential hazards in the workplace. Risks will be managed to ensure they are kept as low as reasonably practicable, particularly in chemical storage and mechanical processes.
- **Employee Engagement:** GSM Industries will encourage active employee participation in health and safety initiatives. Workers will be consulted regularly on safety concerns, and they will be empowered to suggest improvements for their own and others' safety.
- **Resource Allocation:** Adequate resources, including budget, manpower, and expertise, will be allocated to support the systematic management of health, safety, and environmental processes to achieve continuous improvement.
- **Performance Measures:** The factory will establish apparent health and safety performance metrics, set improvement targets, and regularly measure and report progress at all organizational levels.
- **Legal Compliance:** GSM Industries will fully comply with all applicable legal and regulatory requirements related to occupational health and safety, including Bangladesh’s safety standards for industrial operations.
- **Safety Culture:** A strong safety culture will be fostered, where all employees remain vigilant about identifying and addressing safety hazards. Health and safety performance

will be integrated into employee appraisals, recognizing and rewarding those demonstrating adherence to safety protocols.

7.1.3. Local Community Policy

GSM Industries Ltd. will be dedicated to fostering strong and positive relationships with its employees and the local community. The factory's Local Community Policy will emphasize mutual respect, active partnership, and collaboration to support the well-being and development of the community. The key focus areas of this policy will include:

- **Collaboration:** GSM Industries will work closely with local communities, government agencies, and relevant stakeholders to support sustainable development initiatives. This will include contributing to local infrastructure, education, and employment opportunities, aligning with the community's needs.
- **Communication:** The factory management will prioritize transparent and open communication with the local community, regularly sharing information about factory activities, environmental impacts, and social initiatives. Feedback channels will be established to ensure effective engagement with both employees and local residents.
- **Capacity Building:** GSM Industries will actively involve the local community in factory activities, including corporate social responsibility (CSR) projects, environmental awareness campaigns, and skill development programs. This engagement will help build local capacity and empower community members to participate in decision-making that impacts their livelihoods and the environment.

7.1.4. Pollution Control Policy

GSM Industries Ltd. will establish a comprehensive Pollution Control Policy aligned with its Environmental Management Plan (EMP) to prevent and manage pollution effectively. This policy will focus on mitigating the environmental impacts of factory operations in the chemical manufacturing process. Key components of the policy will include:

- **Pollution Prevention:** GSM Industries will ensure that its factory operations prevent pollution on the premises and in the surrounding areas. Strict operational controls will be in place to minimize emissions, discharges, and waste generation.

- **Waste Management:** The factory will implement robust pollution control measures across various waste streams, including:
    - **Liquid Waste:** All liquid waste will be treated using an advanced Effluent Treatment Plant (ETP) designed specifically for the chemical manufacturing processes. This system will ensure that treated water meets regulatory standards before reuse or discharge.
    - **Gaseous Effluents:** Emissions from boilers, generators, and other factory processes will be managed through the installation of emission control systems. Incinerator emissions, if any, will be treated using a scrubbing process to minimize air pollution.
    - **Solid Waste:** Solid waste generated during production will be carefully segregated, collected, and disposed of in compliance with national environmental standards. Open dumping will be strictly prohibited, and waste will be disposed of through environmentally safe methods or by a third party.
    - **Hazardous Waste:** Hazardous waste, including sharp or contaminated materials, will be stored in secure, reinforced concrete containers (RCC tanks) to prevent leaks or environmental contamination until safe disposal by licensed third parties.
- **Environmental Safety:** GSM Industries will take all necessary measures to maintain a safe and clean environment for workers and the community. Regular audits and monitoring will ensure compliance with pollution control policies, and any potential risks will be promptly addressed.

7.2.Environmental Monitoring Plan

Monitoring will be a critical component of the Environmental Management Plan (EMP) at GSM Industries Ltd. Regular monitoring will help determine whether the recommended mitigation and enhancement measures effectively maintain environmental quality. Various types of monitoring, including water, air, and noise, will be carried out periodically to assess pollution levels both within the factory premises and in the surrounding areas.

7.2.1. Monitoring Parameters and Frequency

Based on the collected monitoring data, GSM Industries will evaluate the need for additional or enhanced mitigation measures to ensure pollution levels remain within government-

recommended limits. The following table outlines the parameters and frequency of environmental monitoring activities.

Table7.1 Monitoring Parameters & Frequency

Issue	Location of Monitoring	Parameters	Monitoring Frequency	Responsible Unit/Person
Solid Waste Generation	Every floor, production area, and premises	Volume and type of solid waste generated	Daily	Environmental Management Department
Wastewater Discharge	Effluent Treatment Plant (ETP) inlet and outlet drains	pH, BOD, COD, Temperature, TSS, etc.	Every three months	ETP Manager and Environmental Officer
Stack Emissions & Ambient Air Quality	Generator rooms, boiler area, incinerator, and surrounding factory site	Air pollutants from emissions	Not mandatory	Maintenance Department
Hazardous Waste Generation	Production areas, chemical storage rooms	Chemical waste, hazardous byproducts, sharp waste	Daily	Production and Safety Team
Workplace Environment	Factory premises	Light, air quality, noise levels, temperature, humidity	Every three months	Health and Safety Department
Noise Levels	Various locations within the factory premises	Noise levels during the day and night	Every three months	Health and Safety Department
Drinking Water Quality	Drinking water outlets	pH, total alkalinity, hardness, TDS, arsenic, iron, chloride, fecal coliform	Every six months	Maintenance and Environmental Management Team

Chapter Eight: Analysis of Alternatives

This chapter evaluates various alternatives to the proposed chemical manufacturing factory project by GSM Industries Ltd., considering environmental, social, and economic factors. Each alternative is assessed to determine its implications for chemical manufacturing operations, community impact, and environmental sustainability.

8.1.Do Nothing

Description: This alternative considers not proceeding with the proposed factory project, leaving GSM Industries Ltd.

Implications:

- **Production Capacity:** The current facilities may struggle to meet the increasing demands for chemical manufacturing, potentially limiting the company's ability to serve clients and customers efficiently.
- **Community Impact:** The lack of new factory development may limit employment opportunities and hinder local economic growth. Additionally, not proceeding could lead to missed opportunities for community skills development and capacity building.
- **Environmental Impact:** Construction or factory operations would not create new environmental impacts.
- **Costs and Benefits:** While avoiding upfront construction and operational costs, this option would forgo the potential benefits of expanded production capacity, economic development, and enhanced environmental controls.

8.2.Alternative Land Use

Description: This alternative involves repurposing the designated factory site for other uses, such as community development projects, commercial establishments, or public spaces.

Implications:

- **Community Development:** Repurposing the land for parks, educational facilities, or commercial ventures could provide public amenities, stimulate economic growth, and improve the overall quality of life in the area.

- **Chemical Production:** Not developing the chemical manufacturing factory would prevent GSM Industries from addressing the rising chemical manufacturing services, leading to potential bottlenecks in production and affecting business competitiveness.
- **Environmental Impact:** Environmental impacts could vary depending on the alternative use. A community park could offer green space and environmental benefits, while commercial ventures might increase pollution or strain local resources.
- **Costs and Benefits:** This alternative may yield short-term community and economic benefits but fails to address the growing need for efficient and sustainable chemical manufacturing operations**.**

8.3.Alternative Land Site

Description: This alternative considers relocating the proposed factory to a different site in Dhaka or nearby areas. The new site would be selected based on accessibility, environmental impact, and site suitability.

Implications:

- **Accessibility:** Relocating the factory could offer better logistical advantages or resource access, potentially improving production efficiency. However, the relocation must be strategically planned to ensure the site meets the factory's operational requirements.
- **Environmental Impact:** A new location might reduce environmental disturbances if the site is better suited for industrial development. However, relocating would require additional environmental assessments, land preparation, and infrastructure development, which could lead to delays.
- **Costs and Benefits:** Relocating the factory would involve significant additional costs, including land acquisition, infrastructure development, and potential delays in project timelines. However, it could address concerns about environmental or community impacts at the current site.
- **Community Impact:** The success of this alternative depends on the new site's proximity to workers and its potential to create jobs and contribute to local economic development.

8.4.Conclusion

Each alternative presents distinct advantages and challenges:

- **Do Nothing:** This option avoids construction and environmental impacts but fails to address production limitations or community development needs.
- **Alternative Land Use:** This option could provide community and economic benefits but does not resolve the growing demand for chemical manufacturing services.
- **Alternative Land Site:** Relocating the factory may offer better site-specific advantages but involves added costs, delays, and environmental uncertainties.

After evaluating the alternatives, it is concluded that proceeding with the current site for GSM Industries Ltd.'s factory is the most suitable option. This site aligns with the company's goals and offers several advantages.

a. **Serving the Surrounding Area:** The existing location is strategically positioned to serve the local population and meet the increasing demand for chemical manufacturing services. Its central location ensures that the factory can operate efficiently, contributing to GSM Industries' competitiveness in the chemical industry.
b. **Economic Growth:** Developing the factory at this location will create jobs, stimulate local businesses, and enhance the region's economic infrastructure. The factory's presence may also attract further investment and contribute to broader economic development.
c. **Cost Efficiency:** Utilizing land owned by GSM Industries Ltd. reduces the need for additional land acquisition, thereby lowering upfront costs. This allows the company to invest more resources into sustainable technology and production enhancements.
d. **Environmental Considerations:** The current site has already undergone environmental assessments, and proceeding with the development avoids the challenges and delays associated with new site assessments and approvals. Moreover, the proposed factory will incorporate advanced environmental management practices, including efficient wastewater treatment and emission controls.
e. **Meeting Production Needs:** The existing site is well-suited to meet the increasing demand for processing services. It provides the necessary infrastructure for expanding chemical manufacturing capacity, ensuring that GSM Industries can continue to meet client demands without the complications of relocating or repurposing the land.

In conclusion, the current site offers the optimal solution for GSM Industries Ltd.'s factory project. It supports production goals, contributes to local economic development, and aligns with the company's commitment to environmental sustainability. This approach avoids alternative sites' additional costs and environmental impacts while addressing the growing demand for chemical manufacturing services.

Chapter Nine: Decommissioning Plan

The decommissioning plan for GSM Industries Ltd. outlines a comprehensive strategy to safely dismantle the chemical manufacturing facility, minimize environmental impacts, and restore the site for future use. The plan ensures the decommissioning process is executed responsibly, following all environmental and regulatory guidelines. Each component of the plan is detailed below:

9.1.Project Closure Notification

- **Notification Process:**
    - **Regulatory Bodies:** Notify relevant government agencies, including the Department of Environment and local authorities, about the planned decommissioning activities. Compliance with environmental regulations and local ordinances will be ensured throughout the process.
    - **Stakeholders:** Inform key stakeholders such as employees, contractors, suppliers, and the local community about the project's closure. This transparent communication will help address employment, safety, and environmental concerns.
    - **Public Communication:** Use local media, community meetings, and public notices to inform residents about the decommissioning schedule and potential impacts. This will maintain public trust and ensure smooth communication with the community.
- **Documentation:**
    - **Decommissioning Plan Documentation:** Prepare detailed documentation outlining the decommissioning procedures, safety measures, and contact details for the project managers responsible for overseeing the process.
    - **Regulatory Compliance Records:** Ensure that all necessary permits, approvals, and regulatory documents are current and accessible for review during the decommissioning phase.

9.2.Site Assessment

- **Pre-Demolition Assessment:**
    - **Site Survey:** Conduct a comprehensive site survey to assess current conditions, including the structural integrity of factory buildings, environmental quality,

and the presence of hazardous materials such as reagents or chemicals used in production processes.

- **Review Historical Data:** Analyze historical records of factory operations, maintenance, and environmental assessments to identify potential hazards or risks related to past activities at the site.

- **Hazard Identification:**
  - **Hazardous Materials:** Identify and catalog hazardous materials such as chemical residues, solvents, and dyes used in processing. Specialized services will be employed to handle and dispose of these materials safely.
  - **Risk Assessment:** Conduct a risk assessment to evaluate hazardous substances' potential health and environmental risks. Safety measures will be implemented to protect workers and prevent environmental contamination.

9.3.Dismantling and Removal

- **Dismantling Procedures:**
  - **Detailed Plan:** Develop a structured plan outlining how the facility's structures, machinery, and systems will be safely dismantled. This includes decommissioning chemical manufacturing equipment, drying machines, and other factory infrastructure.
  - **Safety Measures:** Implement safety protocols to protect workers and the surrounding community. This includes using safety barriers, clear signage, and an emergency response plan in case of accidents.
- **Equipment Removal:**
  - **Decommissioning Equipment:** Safely decommission and remove factory equipment, especially machines that contain hazardous components such as solvents, chemical residues, or sharp tools.
  - **Special Handling:** Machines and equipment containing hazardous materials will be handled following strict guidelines to ensure safe disposal or recycling.
- **Structural Demolition:**
  - **Demolition Methods:** Employ appropriate demolition methods for factory buildings. This may include mechanical demolition, dismantling by hand, or controlled demolition techniques.

- **Debris Management:** Segregate demolition debris into recyclable materials (such as metal and concrete) and non-recyclable waste. Ensure that debris is transported and disposed of in accordance with local environmental regulations.

9.4.Waste Management

- **Waste Categorization:**
  - **Types of Waste:** Categorize waste generated during decommissioning into hazardous waste (such as chemical residues, dyes), non-hazardous waste (general building materials), and recyclable waste.
  - **Waste Tracking:** Implement a waste tracking system to monitor and document the types and quantities of waste generated, as well as their disposal or recycling methods.
- **Disposal Procedures:**
  - **Licensed Contractors:** Partner with licensed waste disposal contractors to ensure the proper handling and disposal of hazardous and non-hazardous waste. All waste disposal activities will be compliant with national and international regulations.
  - **Compliance:** Ensure that waste management and disposal are conducted in compliance with environmental regulations, and all documentation is maintained for regulatory review.
- **Recycling and Reuse:**
  - **Recycling Programs:** Establish recycling initiatives for materials such as metals, wood, and concrete. Work with local recycling facilities to minimize waste and promote sustainability.
  - **Reuse Opportunities:** Explore opportunities to repurpose or reuse equipment and materials in other projects, or donate items that may be valuable to local organizations.

9.5.Soil and Water Remediation

- **Soil Testing:**
  - **Sampling and Analysis:** Conduct soil sampling and laboratory analysis to detect any contamination from chemicals or dyes used in the factory's operations.

  - **Contamination Mapping:** Identify and map areas of contamination to target remediation efforts efficiently and prevent further environmental damage.
- **Remediation Measures:**
  - **Treatment Methods:** Apply appropriate remediation techniques such as soil excavation, soil washing, or bioremediation to remove or neutralize contaminated soil.
  - **Regulatory Compliance:** Ensure all remediation activities comply with environmental guidelines and regulatory standards.
- **Water Quality Monitoring:**
  - **Testing:** Conduct regular tests on surface and groundwater near the site to check for any contamination from chemicals or other hazardous materials.
  - **Treatment:** If contamination is found, implement water treatment solutions to clean the water before releasing it back into the environment.

9.6.Site Restoration

- **Restoration Plan:**
  - **Land Regrading:** Regrade the land to restore it to its natural condition or prepare it for future development. Fill any excavations and level the ground where necessary.
  - **Vegetation:** Plant trees, grasses, and other vegetation to stabilize the soil and prevent erosion. This will also improve the visual appeal of the area and promote biodiversity.
- **Final Inspection:**
  - **Inspection Checklist:** Conduct a thorough final inspection to ensure all decommissioning and restoration activities have been completed according to the plan.
  - **Regulatory Approval:** Obtain approval from relevant authorities to confirm that the site is environmentally safe and restored to a satisfactory condition.

9.7.Monitoring and Reporting

- **Ongoing Monitoring:**
  - **Environmental Monitoring:** Implement a monitoring program to track environmental conditions, such as soil and water quality, after the decommissioning process. This helps ensure no residual contamination.

- **Periodic Reviews:** Conduct periodic reviews to assess the long-term success of the remediation and restoration efforts.

- **Reporting:**
  - **Final Report:** Prepare a final report that details all decommissioning activities, waste management practices, and site restoration efforts.
  - **Stakeholder Communication:** Share the final report with key stakeholders, including regulatory bodies, community representatives, and GSM Industries management.

9.8.Health and Safety

- **Health and Safety Plan:**
  - **Risk Assessment:** Perform a risk assessment to identify potential hazards during decommissioning, particularly when handling hazardous materials or equipment.
  - **Safety Measures:** Implement safety measures such as personal protective equipment (PPE), worker training, and strict safety protocols to minimize risks.
- **Risk Management:**
  - **Accident Prevention:** Regular safety audits, inspections, and staff training will be carried out to prevent accidents or injuries.
  - **Emergency Response:** Develop a plan to manage incidents like chemical spills or accidents during decommissioning.

By addressing these components, GSM Industries Ltd. ensures a responsible and thorough approach to decommissioning the chemical manufacturing factory. This plan aims to protect the environment, ensure public and worker safety, and prepare the site for future sustainable use.

Chapter Ten: Public Consultation

10.1. Introduction

The public consultation for the proposed chemical manufacturing facility project by GSM Industries Ltd., located at Gutudia, Dumuria, Khulna, will be conducted to gather input on the project's potential environmental and socio-economic impacts. This consultation will aim to facilitate open and transparent communication between the project developers and the local community. Through various engagement activities, including public meetings and interviews, community members and stakeholders will be invited to share their concerns, suggestions, and expectations regarding the project's environmental footprint, socio-economic effects, and proposed mitigation strategies. The feedback gathered from these consultations will be instrumental in shaping the Environmental Impact Assessment (EIA) report, ensuring that the project aligns with community interests and promotes sustainable development in the area.

10.2. Objectives of Public Consultation and Disclosure Meeting

The objectives of the public consultation for the proposed chemical manufacturing facility project by GSM Industries Ltd. at Gutudia, Dumuria, Khulna, are outlined below:

- **Engagement and Inclusion:** To actively engage the local community, stakeholders, and relevant authorities in the decision-making process, ensuring their opinions, concerns, and feedback are collected and considered.
- **Information Sharing:** To provide clear and comprehensive information about the project’s objectives, scope, location, potential impacts, and proposed mitigation strategies, thereby fostering transparency and understanding among all participants.
- **Addressing Concerns:** To offer a platform for participants to express their concerns, ask questions, and share perspectives on potential environmental, socio-economic, and community impacts associated with the chemical manufacturing facility.
- **Gathering Feedback and Suggestions:** To solicit valuable feedback and suggestions from participants on how to minimize negative impacts, enhance positive outcomes, and incorporate sustainable development practices throughout the project's lifecycle.
- **Promoting Collaboration:** To promote collaboration and partnership between project developers, local community members, stakeholders, and relevant authorities, aiming to achieve a shared understanding and alignment on the project’s vision and objectives.

- **Influencing Decision-Making:** To ensure that the input gathered during the public consultation process significantly influences the decision-making process, project design, and the development of the Environmental Impact Assessment (EIA) report.
- **Building Trust:** To build trust and credibility between GSM Industries Ltd. and the local community by actively listening to concerns, responding to inquiries, and integrating meaningful feedback into the project's planning, implementation, and monitoring phases.

10.3. Approach and Methodology of Public Consultation and Disclosure Meeting

The approach and methodology for the public consultation and disclosure meeting for GSM Industries Ltd.'s proposed chemical manufacturing facility project at Gutudia, Dumuria, Khulna, aim to ensure effective communication, meaningful engagement, and transparency. The following steps outline the suggested approach and methodology for the public consultation:

10.3.1. Preparing for the Consultation:

- **Identify Key Stakeholders:** Engage with relevant stakeholders, including local community members, government authorities, non-governmental organizations (NGOs), manufacturing professionals, and environmental experts, who may have an interest in or be impacted by the project.
- **Define Objectives and Scope:** Clearly outline the objectives of the consultation, the key topics for discussion, and the scope of the process to provide clear guidance for the meeting.
- **Develop an Engagement Plan:** Prepare a comprehensive engagement plan that details the activities, timeline, and resources required to conduct the consultation process effectively.
- **Information Preparation:** Gather all relevant project information, such as project plans, Environmental Impact Assessment (EIA) findings, and proposed mitigation measures, to be shared with participants to facilitate informed discussions.

10.3.2. Communication and Outreach:

- **Publicize the Meeting:** Use a variety of communication channels, including local newspapers, radio stations, community notice boards, social media platforms, and

direct invitations, to inform the community about the consultation meeting and invite their participation.

- **Multilingual Support:** Provide translation services or materials in local languages to ensure all participants, regardless of language barriers, can engage effectively in the consultation.
- **Engage Local Leaders and Influencers:** Collaborate with local community leaders, respected elders, and influencers to spread the word about the meeting and encourage widespread participation.

10.3.3. Consultation Meeting:

- **Facilitate Open Discussion:** Create a welcoming and inclusive environment that encourages open dialogue. Facilitators should ensure that all attendees have the opportunity to voice their opinions, ask questions, and share their concerns without fear of bias or intimidation.
- **Present Project Information:** Begin the meeting with a clear and concise presentation of the project's overview, its purpose, potential environmental and socio-economic impacts, and the proposed mitigation measures. Use visual aids and straightforward language to enhance understanding.
- **Q&A and Interactive Sessions:** Allocate ample time for participants to ask questions, seek clarifications, and provide feedback. Foster interactive discussions that allow for diverse perspectives and ideas to be shared.
- **Workgroup Activities:** Organize smaller workgroup activities or breakout sessions focused on specific issues or concerns. This approach ensures deeper engagement and allows participants to discuss topics more thoroughly.

10.3.4. Disclosure of Information:

- **Transparent Information Sharing:** Provide all participants with access to relevant project documents, reports, and studies, ensuring complete transparency in the disclosure of project-related information.
- **Written Submissions:** Encourage participants to submit written feedback or complete feedback forms to capture their concerns, suggestions, and recommendations in a structured and organized manner.

- **Follow-Up Communication:** Commit to sharing a comprehensive summary of the meeting, including key points discussed, concerns raised, and proposed actions, to keep all participants informed and maintain transparency.

10.3.5. Evaluation and Incorporation:

- **Evaluate Feedback:** Carefully analyze the feedback and input received during the consultation process to identify recurring themes, concerns, and valuable suggestions.
- **Incorporate Feedback:** Utilize the feedback to refine project plans, adjust mitigation measures, and address community concerns to the greatest extent possible, demonstrating a commitment to responsive and responsible project planning.
- **Communication of Outcomes:** Communicate the outcomes of the consultation process, highlighting how the input received has influenced decision-making, and detailing any modifications made to the project based on the feedback provided by participants.

Chapter Eleven: Conclusion

The proposed site for GSM Industries Ltd., dedicated to chemical manufacturing, is strategically located at Gutudia, Dumuria, Khulna. This location was chosen due to its excellent road connectivity, reliable electricity supply, and access to essential services. Additionally, the site benefits from adequate groundwater resources, which are vital for the operational needs of the chemical manufacturing facility.

The current Environmental Impact Assessment (EIA) report comprehensively evaluates the potential environmental and socio-economic impacts associated with the project. It underscores the necessity of implementing thorough mitigation measures to manage these impacts effectively. Key measures identified include properly handling wastewater, ensuring water reuse and treatment, and adhering to stringent environmental controls to minimize pollution associated with the chemical manufacturing processes.

The project's success is contingent upon strict adherence to the Environmental Management Plan (EMP) detailed in this report. By following the recommended practices, GSM Industries Ltd. will ensure a safe and sustainable environment for its employees and the surrounding community. The facility is committed to maintaining high environmental protection and sustainability standards throughout its operations.

The management of GSM Industries Ltd. has demonstrated a proactive approach to addressing environmental challenges. Initial sustainability measures have already been implemented, and the remaining actions outlined in the EMP will be executed without delay. This commitment will enable the company to meet and exceed regulatory requirements and environmental standards.

The project is poised to become a leading chemical manufacturing facility in Khulna Division, recognized for its innovative processes and commitment to environmental stewardship. With the ongoing support and dedication of the management and staff, GSM Industries Ltd. is set to significantly impact the community and the chemical industry in Bangladesh, fostering sustainable practices that benefit both the environment and the economy.

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Annexure

Annexure A: Wastewater Treatment Plant (ETP) Detail, Calculation, Design and Drawings

Annexure B: Company Profile with Factory Process Flow

Annexure C: Location Maps

Annexure D: Additional Documents

Annexure E: Test Reports