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## Project summary table

Section	Parameter	Details
<b>1. Project Identification</b>	Name of Project / M/S	M/s ACM Lithium Batteries (Pvt) Limited
	Project Location	Plot No. 18 and 22, situated on NS-1 Road, Rawat Industrial Estate, Rawalpindi
	Geographical Coordinates	Latitude: 33°30'54.62"N Longitude: 73°14'4.63"E
<b>2. Proponent Information</b>	Proponent Name	Muhammad Mustafa bin Talha
	CNIC	61101-7154207-9
	Proponent Address	Plot No. 22, NS-1 Road, Rawat Industrial Estate, District Rawalpindi
<b>3. Project Overview</b>	Total Project Cost	Rs. 500 Million
	Project type	Proposed
	Process Description	Factory for assembly of Lithium Batteries for automotive, deep-cycle, stationery, and telecom batteries
	Land Area and Ownership	(4800 square yards/ 8 kanals
	Allied Facilities	Warehouse, Admin Block, Utilities, Generators, Boilers etc.
<b>4. Waste Management</b>	Types of Waste	Solid Waste, Plastic, Hazardous, Organic, E-Waste
	Estimated Waste Generation	Approximately 400 kg to 600 kg of total waste generated per month.
	Waste Handling Measures	Segregation, Storage, Transport
	Final Disposal Plan	Recyclers
<b>5. Wastewater Management</b>	Coordinates of WWTP	Latitude: 33°33'54.92"N Longitude: 73°24'4.93"E
	Treatment Method	(Primary / Secondary / Tertiary)
	Disposal Method & Location	Irrigation
<b>6. Rainwater Harvesting</b>	Harvesting Infrastructure	Pits, Storage Tanks, Recharge Wells
	Collection Source	Rooftop / Surface Runoff

	Implementation Status	Planned														
<b>7. Plantation &amp; Green Development</b>	Proposed Green Area	5 to 7% of the total project area														
	Tree Types and Numbers	<table border="1"> <thead> <tr> <th>Species (Botanical Name)</th> <th>Common Name</th> <th>Proposed Quantity</th> </tr> </thead> <tbody> <tr> <td><b>Azadirachta indica</b></td> <td>Neem</td> <td>25</td> </tr> <tr> <td><b>Dalbergia sissoo</b></td> <td>Sheesham</td> <td>20</td> </tr> <tr> <td><b>Cassia fistula</b></td> <td>Amaltas</td> <td>15</td> </tr> <tr> <td><b>Eucalyptus camaldulensis</b></td> <td>Sufeda</td> <td>10</td> </tr> </tbody> </table>	Species (Botanical Name)	Common Name	Proposed Quantity	<b>Azadirachta indica</b>	Neem	25	<b>Dalbergia sissoo</b>	Sheesham	20	<b>Cassia fistula</b>	Amaltas	15	<b>Eucalyptus camaldulensis</b>	Sufeda
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<b>Cassia fistula</b>	Amaltas	15														
<b>Eucalyptus camaldulensis</b>	Sufeda	10														
<b>8. CSR &amp; Community Welfare</b>	CSR Budget	3-5 % of the total project Cost														
	Activities	Health & Safety Education Environment & Sustainability Water, Sanitation & Hygiene (WASH) Livelihood & Skill Development Community Engagement & Welfare														

# Executive Summary

## 1. Title and Location of the Project

### Project Title:

Proposed Establishment for assembly of Lithium Battery Assembly under the name of **ACM Lithium Batteries (Pvt.) Ltd.**

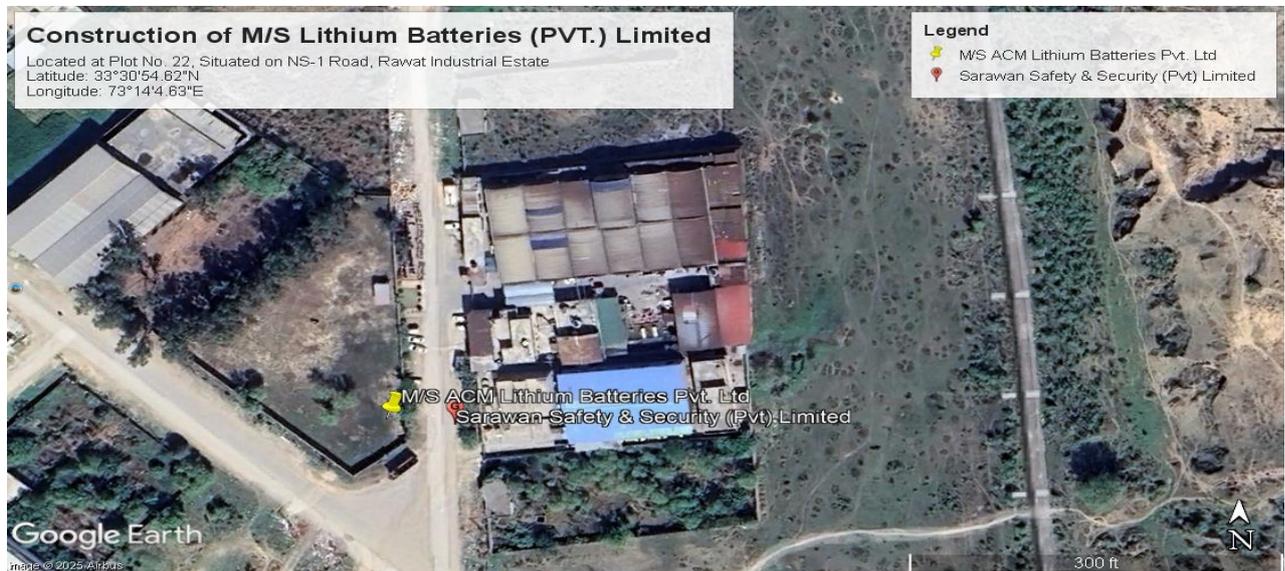
### Project Location:

Plot No.18 and 22, situated on NS-1 Road, RCCI Industrial Estate, Rawat, Rawalpindi, Punjab, Pakistan. The site is located within a formally designated and managed industrial estate that provides essential services such as internal roads, utilities, drainage, and solid waste collection systems, making it an ideal location for industrial operations involving battery technology.

### Geographical Coordinates:

- Latitude: 33°30'54.62"N
- Longitude: 73°14'4.63"E

The area is free from ecologically sensitive receptors, residential settlements, or any heritage sites, thus significantly minimizing off-site environmental risks.



## 2. Name of the Proponent

- **Company Name:** ACM Lithium Batteries (Pvt.) Ltd.
- **Authorized Representative:** Muhammad Mustafa Bin Talha
- **Contact No.:** 0324-5351520

The proponent is committed to sustainable industrial growth and plans to manufacture lithium-ion battery packs using safe, modern, and energy-efficient methods compliant with international standards and Pakistani environmental laws.

### 3. Name of the Organization Preparing the Report

The EIA report has been prepared by:

- **Consultant:** Pak Green Enviro-Engineering (Pvt.) Ltd.
- **Office Address:** 46-M, Gulberg III, Lahore
- **Contact:** 042-35441444, 0303-4442335

Pak Green Enviro-Engineering (Pvt.) Ltd. is registered with the Punjab Environmental Protection Agency and is experienced in conducting impact assessments for industrial projects including electronics, automotive, and clean energy sectors.

### 4. Brief Outline of the Proposal

#### Project Overview

ACM Lithium Batteries (Pvt.) Ltd. intends to establish a state-of-the-art lithium battery assembly facility for the production of advanced battery packs, including automotive, deep cycle, stationary, and telecom batteries. These battery packs will be used in electric vehicles (EVs), energy storage systems, and various backup power applications. The facility will focus on the assembly of imported battery cells, integration of Battery Management Systems (BMS), and quality testing prior to market release.

The facility is spread across approximately 4800 yards/ 8 kanals and will include production areas, warehousing, administrative blocks, and battery testing laboratories. All operations will be conducted in enclosed buildings with emissions and waste managed according to national environmental regulations.

#### Objectives of the Project

- To locally assemble lithium-ion batteries for the domestic EV and renewable energy markets.
- To reduce import dependency and support indigenous battery manufacturing.
- To create skilled employment opportunities in the energy storage sector.
- To promote green technology adoption and support Pakistan's climate commitments.

## 5. Scope and Need for the EIA

As per the **Pakistan Environmental Protection Act, 1997** and **Punjab Environmental Protection Rules, 2012**, battery assembly plants involving hazardous materials such as lithium and electronic waste require an Environmental Impact Assessment (EIA). This is due to the potential risks to air quality, worker health, fire hazards, and hazardous waste generation.

The EIA for ACM Lithium Batteries assesses all phases of the project planning, construction, and operation and provides mitigation and monitoring strategies to ensure sustainable, compliant, and low-impact industrial development.

## 6. Key Environmental Aspects Considered

The following environmental domains were assessed:

- **Physical Environment:** Air quality, noise levels, soil contamination risks, and water availability.
- **Ecological Environment:** Presence of flora and fauna within the RCCI Industrial Estate and buffer zones.
- **Socioeconomic Environment:** Employment generation, infrastructure development, and interaction with nearby communities and industries.

The site is free from environmentally sensitive areas, natural waterways, or settlements. Its location within a controlled industrial estate ensures a well-contained environmental footprint.

## 7. Environmental Management and Mitigation Measures

The EIA has identified several minor to moderate environmental impacts that can be **effectively mitigated** through practical engineering and procedural controls. These include:

- **Air emissions** from vehicle traffic and standby generators will be minimized using EURO-compliant engines and proper ventilation systems.
- **Solid waste**, including packaging, will be sorted at source, and recyclables will be sold to licensed vendors.
- **Hazardous waste**, such as rejected cells and damaged components, will be stored in sealed containers and disposed of through EPA-approved handlers.
- **Fire safety** will be managed through fire suppression systems, thermal sensors, and staff training in lithium fire response protocols.

- **Rainwater harvesting** and green landscaping will be used to manage runoff and promote sustainable site development.

An **Environmental Management and Monitoring Plan (EMMP)** has been prepared and will be implemented throughout the project lifecycle.

## 8. Proposed Environmental Monitoring Program

To ensure the effectiveness of mitigation and compliance measures, a robust monitoring plan will be adopted, including the following parameters:

<b>Parameter</b>	<b>Project Phase</b>	<b>Frequency</b>	<b>Responsible</b>
Ambient Air Quality	Construction/Operation	Quarterly	Third-party Lab + Site Officer
Noise Levels	Both Phases	Bi-annually	HSE Supervisor
Groundwater Quality	Operational Phase	Bi-annually	Environmental Officer
Waste Segregation Logs	Ongoing	Weekly	Site Environmental Technician
Fire & Safety Drills	Operational Phase	Bi-annually	Facility Manager

These results will be documented and reported to the **Punjab Environmental Protection Agency (EPA)** on a quarterly basis.

## 9. Conclusion

The findings of this EIA clearly indicate that the proposed project by ACM Lithium Batteries (Pvt.) Ltd. is environmentally viable, technically feasible, and socially beneficial. Given its location within a fully equipped industrial estate and its alignment with clean energy objectives, the project is expected to bring long-term benefits with minimal environmental risk, provided that the mitigation and monitoring framework is followed in full. It is therefore recommended that the project be granted environmental clearance

# Chapter 1

## Introduction

### 1.1 Purpose of the Report

This Environmental Impact Assessment (EIA) Report has been prepared to fulfill the legal requirement under Section 12 of the Pakistan Environmental Protection Act (PEPA), 1997, and in compliance with the Punjab Environmental Protection (Review of IEE and EIA) Regulations, 2000. The purpose of this report is to identify, predict, and evaluate the potential environmental and social impacts associated with the establishment of a lithium battery assembly facility, and to develop appropriate mitigation and monitoring measures that ensure the protection of the environment and public health.

The report aims to assist the Punjab Environmental Protection Agency (Punjab-EPA) in decision-making regarding the approval of the proposed project, and to ensure that the project is planned and executed in an environmentally responsible manner. It also serves as a communication tool between the project proponent, regulatory bodies, stakeholders, and the public.

The EIA highlights both the positive and negative impacts of the project, along with measures to enhance the beneficial outcomes and minimize or eliminate adverse effects. The preparation of this report demonstrates the commitment of the proponent to comply with national environmental regulations and to integrate sustainability into industrial development practices.

### 1.2 Identification of Project and Proponent

The proposed project involves the establishment of a Greenfield lithium battery assembly plant that will focus on assembling lithium-ion battery packs for automotive, deep-cycle, stationary, and telecommunication applications. The assembly unit will not involve cell manufacturing but will receive cells from certified suppliers and integrate them into battery packs with associated electronics and casing.

Details of the project and proponent are given in the table below:

<b>Parameter</b>	<b>Details</b>
<b>Project Title</b>	Lithium Battery Assembly Plant

<b>Parameter</b>	<b>Details</b>
<b>Project Nature</b>	(New Installation)
<b>Project Location</b>	Plot No.18 and 22, NS-1 Road, Rawat Industrial Estate, District Rawalpindi
<b>Production Capacity</b>	3,000 batteries per month
<b>Proponent Name</b>	Mr. Muhammad Mustafa Bin Talha
<b>CEO/Managing Partner</b>	Mr. Muhammad Mustafa Bin Talha
<b>Proponent's Office Address</b>	Office #02, Street 63, Sector F-8/4, Islamabad
<b>Proponent's Contact Number</b>	+92 324 5351520
<b>Email Address</b>	mustafabintalha@acmgroup.com.pk

The proponent has expressed commitment to sustainable industrial growth by choosing a renewable energy-supporting product line, which directly contributes to clean energy adoption and technological advancement in Pakistan. The proponent is actively engaging with certified consultants and intends to fully comply with environmental regulations before the start of any physical activity on the site.

### 1.3 Details of Consultant

The EIA report has been prepared by **Pak Green Enviro-Engineering (Pvt.) Ltd.**, an environmental consultancy firm based in Lahore. The firm has extensive experience in conducting environmental assessments and has successfully handled projects in various sectors including industry, infrastructure, energy, and waste management.

The key details of the environmental consultant are presented in the table below:

<b>Parameter</b>	<b>Details</b>
<b>Consultant Company Name</b>	Pak Green Enviro-Engineering (Pvt.) Ltd.

Parameter	Details
Chief Executive Officer (CEO)	Mr. Abdul Hafeez Nasir
Registered Office Address	46-M, Gulberg III, Lahore
Consultant's Contact Number	0303-4442334
Email Address	eia@pakgreen.pk

Pak Green Enviro-Engineering (Pvt.) Ltd. is registered with relevant regulatory bodies and is authorized to conduct EIA and IEE studies under national regulations. The consultant has conducted baseline environmental surveys, impact analysis, and developed the Environmental Management Plan (EMP) for the proposed lithium battery assembly facility in close coordination with the proponent. The firm has also facilitated stakeholder engagement activities to ensure that community and regulatory concerns are considered during project planning.

#### 1.4 Brief Description of Nature, Size, and Location of the Project

The proposed project entails the establishment of a lithium battery assembly facility by M/s ACM Lithium Batteries (Pvt.) Ltd. at Plot No.18 and 22, NS-1 Road, Rawat Industrial Estate, District Rawalpindi, Punjab. The project is categorized as a **Greenfield industrial initiative**, involving the installation of new infrastructure, machinery, and utilities on undeveloped land specifically designated for industrial activities.

The facility is designed to assemble lithium-ion batteries primarily for applications in the automotive sector, renewable energy storage (deep-cycle batteries), backup power (stationary systems), and telecommunication infrastructure. The assembly operations will include the arrangement and connection of lithium-ion cells, integration of Battery Management Systems (BMS), enclosure in protective casings, and final testing before packaging and dispatch.

The total production capacity of the plant is projected at approximately **3,000 batteries per month**, with flexibility to scale up based on market demand. The plant will operate in compliance with relevant environmental and occupational safety standards, particularly focusing on safe handling of lithium cells, proper waste segregation, fire risk mitigation, and noise management.

The **project components** are expected to include:

- Battery assembly units
- Quality control and testing section
- Administrative block
- Storage and inventory section
- Utility block (including generators, compressed air system, and HVAC)
- Worker amenities and first-aid center
- Internal circulation and parking area

The detailed project overview is presented below:

<b>Parameter</b>	<b>Details</b>
<b>Project Title</b>	Lithium Battery Assembly Facility
<b>Proponent</b>	M/s ACM Lithium Batteries (Pvt.) Ltd.
<b>Project Nature</b>	Greenfield (New Industrial Installation)
<b>Project Type</b>	Assembly Plant for Lithium-ion Battery Packs
<b>Production Capacity</b>	3,000 battery packs/month
<b>Project Location</b>	Plot No. 18 and 22, NS-1 Road, Rawat Industrial Estate, District Rawalpindi
<b>Total Area</b>	4800 square yards/ 8 kanals
<b>Accessibility</b>	Directly accessible via NS-1 Road and connected to the GT Road corridor
<b>Nearest Settlement</b>	Within 2–3 km radius – Rawat Village and nearby industrial units
<b>Surrounding Land Use</b>	Predominantly industrial and commercial

The site selection has been made carefully within the Rawat Industrial Estate, which is a planned industrial zone managed by the relevant industrial development authorities. The

location offers logistical advantages due to its proximity to major transportation routes, including the Grand Trunk (GT) Road and the Islamabad Expressway. The site is situated away from sensitive receptors such as schools, hospitals, and densely populated residential zones, which helps in minimizing potential environmental and social impacts.

The facility will not involve high-temperature processes or cell manufacturing, which significantly reduces the environmental footprint as compared to full-scale battery manufacturing units. Most operations will be carried out indoors in a controlled environment, minimizing dust, emissions, and noise. However, because of the nature of materials involved (such as lithium-ion cells, BMS modules, adhesives, and plastic casings), the project still requires careful environmental management, especially in the areas of waste disposal, fire prevention, and occupational safety.

The proposed project is aligned with the national goals of transitioning to cleaner energy systems and enhancing domestic manufacturing capacity in the renewable and electric mobility sectors. It is expected to contribute positively to economic growth, employment generation, and technological advancement.

### Screening of the Proposed Project

The screening of a project is the initial step in the environmental assessment process. It determines whether a proposed project requires an Initial Environmental Examination (IEE) or a full Environmental Impact Assessment (EIA), based on the type, scale, and location of the project, as well as the nature of its likely environmental and social impacts. In Pakistan, this process is governed by the Pakistan Environmental Protection Act (PEPA), 1997, and more specifically, by the Punjab Environmental Protection (Review of IEE and EIA) Regulations, 2000.

According to **Schedule II** of the aforementioned regulations, a full **Environmental Impact Assessment (EIA)** is mandatory for industrial projects involving the handling of hazardous substances, manufacturing of batteries, or operations with significant waste generation and fire risk potential. This project falls **under schedule II, Category B** manufacturing and processing, **Clause. 12**. The lithium battery assembly plant proposed by **M/s ACM Lithium Batteries (Pvt.) Ltd.** falls under this category due to the following characteristics:

- The project will handle lithium-ion cells which are classified as hazardous materials under international and national regulations due to their flammable and reactive nature.

- The operations will generate solid waste including potentially hazardous components such as damaged cells, electronic waste (e-waste), and chemically contaminated materials.
- The facility poses fire and explosion risks that must be properly assessed and mitigated.
- The site is located in an industrial estate, yet it requires verification of its proximity to sensitive receptors and ecological features.

The key screening criteria as per the regulatory framework are summarized below:

Screening Criteria	Project Characteristics	EIA Required
Handling of hazardous materials	Lithium-ion cells, adhesives, BMS components	Yes
Solid and hazardous waste generation	Rejected battery cells, e-waste, plastic waste	Yes
Project size and production capacity	3,000 lithium battery packs per month	Yes
Location sensitivity	Within industrial estate, but requires verification of surrounding use	Yes
Potential environmental and safety impacts	Fire risk, waste disposal, occupational safety	Yes

Given these factors, the project has been classified as one requiring a comprehensive EIA study to adequately assess all possible environmental and social impacts and to ensure that appropriate mitigation measures are incorporated at the design, construction, and operational phases.

This EIA is intended to fulfill the legal requirements for environmental approval from the Punjab Environmental Protection Agency (Punjab-EPA). The report includes a baseline assessment of environmental parameters (air, water, noise, land use), identification of potential risks, stakeholder consultations, and a detailed Environmental Management Plan (EMP) to ensure that the project operates within sustainable and safe limits.

Furthermore, the screening process also ensures that the project proponent remains in compliance with international best practices, including those recommended by the International Finance Corporation (IFC) and the World Bank Environmental, Health and Safety (EHS) Guidelines for battery and electronics-related industries.

In conclusion, the screening process has confirmed that a full-scale EIA is justified and required for this project. This document has therefore been prepared to meet that requirement, providing a comprehensive evaluation of the project's environmental and social implications.

### Scoping of the EIA Study

Scoping is a fundamental stage in the Environmental Impact Assessment (EIA) process that identifies the key environmental and social aspects likely to be affected by the proposed project. The purpose of scoping is to define the extent, focus, and methodology of the study so that all potentially significant impacts are comprehensively evaluated, while unnecessary or insignificant areas are excluded. It also helps to prioritize concerns raised by stakeholders and ensures that the final report provides relevant, actionable findings.

For the proposed **Lithium Battery Assembly Plant by M/s ACM Lithium Batteries (Pvt.) Ltd.**, scoping was carried out in accordance with the requirements of the **Punjab Environmental Protection (Review of IEE and EIA) Regulations, 2000**. The scope of the study was determined based on the nature of the project, materials involved, process flow, location, and surrounding environment, as well as applicable national and international environmental guidelines.

The following parameters were scoped into the study:

- 1. Baseline Environmental Assessment:**

A comprehensive environmental baseline was established through primary field investigations and secondary data collection. It included physical parameters such as air quality, noise levels, groundwater availability and quality, soil conditions, and meteorology. The ecological and socioeconomic conditions in and around the project site were also assessed.

- 2. Impact Identification and Evaluation:**

Based on the project design and input materials (e.g., lithium cells, BMS units, adhesives, metal and plastic casings), potential impacts were assessed on air, water, land, occupational health and safety, waste generation, and nearby communities. The

environmental risks associated with fire, hazardous waste handling, and energy usage were also considered.

**3. Legal and Institutional Framework:**

The applicable national laws, provincial regulations, environmental standards, and guidelines from the World Bank and IFC were reviewed to ensure legal compliance and to incorporate good industry practices.

**4. Consultation with Stakeholders:**

Preliminary engagement was conducted with industrial estate management, neighboring industries, and workers to collect concerns and suggestions, which were used to fine-tune the focus of the EIA. Stakeholder feedback helped shape the Environmental Management Plan (EMP) and hazard mitigation strategies.

**5. Development of Environmental Management and Monitoring Plans:**

The scoping exercise identified the need for a comprehensive EMP covering mitigation strategies, monitoring programs, emergency response planning, and capacity-building measures. The monitoring plan includes parameters, frequency, responsible entities, and reporting mechanisms.

The following table summarizes the core thematic areas included in the EIA study scope:

<b>Thematic Area</b>	<b>Scope of Assessment</b>
Physical Environment	Air quality, noise, soil, groundwater, drainage patterns
Biological Environment	Existing vegetation, site biodiversity, ecological sensitivity (if any)
Socioeconomic Environment	Workforce, community interactions, economic benefits, safety concerns
Waste Management	Identification of solid, hazardous, and e-waste; handling and disposal mechanisms
Fire and Chemical Hazard Assessment	Risk of ignition from lithium cells, emergency response, firefighting infrastructure

<b>Thematic Area</b>	<b>Scope of Assessment</b>
Regulatory and Institutional Setting	National/provincial laws, PEQS, World Bank and IFC standards
Environmental Management	Mitigation measures, roles/responsibilities, compliance tracking
Health & Safety Considerations	Occupational health risks, PPE, fire prevention protocols, emergency preparedness

The scoping exercise ensures that all significant aspects of the project that could affect the environment or society have been adequately covered in this EIA report. It also establishes the framework for a precautionary and preventive approach, particularly with respect to handling hazardous materials and ensuring safe working conditions for operational staff.

## Chapter 2

### Consideration of Alternatives

#### 2.1 Site Alternatives: Selection and Rejection Criteria

The location of an industrial facility significantly influences its operational efficiency, environmental footprint, and community acceptance. Therefore, a comparative analysis of multiple site alternatives was undertaken to select the most suitable location for the lithium battery assembly plant.

Initially, three locations were identified and examined based on proximity to industrial infrastructure, availability of utilities, transportation access, legal permissibility, distance from sensitive receptors, and environmental compatibility. These included the Rawat Industrial Estate, Hattar Industrial Estate, and a privately owned plot in the suburban outskirts of Islamabad near Taxila.

A detailed site evaluation matrix is presented below:

<b>Site Location</b>	<b>Zoning Status</b>	<b>Utility Access</b>	<b>Environmental Sensitivity</b>	<b>Logistics and Market Access</b>	<b>Final Assessment</b>
Rawat Industrial Estate	Designated industrial zone	Available (electricity, water, gas)	Low – located within developed estate	Excellent – via GT Road and Islamabad Expressway	<b>Selected</b>
Hattar Industrial Estate	Designated industrial zone	Available but limited for specialized facilities	Moderate – near rural settlements	Moderate – far from HQ in Islamabad	Rejected
Suburban Taxila	Non-industrial (peri-urban)	Not readily available	High – near heritage and	Poor – road access limited	Rejected

Site Location	Zoning Status	Utility Access	Environmental Sensitivity	Logistics and Market Access	Final Assessment
(Private land)			archaeological sites		

The selected site, **Plot No. 18 and 22 in Rawat Industrial Estate**, offered clear advantages. It is officially zoned for industrial use and falls under the jurisdiction of authorities that support environmental compliance. It has reliable access to utilities, waste disposal options, and is connected to the regional highway network. Moreover, the surrounding environment is already industrial in nature, minimizing the risk of ecological disruption or social resistance.

The other two alternatives were eliminated. The Hattar location was distant from the company’s base of operations and raised concerns about supply chain delays and overheads. The suburban Taxila site, while affordable, posed regulatory issues related to zoning and proximity to heritage-sensitive areas, disqualifying it from serious consideration.

## 2.2 Design and Technology Alternatives: Selection and Rejection Criteria

The design and technology configuration of the plant is critical to the success of the proposed lithium battery assembly project. During the planning stage, the project team explored various assembly line designs, operational layouts, and levels of automation to determine the most technically and economically appropriate option.

Three technology scenarios were considered: a fully manual assembly line, a fully automated system with high capital investment, and a semi-automated modular design. Each scenario was evaluated for its operational efficiency, safety, environmental control capability, energy consumption, and compatibility with the local workforce.

The comparative evaluation is summarized below:

Design/Technology Option	Capital Investment	Precision & Safety	Operational Efficiency	Environmental Control	Verdict
Manual Assembly (Hand Tools Only)	Low	Low – high human error	Low – labor intensive	Poor – minimal systems	Rejected

<b>Design/Technology Option</b>	<b>Capital Investment</b>	<b>Precision &amp; Safety</b>	<b>Operational Efficiency</b>	<b>Environmental Control</b>	<b>Verdict</b>
Fully Automated Imported System	Very High	Very High – consistent	High – but rigid and costly	High – automated containment	Rejected (Phase II)
Semi-Automated Modular System	Moderate	Medium to High	Medium – scalable with time	Adequate – localized controls	<b>Selected</b>

The manual assembly option was ruled out due to the inherent risks of inconsistency, high error rates, and lack of control over heat-sensitive materials such as lithium cells and adhesives. In addition, the manual route would require intensive training, offer little in terms of worker safety, and increase the risk of battery failure.

The fully automated system, though technically appealing, was assessed as financially impractical at the project’s initial stage. It would require significant capital investment, advanced software integration, and a specialized operations team. The system was therefore considered more suitable for a later expansion phase once the initial setup becomes operational and market demand stabilizes.

The **semi-automated modular assembly line** was selected for its balance between performance, safety, and cost. It allows partial automation of sensitive tasks such as cell sorting and tab welding, while retaining human oversight for final assembly, inspection, and packaging. This approach ensures product quality, manageable operational costs, and a lower environmental risk profile.

Furthermore, the modular layout allows the facility to expand organically as demand increases, with minimal disturbance to the existing infrastructure.

### 2.3 Environmental Alternatives: Selection and Rejection Criteria

In line with the principles of sustainable development, various environmental alternatives were considered to minimize the potential negative impacts of the lithium battery assembly facility. These alternatives addressed aspects such as emissions control, fire prevention, waste management, resource use efficiency, and site design.

One of the most critical environmental considerations was the handling and storage of lithium-ion cells. Open-air storage was initially proposed due to space savings but was rejected after a detailed risk assessment highlighted the elevated fire and oxidation hazard it posed. Instead, temperature-controlled indoor storage with fireproof enclosures and sensors was incorporated into the final design.

Wastewater management also presented a decision point. The option of direct discharge of industrial effluent into the municipal sewerage system was considered. However, this posed compliance challenges under the Punjab Environmental Quality Standards (PEQS), especially if chemical residues or cleaning agents from the battery casing process entered the stream. Therefore, an in-house Wastewater Treatment Plant (WWTP) with oil and grease traps, neutralization tanks, and settling chambers was selected.

Fire prevention strategies were also reviewed in detail. Passive ventilation and conventional water sprinkler systems were rejected due to incompatibility with electrical fires and lithium-related combustion. Instead, the selected system includes CO<sub>2</sub>-based fire suppression units, thermal sensors, and emergency shutoff protocols tailored for lithium-ion fire hazards.

A summary of environmental alternatives considered is provided below:

<b>Environmental Component</b>	<b>Option Considered</b>	<b>Assessment</b>	<b>Final Decision</b>
Lithium Cell Storage	Open-air under sheds	High fire/oxidation risk	Rejected
	Indoor, temperature-controlled, sealed racks	Low risk, easily monitored	<b>Selected</b>
Wastewater Disposal	Direct to sewer	Non-compliant, risk of chemical contamination	Rejected
	On-site treatment and neutralization	Controlled and sustainable	<b>Selected</b>
Fire Suppression System	Passive ventilation and sprinklers	Ineffective for lithium fires	Rejected

<b>Environmental Component</b>	<b>Option Considered</b>	<b>Assessment</b>	<b>Final Decision</b>
	CO <sub>2</sub> /Inergen suppression with early detection	Proven technology, compact, safe	<b>Selected</b>

These selected environmental measures are integrated into the design and operational strategy of the facility to ensure regulatory compliance, minimize ecological damage, and enhance occupational safety. The project’s environmental plan reflects a proactive and precautionary approach, essential for high-risk materials like lithium cells.

## 2.4 Economic Alternatives: Selection and Rejection Criteria

The selection of an economically viable model is crucial for ensuring the long-term success and sustainability of any industrial project. The financial dimension of the lithium battery assembly plant was carefully assessed through a comparative review of alternative project scales, cost structures, and automation levels. These alternatives were examined not only in terms of capital investment and return on investment (ROI), but also with reference to operational resilience, local labor integration, environmental compliance costs, and the scalability of the plant.

Three major economic alternatives were evaluated in detail:

1. A Small-Scale Pilot Plant
2. A High-Automation Large-Scale Facility
3. A Mid-Scale Semi-Automated Facility with Environmental Controls (Selected Option)

Each model was analyzed with reference to its financial implications, operational demands, production flexibility, and alignment with current market conditions. The evaluation also considered external economic risks such as import cost volatility, labor availability, and regulatory expenses.

The selection process aimed to identify a model that could deliver short-term operational stability while also offering a platform for future scaling and technological upgrades.

### 2.4.1 Small-Scale Pilot Plant

The first option involved a low-capacity, manually operated pilot facility, with minimal automation and reduced space requirements. This model was initially considered to validate

production processes and test market response. It offered low initial capital expenditure and allowed for quick deployment.

However, after careful financial modeling, it was observed that the small-scale approach would result in higher per-unit production costs, inconsistent product quality, and minimal compliance controls. Moreover, the lack of automation in sensitive processes such as cell joining and testing introduced higher occupational and fire risks. The model also lacked economic resilience in the face of rising material and logistics costs, making it unsustainable in the medium to long term.

The small-scale model was therefore rejected due to its limited economic viability, lower efficiency, and inability to meet environmental and safety benchmarks.

#### 2.4.2 High-Automation Large-Scale Facility

The second alternative considered a fully automated, high-output facility designed to produce lithium battery packs at a national or regional scale. This model incorporated advanced robotic systems, integrated quality control, and multi-line assembly with minimal human labor involvement.

This approach showed excellent results in terms of output consistency, safety, and long-term economic returns. However, it required a significantly high initial investment, sophisticated control systems, and foreign technical expertise. Additionally, this model involved a longer gestation period before achieving profitability, due to the time required to train specialized staff and optimize the automated processes.

Given the startup nature of the project and the emerging status of the lithium battery market in Pakistan, the proponent determined that this option posed an excessive financial burden and high operational risk in the current context. As such, this option was deferred for a future phase of expansion.

#### 2.4.3 Mid-Scale Facility with Environmental Controls (Selected Option)

The selected alternative involves a mid-sized, semi-automated battery assembly facility capable of producing up to 3,000 battery packs per month. This model strikes a balance between financial investment, product quality, labor utilization, and compliance with environmental regulations.

This configuration features modular semi-automated lines for battery cell welding, BMS integration, casing, and final testing, supported by skilled human operators. The facility design

incorporates energy-efficient systems, a localized Wastewater Treatment Plant (WWTP), CO<sub>2</sub>-based fire suppression mechanisms, and proper e-waste management.

The model supports phased investment, quicker return on investment, and smoother adaptability to changes in battery technology and regulatory standards. Furthermore, the integration of environmental controls in the plant design reduces the risk of future penalties, shutdowns, or compliance failures.

#### 2.4.4 Comparative Summary

The table below summarizes the evaluation of the three economic alternatives considered:

<b>Criteria</b>	<b>Small-Scale Pilot Plant</b>	<b>High-Automation Large-Scale</b>	<b>Mid-Scale Semi-Automated (Selected)</b>
<b>Capital Investment (CAPEX)</b>	Low	Very High	Moderate
<b>Operational Costs (OPEX)</b>	High (labor intensive)	Moderate	Moderate
<b>Product Quality</b>	Inconsistent	High	Consistent
<b>Scalability</b>	Poor	Excellent	Good
<b>Environmental Compliance</b>	Low	High	High
<b>Time to ROI</b>	Long	Medium to Long	Short to Medium
<b>Fire &amp; Safety Risks</b>	High	Low	Low
<b>Technical Staffing</b>	Minimal	Specialized	Skilled, locally available
<b>Status</b>	Rejected	Deferred (Future Phase)	<b>Selected</b>

#### 2.4.5 Long-Term Economic Viability

The mid-scale model provides a practical foundation for entering Pakistan's growing energy storage and electric mobility markets. It allows the proponent to build brand credibility, generate cash flow, and develop local technical capacity in battery assembly. This option also enables the integration of circular economy principles by allowing future upgrades for recycling, solar charging integration, and smart BMS development.

The flexibility and modularity of the selected economic model ensure that the facility can be expanded or diversified in a phased manner, without incurring large upfront financial risks. Additionally, the adoption of strong environmental controls ensures regulatory alignment, which is increasingly important for long-term market competitiveness and access to green financing instruments.

## Chapter 03

### Description of the Project

This chapter provides a comprehensive overview of the proposed lithium battery assembly facility, including the project's objectives, geographical location, land use characteristics, and spatial layout. The aim is to clearly define the physical and operational components of the project that may influence environmental and social parameters, as assessed in the subsequent chapters of this report.

#### 3.1 Objectives of the Project

The proposed project by M/s ACM Lithium Batteries (Pvt.) Ltd. aims to establish a technologically advanced, environmentally compliant lithium battery assembly plant in Pakistan. The strategic objective of the project is to meet the growing domestic and industrial demand for lithium battery packs, which are increasingly being used in energy storage systems, solar energy backup units, and electric mobility solutions.

The project is aligned with national policies promoting clean energy transition, indigenous manufacturing, and industrial modernization. The proponent intends to reduce reliance on imported battery packs by localizing assembly processes and integrating sustainable practices into production. By initiating this project, the company also seeks to develop technical capacity, generate employment, and ensure environmental safety in handling lithium-based components.

The table below summarizes the core objectives of the proposed lithium battery assembly facility:

**Table 11: Summary of Project Objectives**

S. No.	Objective
1	To establish a medium-scale lithium battery assembly unit capable of producing approximately 3,000 battery packs per month.
2	To contribute to national self-reliance in energy storage technologies through local production.

S. No.	Objective
3	To support Pakistan's clean energy transition by providing quality battery solutions for solar and EV applications.
4	To create skilled job opportunities in a technologically specialized and emerging industrial sector.
5	To incorporate safety, fire protection, and hazardous waste management systems in compliance with national and international standards.
6	To lay the foundation for future expansion into high-capacity production and recycling of battery components.

These objectives reflect the project's dual focus on commercial viability and environmental sustainability. The initiative not only supports energy infrastructure resilience but also promotes responsible industrial growth aligned with the Sustainable Development Goals (SDGs), particularly SDG 7 (Affordable and Clean Energy) and SDG 9 (Industry, Innovation, and Infrastructure).

### 3.2 Location and Site Layout of the Project

The proposed lithium battery assembly plant will be located at Plot No. 18 and 22, NS-1 Road, Rawat Industrial Estate, in District Rawalpindi, Punjab. The site is situated within a formally declared industrial zone managed by the Punjab Industrial Estates Development and Management Company (PIEDMC). This location was selected based on its favorable infrastructural provisions, proximity to major markets and highways, and minimal ecological sensitivity.

The geographical coordinates of the site are:

Parameter	Details
Latitude:	33°30'54.62"N
Longitude:	73°14'4.63"E
District	Rawalpindi

<b>Parameter</b>	<b>Details</b>
Province	Punjab
Access Route	GT Road / Islamabad Expressway
Zoning Classification	Industrial

The site is accessible through well-established transport corridors, ensuring smooth logistics for raw materials and product distribution. The estate is already equipped with essential utilities, including electricity, water, road networks, and waste disposal connections. The project area is located approximately 35 km from Islamabad city center, ensuring proximity to key commercial markets, human resources, and regulatory offices.

A preliminary land survey confirmed that the site is flat, free from major environmental constraints, and outside the bounds of any protected ecological or cultural zones. There are no natural water bodies or forested areas within or near the project plot. The surrounding plots are occupied by other industrial units, thereby minimizing the potential for land-use conflicts or community-based objections.

The site layout has been designed to optimize workflow, safety, and environmental management. The internal configuration includes areas allocated for:

- Battery assembly operations and machinery halls
- Quality control and testing laboratories
- Administrative offices and staff facilities
- Secured storage for raw materials and finished products
- Environmental infrastructure, including wastewater treatment and fire safety systems
- Circulation paths, emergency exits, and vehicle loading zones

A summary of the layout components and spatial allocation is presented below:

Component	Estimated Area Allocation	Remarks
Assembly and Process Area	45–50%	Core production lines including cell welding and BMS integration
Raw Material and Finished Goods Stores	15%	Separated by fire-rated partitions with restricted access
Administration and Support Facilities	10%	Offices, cafeteria, lockers, and utilities
Environmental Control Infrastructure	10%	Wastewater Treatment Plant, fire suppression unit, emergency control
Circulation and Parking	15–20%	Access roads, turning bays, parking, and open area

A detailed **site layout map** illustrating the exact positioning of functional zones is attached



The site has been planned to ensure operational efficiency, personnel safety, and environmental responsibility, in line with the design requirements for lithium-ion battery facilities and fire-sensitive industrial operations.

### 3.3 Land Use on the Site

The land designated for the establishment of the proposed lithium battery assembly plant is situated within the Rawat Industrial Estate, District Rawalpindi, which is formally classified as an industrial zone under the jurisdiction of the Punjab Industrial Estates Development and Management Company (PIEDMC). The estate is planned and regulated specifically for medium to large-scale industrial operations, with predefined zoning, infrastructure, and environmental protocols.

The specific plot, **Plot No. 18 and 22, NS-1 Road**, has been allotted to M/s ACM Lithium Batteries (Pvt.) Ltd. for the development of a lithium battery assembly facility. The land is free from prior construction, encroachment, agricultural activity, or natural vegetation, and is considered fully suitable for industrial construction without the need for reclassification or land use conversion.

The terrain is flat and stable, with no drainage complications or known geological vulnerabilities. The site does not lie within a floodplain or seismic fault line and is not located near any protected natural habitats, water bodies, wetlands, or areas of cultural or religious significance.

A preliminary environmental screening of the land use indicates that the project will not result in the displacement of any local communities, wildlife, or vegetation. The proposed construction and operation of the facility are therefore not expected to result in land use conflict or degradation of ecologically sensitive resources.

The internal land use distribution of the project site has been carefully planned to ensure operational efficiency, fire safety, environmental compliance, and future expandability. The planning has been guided by industrial layout standards and the best practices applicable to lithium battery manufacturing and energy storage systems.

The facility incorporates fire-resistance measures, segregated storage, waste management zones, and safe circulation paths, ensuring compliance with safety and environmental regulations. Adequate setback and buffer zones have also been maintained between critical infrastructure, such as the battery cell storage and administrative buildings.

The facility design ensures that all hazardous operations are confined indoors, with appropriate environmental controls including ventilation systems, thermal monitoring, and spill containment. Furthermore, space has been reserved for the future addition of solar panels,

recycling units, or automation upgrades, reinforcing the adaptability of the site to emerging technological and environmental standards.

In conclusion, the selected land is suitable for the proposed industrial activity, with no anticipated land use conflicts or violations of zoning regulations. The project design ensures optimal and responsible use of the land, aligned with both operational goals and sustainability principles.

### 3.4 Road Access

The proposed lithium battery assembly facility is located within Rawat Industrial Estate, District Rawalpindi, which is a formally planned industrial zone equipped with internal road infrastructure and external highway connectivity. The site is directly accessible from NS-1 Road, which runs through the industrial estate and connects seamlessly to the Grand Trunk (GT) Road, one of Pakistan’s major transportation corridors. From GT Road, the site is further connected to the Islamabad Expressway, facilitating access to Islamabad, Rawalpindi, and adjoining commercial zones.

This location provides significant logistical advantages, including the smooth transport of raw materials (e.g., lithium cells, casings, adhesives) to the facility and efficient distribution of finished battery packs to regional markets. The roads are suitable for both light and heavy vehicles and are routinely maintained by the estate’s management authority, PIEDMC.

Within the project site, internal circulation routes will be developed using concrete pavers or RCC pathways, with designated loading and unloading bays, turning radii for large transport vehicles, and clearly marked entry/exit points. The road access design ensures compliance with industrial safety standards, especially concerning the movement of flammable and hazardous materials.

A summary of road access and transport features is provided below:

<b>Parameter</b>	<b>Details</b>
Estate Access Road	NS-1 Road, within Rawat Industrial Estate
Nearest Major Highway	Grand Trunk (GT) Road – approx. 1.2 km
Secondary Access	Islamabad Expressway via Koral or DHA interchange

Parameter	Details
Site Entry Type	Gated, with controlled access
Internal Roads	RCC/paved, 15–20 ft. width for heavy vehicles
Parking Provisions	Separate bays for trucks and staff vehicles
Road Ownership & Maintenance	Punjab Industrial Estates Development & Management Company (PIEDMC)

This strategic road connectivity supports uninterrupted operations, ensures timely supply chain activity, and enhances the overall commercial viability of the facility. It also provides access for emergency response vehicles, an important consideration given the flammable nature of lithium materials.

### 3.5 Vegetation Features of the Site

The designated site for the project lies within a previously demarcated and developed industrial estate. As a result, the land does not support any significant natural vegetation, ecological habitats, or cultivated flora. A preliminary ecological assessment conducted during the site reconnaissance confirmed the absence of indigenous tree species, shrubs, or agricultural land.

The topsoil shows signs of previous leveling activity, and the surface is mostly compacted with loose gravel and minor patches of seasonal grass. There are no water bodies, drainage channels, or wetland ecosystems within or immediately adjacent to the project boundaries. Moreover, no protected or endangered plant species, as per the Punjab Wildlife (Protection, Preservation, Conservation and Management) Act, 1974, were observed on site.

Despite the lack of existing vegetation, the proponent recognizes the importance of green infrastructure in mitigating air quality impacts, improving microclimatic conditions, and enhancing aesthetic value. Therefore, a Plantation Plan has been proposed, targeting both the perimeter and internal open spaces of the facility.

The planned green development will focus on planting non-invasive, drought-resistant, and native species that require minimal irrigation and maintenance. Shade-providing trees and ornamental plants will be introduced along boundary walls, parking lots, and the administrative block.

A summary of the vegetation context and proposed green development is provided below:

<b>Feature</b>	<b>Status / Plan</b>
Existing Vegetation	Minimal – mostly barren with patches of dry grass
Presence of Trees or Shrubs	None
Agricultural Activity	Not present
Ecological Sensitivity	Low – within a designated industrial estate
Protected Flora Presence	None observed
Proposed Green Area (Planned)	Approx. 800–1,000 sq. ft. for tree plantation and landscaping
Tree Species (Tentative)	Amaltas (Cassia fistula), Sukh Chain (Pongamia), Neem (Azadirachta indica)
Green Development Implementation	To be initiated during construction and maintained post-operation

The plantation strategy is designed not only to comply with **Punjab Environmental Protection Agency (EPA)** expectations but also to contribute to carbon sequestration, visual buffering, and occupational health improvements for facility staff.

### 3.6 Cost and Magnitude of Operation

The total estimated cost of the proposed lithium battery assembly facility is **PKR 500 million**, covering all aspects of development including land development, construction, equipment procurement, utility installations, fire and environmental safety measures, staffing, and commissioning. This cost assessment has been developed through detailed financial planning, in consultation with vendors and contractors, and is based on current market rates and best practices for industrial infrastructure.

The facility will operate on a medium scale, with a planned capacity to assemble up to 3,000 lithium battery packs per month. This operational volume reflects a balance between production efficiency and manageable startup risk. The plant's semi-automated production lines will allow for consistent output while retaining flexibility for technology adaptation and

product variation. This magnitude of operation positions the project as a major contributor to Pakistan's emerging electric mobility and energy storage sectors.

In terms of employment, the facility will generate approximately 50 to 70 direct jobs for technical, administrative, and support staff during the operational phase. Indirect employment will also be created through procurement, logistics, packaging, maintenance, and waste recycling partnerships. The project will contribute to industrial growth, skill development, and the enhancement of local supply chains, particularly in the field of battery technology and clean energy solutions.

### 3.7 Schedule of Implementation

The implementation of the proposed lithium battery assembly plant will follow a phased construction and commissioning plan, spanning an estimated duration of 10 to 12 months, starting from the date of receipt of all necessary regulatory approvals, including environmental clearance. The scheduling has been developed in consultation with engineering consultants, civil contractors, and equipment suppliers to ensure that critical activities can proceed concurrently where feasible, without compromising quality, safety, or compliance obligations.

In the initial phase, the project will commence with administrative mobilization, procurement finalizations, and the preparation of the site. This will include boundary demarcation, leveling of the land, and utility connections, followed by the start of civil construction activities. Site preparation and basic civil works such as foundation laying, structural framing, and flooring are expected to be completed within the first four months.

Machinery procurement and installation will begin during the third month and continue in parallel with construction. The equipment, including welding stations, cell assembly tools, fire suppression systems, and testing units, will be delivered and installed as sections of the facility become ready. This parallel workflow ensures time optimization and minimizes project downtime.

Once structural and mechanical installations are in place, the utility systems, including electrical connections, compressed air pipelines, internal lighting, safety alarms, and water supply, will be connected and tested. Simultaneously, the environmental protection systems such as the Wastewater Treatment Plant (WWTP), e-waste handling stations, and ventilation systems will be commissioned.

The final stage will consist of testing, system calibration, workforce training, and trial production runs, which will occupy approximately one to two months. This period will be used to verify equipment performance, ensure staff readiness, and test operational protocols, especially those related to fire safety, hazardous material handling, and emergency procedures.

The overall project schedule is designed to allow adequate time for regulatory inspections, approvals from utility providers, and procurement of third-party certifications where applicable. Provision for unforeseen delays, such as material supply interruptions or adverse weather conditions, has also been incorporated through the allocation of contingency time slots within the schedule.

Through this structured and carefully timed implementation approach, the proponent aims to ensure that the facility is not only functional by the projected deadline but also fully compliant with operational, environmental, and safety standards. The planning reflects a balance between rapid development and sustainable, responsible industrial deployment.

### 3.8 Description of the Project

The project involves the development of a semi-automated lithium battery assembly facility, where imported lithium-ion cells will be processed and assembled into complete battery packs. The operations will include cell tab welding, casing, Battery Management System (BMS) integration, insulation, final performance testing, and packaging. The facility will cater to the growing demand for battery solutions in electric vehicles, solar energy systems, and backup storage for the telecommunications sector.

The core functions of the plant will be executed indoors under a controlled environment with built-in fire and electrical safety measures. The plant will be equipped with ventilation systems, ESD (Electrostatic Discharge) protection, e-waste segregation zones, and a dedicated Wastewater Treatment Plant (WWTP) to ensure compliance with environmental regulations. Energy-efficient lighting and machinery will be installed to minimize the plant's operational carbon footprint. The project will follow national safety standards and adhere to the environmental guidelines set forth by the Pakistan Environmental Protection Agency (Pak-EPA) and relevant provincial bodies.

A summary of key project components is provided in the table below:

Component	Description
Project Type	Semi-automated Lithium Battery Assembly Facility
Location	<b>Plot No. 18 and 22</b> , NS-1 Road, Rawat Industrial Estate, Rawalpindi
Operational Capacity	3,000 battery packs/month (initial phase)
Land Area	4800 square yards/ 8 kanals
Project Cost	PKR 500 million
Key Processes	Cell tab welding, BMS integration, casing, testing, packaging
Utilities Required	Electricity, backup generators, industrial water supply, compressed air
Environmental Controls	WWTP, Fire Suppression System, E-waste Storage and Handling Area
Compliance Requirements	Subject to EIA Approval, Safety NOCs, WWTP discharge approvals
Employment Generation (Estimated)	50–70 direct employees, additional indirect jobs via logistics and vendors

This project is designed to serve as a scalable model for clean and efficient battery production in Pakistan and will enable local industry to benefit from global trends in renewable energy and electric mobility. The investment is expected to bring not only financial returns but also long-term environmental and industrial benefits.

### 3.9 Restoration and Rehabilitation Plans

The proposed lithium battery assembly plant is to be developed on a pre-designated industrial plot within Rawat Industrial Estate, Rawalpindi. While the site itself is devoid of natural vegetation and was previously allocated for industrial use, construction and operational activities may temporarily alter the physical conditions of the land. Therefore, a **restoration and rehabilitation plan** is essential to ensure that post-construction and operational land

conditions are environmentally stable, visually compatible with surrounding areas, and compliant with environmental regulations.

The restoration plan focuses on mitigating any short-term physical disturbances caused by site clearance, excavation, equipment mobilization, and material storage during the construction phase. Once the civil works are completed, any temporary structures such as contractor sheds, material stockpiles, and construction debris will be completely removed. The ground will be re-leveled, compacted, and prepared for final landscaping or structural integration. Areas affected by oil spills or construction waste will be cleaned and treated to prevent soil contamination.

**Rehabilitation measures** include the development of green buffers along the site's perimeter, particularly near the administrative block and parking zones. This not only helps in dust suppression and heat reduction but also enhances visual appeal and contributes to a healthier work environment. The plantation plan includes drought-tolerant and native plant species suited to the region's climate, which require minimal irrigation and maintenance.

Where feasible, the plan incorporates the use of permeable materials for footpaths and open spaces to support rainwater infiltration and reduce surface runoff. Any barren patches or leftover disturbed areas within the site will be landscaped or stabilized using gravel or grass cover to prevent erosion and dust dispersion.

The rehabilitation strategy extends to the post-operational phase as well. If at any stage the project operations are scaled down or relocated, the site will be decommissioned in line with applicable environmental protocols. This includes the removal of machinery, proper disposal of hazardous materials, decontamination of surfaces, and repurposing of infrastructure wherever feasible. A formal decommissioning and land recovery plan will be developed at that stage in consultation with the relevant authorities.

In addition, the proponent commits to periodic monitoring and documentation of land condition, especially in storage and handling zones of lithium cells and chemical materials. Restoration activities will be part of the facility's Environmental Management Plan (EMP) and overseen by qualified environmental and safety officers.

In conclusion, the restoration and rehabilitation approach ensure that the environmental integrity of the site is maintained throughout the life cycle of the project—from pre-

construction through operational phases and even into future transitions or closure, demonstrating the proponent’s long-term commitment to responsible land stewardship.

### 3.10 Rainwater Harvesting System Design and Integration

#### 1. Introduction

As part of its commitment to environmental sustainability and resource efficiency, M/s ACM Lithium Batteries (Pvt.) Ltd. has incorporated a Rainwater Harvesting (RWH) system into the design of the proposed lithium battery assembly facility. The objective is to reduce dependency on municipal or groundwater sources by utilizing naturally available rainwater for non-potable uses within the facility. The project site, located in Rawat Industrial Estate, falls within a region that receives moderate seasonal rainfall. Harnessing this rainfall through an engineered system offers a practical and sustainable solution for water conservation, reduction in runoff, and enhancement of groundwater recharge.

The integration of the RWH system is also in alignment with national priorities outlined in Pakistan’s National Water Policy 2018, and complements SDG 6 (Clean Water and Sanitation), which encourages efficient water use and the adoption of green infrastructure in industrial development.

#### 2. System Components and Technical Design

The RWH system has been designed to collect, convey, filter, and store rainwater from rooftops and paved surfaces of the facility. The system will be seamlessly integrated into the architectural and drainage layout of the plant.

Key components and technical features of the system are described in the following table:

Component	Description
Catchment Area	Rooftops of assembly building, utility block, and open concrete surfaces
Conveyance System	HDPE/PVC pipelines and surface drains to channel runoff to central collection points
First Flush Diverter	Device to discard initial rainfall carrying dust, debris, and contaminants

<b>Component</b>	<b>Description</b>
Filtration Unit	Multi-layer filters (gravel, sand, charcoal) to purify water before storage
Storage Infrastructure	RCC or HDPE underground tanks (capacity ~25,000–30,000 liters)
Recharge Mechanism (optional)	Soak pits or recharge wells to infiltrate excess water into groundwater strata
Pump & Control System	Low-energy pump with float sensor for water distribution to non-potable uses

The expected annual rainfall in the Rawalpindi region is approximately 900–1,000 mm, which offers substantial water harvesting potential when applied across the facility’s total catchment area. The rooftop and paved surfaces combined provide an estimated 700–900 m<sup>2</sup> of effective collection area. The system is expected to capture 70–80% of usable rainfall, depending on weather variability and maintenance efficiency.

### 3. Usage and Environmental Benefits

The harvested rainwater from the facility’s rooftops and paved surfaces will be used for various non-potable applications within the premises of the lithium battery assembly plant. These uses include floor and surface washing, irrigation of landscaped areas and tree belts, flushing systems in restrooms (where appropriate), and water supplementation for process cooling or fire safety reserves. By diverting rainwater toward these internal uses, the facility will significantly reduce its dependence on conventional freshwater sources such as municipal supply or groundwater, thus promoting long-term sustainability in water resource management.

One of the most significant environmental benefits of the rainwater harvesting system is its contribution to water conservation. The reuse of rainwater within the facility reduces the overall extraction pressure on local groundwater aquifers, which are already under stress in the Rawalpindi region. Moreover, the reduction in demand on municipal water infrastructure will support the broader goals of regional water balancing and urban water resilience, especially during dry seasons or supply shortages.

The system also helps mitigate stormwater runoff from impervious surfaces, which is a common cause of urban flooding and soil erosion. By collecting and storing rainwater at the point of origin, the project minimizes surface water discharge into drains and nearby roads, thereby helping to prevent localized waterlogging. In cases where the system includes recharge wells or soak pits, it can also support the replenishment of shallow groundwater layers, aiding in aquifer sustainability.

Beyond hydrological benefits, the use of harvested rainwater supports the health and growth of plantation areas established under the green development plan of the facility. Regular irrigation using non-chlorinated, naturally soft rainwater is beneficial for trees, shrubs, and ornamental plants, enhancing the overall aesthetics and microclimatic regulation of the site. Additionally, maintaining green zones contributes to air purification, shade creation, and dust suppression, thereby improving the occupational environment for workers and staff.

The system's integration also aligns with corporate environmental responsibility and is likely to improve the facility's performance in future environmental audits or sustainability assessments. By adopting rainwater harvesting at the design stage, M/s ACM Lithium Batteries (Pvt.) Ltd. demonstrates a proactive approach to climate-sensitive industrial planning and sets an example for similar medium-scale industrial projects across Pakistan.

#### 4 Maintenance and Monitoring

The efficiency, longevity, and effectiveness of the rainwater harvesting (RWH) system depend significantly on a structured and proactive maintenance and monitoring program. M/s ACM Lithium Batteries (Pvt.) Ltd. recognizes that without regular upkeep, the system's components—such as the filtration unit, storage tanks, and conveyance infrastructure—can become clogged or degraded, thereby reducing water quality and harvesting efficiency. Therefore, the project has incorporated a routine maintenance plan into the overall facility management system.

Prior to the monsoon season each year, all catchment areas, including rooftops and open surfaces, will be thoroughly cleaned to remove dust, leaves, and debris that may otherwise contaminate the first runoff. Downpipes and surface drains connected to the conveyance system will be flushed to prevent blockages. The first flush diverters, which are designed to discard the initial volume of polluted rainwater, will be inspected and tested to ensure proper functioning before each rainfall event. Any mechanical or manual adjustments required for redirection or flushing will be conducted at this stage.

The filtration unit will undergo monthly inspections and quarterly cleaning cycles to prevent buildup of sediment, organic material, or microbial growth. Where multilayer filters are used, the sand and charcoal layers will be replaced or sterilized based on wear, usage intensity, and laboratory testing results. To prevent mosquito breeding or algae growth, all open or semi-covered parts of the system will be sealed or fitted with protective mesh.

Storage tanks—whether RCC or HDPE—will be visually inspected for cracks, leaks, and sediment deposition. Internal cleaning of the tanks will be scheduled at least twice a year. If harvested water is used for applications involving human or equipment contact, such as irrigation or floor cleaning, basic water quality parameters including pH, turbidity, and microbial counts will be tested at an authorized laboratory on a bi-annual basis.

Monitoring responsibilities will lie with the **Facility Maintenance Team**, under the supervision of the designated Environmental, Health, and Safety (EHS) Officer. This team will maintain a **Rainwater Harvesting Logbook**, where records of inspections, maintenance activities, rainfall volumes, and water usage will be documented. These records will serve as part of the Environmental Management System (EMS) of the facility and will be available for review by internal auditors, external verifiers, and the Punjab Environmental Protection Agency (EPA) during compliance inspections.

Through this structured maintenance and monitoring protocol, the project ensures that the rainwater harvesting system remains operational, safe, and effective throughout the lifecycle of the plant. It also reflects the proponent's commitment to sustainable water use and compliance with national environmental standards.

### 5 Compliance and Best Practice Alignment

The design, installation, and planned operation of the rainwater harvesting (RWH) system at M/s ACM Lithium Batteries (Pvt.) Ltd. have been developed in accordance with applicable national regulations and global best practices. The system aligns with the broader environmental conservation objectives set forth in Pakistan's **National Water Policy 2018**, which emphasizes the promotion of rainwater harvesting as a sustainable method to address water scarcity and reduce stress on conventional water sources. Additionally, the system design adheres to guidelines recommended by the Pakistan Council of Research in Water Resources (PCRWR) for the implementation of urban and industrial-scale RWH structures.

At the provincial level, the project meets the requirements of the Punjab Environmental Protection (Amendment) Act, 2012 and follows the principles outlined in the Punjab Green

Development Program (PGDP), which encourages water conservation and the integration of environmental safeguards in industrial planning. The facility also complies with relevant clauses of the Building Code of Pakistan (Seismic Provisions 2007 and updated versions) regarding structural integrity, drainage management, and water retention systems.

Internationally recognized standards and protocols have also informed the system's development. Recommendations from the United Nations Environment Programme (UNEP), the World Health Organization (WHO), and the International Water Association (IWA) were reviewed during the planning stage to ensure the system is in line with globally accepted rainwater harvesting methodologies, particularly regarding system hygiene, quality assurance, and monitoring practices.

The RWH system has been designed to support the organization's eventual compliance with ISO 14001: Environmental Management Systems, ensuring its integration into the broader framework of resource efficiency and pollution prevention. Periodic assessments of system performance and alignment with national and international benchmarks will be conducted as part of internal audits or during regulatory inspections. The facility's Environmental Management Plan (EMP) will include this rainwater harvesting initiative as a permanent component, subject to regular review, reporting, and continuous improvement.

By embedding compliance at both the design and operational levels, M/s ACM Lithium Batteries (Pvt.) Ltd. reinforces its corporate responsibility toward sustainable resource management and environmental stewardship. The rainwater harvesting system is not only a functional infrastructure element but also a representation of the proponent's alignment with Pakistan's environmental vision and international sustainability commitments under the Sustainable Development Goals (SDGs)—particularly Goal 6 (Clean Water and Sanitation) and Goal 13 (Climate Action).

## Chapter 04

### Description of the Environment

This chapter presents a comprehensive overview of the environmental setting in which the proposed lithium battery assembly plant will be established. The understanding of existing environmental conditions is essential for predicting potential impacts and designing effective mitigation strategies. The baseline environment has been assessed through a combination of site surveys, secondary data from published sources, and laboratory analyses.

#### 4.1 Baseline Physical Environment

The project site is located in Rawat Industrial Estate, District Rawalpindi, within the Pothohar Plateau—a semi-arid region marked by moderate elevation, dry valleys, and eroded hills. The climate of the area is characterized as semi-arid subtropical, with hot summers and cool winters. The summer season begins in May and continues until September, with peak temperatures reaching over 40°C. The winter season, from November to February, sees temperatures dropping to as low as 5°C. The annual average rainfall is approximately 900–1,000 mm, the majority of which occurs during the monsoon months of July to September.

The soil in the area is classified as sandy loam, with good drainage characteristics and moderate load-bearing capacity, making it suitable for industrial construction. Soil testing from the project site confirmed its stability for foundation works. The area is not located in any seismically active fault zone; however, standard seismic load considerations as per Building Code of Pakistan (Seismic Provisions) are being followed.

Ambient air quality measurements indicate that key parameters such as Particulate Matter (PM<sub>10</sub> and PM<sub>2.5</sub>), Sulphur Dioxide (SO<sub>2</sub>), and Nitrogen Dioxide (NO<sub>2</sub>) are within permissible limits set by National Environmental Quality Standards (NEQS). Occasional increases in dust levels were observed during dry, windy periods, likely due to vehicular movement on unpaved roads and nearby construction activity.

Noise levels recorded during daytime ranged between 64 to 70 dB(A) near the roadside boundary of the site, which is below the NEQS limit of 85 dB(A) for industrial zones. There are no natural surface water bodies or wetlands within or around the site; however, shallow

groundwater resources exist and are accessed through bore wells. Water samples indicate acceptable pH and Total Dissolved Solids (TDS) levels for industrial non-potable use.

**Table 4.1: Summary of Physical Environmental Parameters**

Parameter	Observed Value	NEQS Limit / Benchmark	Remarks
Temperature Range	5°C – 42°C	–	Seasonal variation
Rainfall (Annual)	900–1,000 mm	–	Concentrated in monsoon season
Air Quality (PM <sub>10</sub> )	112 µg/m <sup>3</sup>	150 µg/m <sup>3</sup>	Within NEQS
Noise Level (Day)	64–70 dB(A)	85 dB(A)	Acceptable for industrial zone
Soil Type	Sandy Loam	–	Good for construction
Water pH	7.4	6.5–8.5	Suitable for industrial applications
TDS	486 mg/L	<1,000 mg/L	Acceptable for non-potable use

## 4.2 Baseline Ecological Environment

The ecological environment of the project site and its surrounding area has been significantly modified due to industrial development. The site is a levelled plot with no natural vegetation cover or forested areas, and the immediate surroundings consist of other industrial units and access roads. The land was cleared and allocated for industrial use under the Punjab Industrial Estates Development & Management Company (PIEDMC), eliminating the presence of native ecosystems.

Floral diversity within the project boundary is minimal and restricted to weeds, grasses, and a few planted ornamental tree species such as *Conocarpus erectus* and *Eucalyptus*

*camaldulensis*. These species are non-native and are typically used in landscaping in industrial zones due to their rapid growth and minimal water requirement.

Faunal presence is similarly limited. Only common, urban-adapted bird species such as house sparrows (*Passer domesticus*), common mynas (*Acridotheres tristis*), and rock pigeons (*Columba livia*) were observed during the site reconnaissance survey. No nests, breeding grounds, or migratory paths were detected within or around the site. Small insects and ground-dwelling fauna typical of dry environments were also noted, but no endangered or protected species were recorded.

Given the transformed and urban nature of the environment, the ecological value of the site is low. However, as part of its green development plan, the proponent has committed to establishing **green buffer zones** using native and drought-resistant plant species, thereby enhancing local biodiversity over time.

**Table 4.2: Baseline Ecological Features of the Project Site**

Component	Observed Features	Ecological Status
Vegetation	Sparse grasses, planted <i>Eucalyptus</i> , <i>Conocarpus</i>	Artificial; non-native species
Fauna (Birds)	<i>Passer domesticus</i> , <i>Acridotheres tristis</i> , <i>Columba livia</i>	Common urban-adapted species
Mammals	None observed	Not applicable
Reptiles	Not observed; possible presence of small lizards	Non-significant
Endangered Species	None	No record or evidence
Wildlife Corridor	None	Site lies outside migratory pathways

### 4.3 Baseline Socioeconomic Environment

The socio-economic setting of the proposed project falls within the broader context of Rawat Industrial Estate and its surrounding residential areas, including Rawat town and nearby villages. The industrial estate is a planned zone managed by PIEDMC, and it hosts a range of medium-sized industries engaged in engineering, packaging, warehousing, and logistics.

The population in the surrounding areas consists of both local residents and migrant labor. A majority of the working-age population is engaged in industrial employment, mechanical repair work, transport services, small-scale trade, and daily wage labor. Educational and healthcare facilities are available in Rawat town, located approximately 3–4 km from the project site. The area is well-connected by the Grand Trunk Road (N-5), allowing easy commuting for labor and transportation of goods.

Basic civic amenities such as electricity, water supply, and waste disposal are available but are often supplemented by private arrangements due to high demand. There are no historically significant structures, religious sites, or protected monuments within or around the project's immediate influence zone.

Preliminary discussions with local stakeholders revealed a positive attitude toward the project, especially in terms of employment prospects and technology introduction. Concerns raised during initial consultations were primarily related to environmental safety, dust control, and wastewater management, for which the proponent has presented detailed mitigation plans within this EIA.

**Table 4.3: Socioeconomic Profile of the Project Area**

<b>Parameter</b>	<b>Description</b>
Nearest Settlement	Rawat Town (~3 km)
Population Type	Mixed (locals and industrial workers)
Employment Sources	Industrial labor, transport, trade
Healthcare Facilities	Available in Rawat and nearby private clinics
Educational Institutions	Government schools and private academies

<b>Parameter</b>	<b>Description</b>
Road Connectivity	Access via Grand Trunk Road (N-5)
Community Perception	Generally positive; seeking job opportunities
Land Acquisition Issues	None; plot pre-allocated in industrial estate

#### 4.4 Laboratory Reports

To establish a quantitative understanding of the environmental conditions of the project site, baseline sampling and laboratory analyses were conducted for air, noise, and water quality. These assessments were carried out prior to the commencement of construction to form a reference point for future environmental monitoring. All samples were collected following standard procedures and analyzed at an accredited third-party laboratory recognized by the Punjab Environmental Protection Agency (EPA).

Air quality sampling was conducted at the central point of the project plot and along the main access road to assess potential exposure to vehicular emissions and dust. Parameters tested included Particulate Matter (PM10 and PM2.5), Sulphur Dioxide (SO<sub>2</sub>), Nitrogen Dioxide (NO<sub>2</sub>), and Carbon Monoxide (CO). The results indicated that concentrations of all major pollutants remained well within the National Environmental Quality Standards (NEQS) for industrial areas. Noise monitoring was conducted during daytime peak hours and reflected sound levels ranging from 64.1 to 69.7 dB(A), which is within the acceptable limit of 85 dB(A) as defined for industrial zones.

Groundwater was sampled from a bore located near the project site. Parameters such as pH, Total Dissolved Solids (TDS), Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), and heavy metals were tested to determine suitability for non-potable industrial applications. Results confirmed that the groundwater meets NEQS thresholds for industrial use, particularly for cooling and cleaning operations within the facility.

The data from these laboratory analyses not only supports the environmental viability of the site but also provides a benchmark for the Environmental Management Plan (EMP) to track post-construction impacts.

**Table 4.4: Summary of Baseline Environmental Laboratory Results**

Parameter	Unit	NEQS Standard	Remarks
PM <sub>10</sub> (24 hr avg)	µg/m <sup>3</sup>	150	Within NEQS
PM <sub>2.5</sub> (24 hr avg)	µg/m <sup>3</sup>	75	Compliant
SO <sub>2</sub>	µg/m <sup>3</sup>	120	Low pollution levels
NO <sub>2</sub>	µg/m <sup>3</sup>	80	Well within limit
CO	mg/m <sup>3</sup>	5	Safe concentration
Noise (Daytime)	dB(A)	85	Acceptable industrial range
Groundwater pH	–	6.5–8.5	Neutral, suitable for use
TDS	mg/L	<1,000	Good water quality
BOD (Water)	mg/L	<80	Within safe limits
COD (Water)	mg/L	<150	Environmentally compliant

#### 4.5 Site Suitability

The selection of the project site for the proposed lithium battery assembly plant was based on both environmental and strategic planning considerations. The site is located within the boundaries of **Rawat Industrial Estate**, which is a formally notified and approved industrial zone developed under the Punjab Industrial Estates Development and Management Company (PIEDMC). The estate is zoned exclusively for industrial activity and offers essential infrastructure including internal roads, drainage, electricity supply, and water access.

Topographically, the site is flat, compacted, and does not require significant grading or earthwork, reducing environmental disturbance during construction. It is not part of any floodplain, wetland, protected forest, or ecological corridor, ensuring that project development will not result in the displacement or degradation of sensitive habitats. The absence of water bodies, steep slopes, or erodible soil features further supports the engineering suitability of the plot for the intended industrial construction.

The land is free from encumbrances and is not subject to legal disputes, resettlement, or relocation concerns. The proponent has acquired full legal possession of the plot and holds a formal allotment from the industrial estate authorities. There are no cultural, religious, or heritage sites within or in the vicinity of the project boundary, eliminating the risk of damage to any culturally sensitive assets.

Proximity to major road networks, including **National Highway N-5 (Grand Trunk Road)**, ensures ease of transportation of raw materials and dispatch of finished goods, while also facilitating worker mobility. The availability of labor from nearby urban settlements such as Rawat town and surrounding villages ensures workforce availability without the need for on-site accommodations.

The estate's infrastructure includes provisions for solid waste management, rainwater drainage, and future connection to a centralized wastewater treatment plant. These support systems enhance the environmental viability of the site and allow the proponent to meet regulatory requirements efficiently.

Considering all physical, ecological, legal, and logistical parameters, the selected site is deemed **highly suitable** for the establishment of a lithium battery assembly unit in compliance with environmental and industrial planning guidelines.

## Conclusion

The environmental baseline assessment confirms that the proposed site is ecologically and socially compatible with the intended industrial use. Physical conditions are stable, ecological impacts are minimal due to prior land-use changes, and socio-economic outcomes are expected to be positive. The proponent's planned green development, pollution control measures, and stakeholder engagement strategies further ensure that the project will proceed with environmental integrity and regulatory compliance.

## Flora and Fauna

Flora	Status
<i>Cynodon dactylon</i> (grass)	Common/native
<i>Calotropis procera</i>	Wild shrub
<i>Conocarpus erectus</i>	Planted ornamental

<b>Flora</b>	<b>Status</b>
<i>Eucalyptus camaldulensis</i>	Planted ornamental
<b>Fauna</b>	<b>Status</b>
<i>Passer domesticus</i> (sparrow)	Common
<i>Acridotheres tristis</i> (myna)	Common
<i>Columba livia</i> (pigeon)	Common

No endangered, rare, or protected species were recorded in the project area.

## Chapter 05

### Impact Assessment

This chapter presents the identification, prediction, and evaluation of potential environmental and social impacts that may arise due to the establishment and operation of the lithium battery assembly plant by M/s ACM Lithium Batteries (Pvt.) Ltd. The purpose of the impact assessment is to determine the significance of these effects in relation to baseline environmental conditions and to provide a foundation for developing appropriate mitigation and management strategies.

#### 5.1 Methodologies for Impact Identification

The impact assessment process was guided by standard environmental impact assessment methodologies, integrating both qualitative and quantitative approaches. Key sources included project-specific data, field investigations, laboratory analysis, and stakeholder inputs. The methodology followed for this assessment is in alignment with the Pakistan Environmental Protection Act, 1997, and best international EIA practices including the use of matrices and comparison with baseline conditions.

Potential impacts have been assessed for both the construction phase and operational phase of the project, and where relevant, for the decommissioning phase. The approach includes identification of environmental aspects, analysis of receptor sensitivity, and estimation of the magnitude and duration of impacts. Direct, indirect, short-term, long-term, and cumulative impacts have all been taken into consideration.

##### 5.1.1 Baseline Data Collection

Baseline data collection is a fundamental step in impact assessment. It enables a clear understanding of the pre-project environmental conditions against which future changes and potential impacts can be measured. For this project, baseline data was collected through a combination of methods including physical surveys, environmental sampling, laboratory analysis, and a review of existing meteorological and land use data.

Primary data included air quality, noise levels, groundwater sampling, and visual inspection of flora and fauna. Secondary data was obtained from published reports, remote sensing data, and Pakistan Meteorological Department records. The data helped in the establishment of existing environmental quality and ecological sensitivities.

### 5.1.2 Meteorological Data

Meteorological conditions significantly influence the dispersion of air pollutants and local microclimatic impacts of industrial projects. For this purpose, long-term climate data from the Pakistan Meteorological Department (PMD) was reviewed. The Rawat area experiences a semi-arid climate with significant seasonal variation. Wind speed and direction are critical for assessing pollutant dispersion and were incorporated into the impact modeling process.

The table below summarizes key climatic variables:

**Table 5.1: Summary of Climatic Variables (Rawat Region)**

Parameter	Observed Range	Remarks
Average Temperature	5°C (winter) – 42°C (summer)	Influences ambient thermal emissions
Annual Rainfall	900–1,000 mm	Affects surface runoff and drainage
Prevailing Wind	Southwest – Northeast	Critical for air dispersion modeling
Wind Speed	4 – 11 km/h	Varies seasonally, higher in summer
Humidity Levels	35% – 65%	Affects particulate matter behavior

Meteorological data was used to analyze the extent of air pollutant dispersion and to design stormwater and rainwater harvesting infrastructure. Temperature and rainfall conditions also informed plant design in terms of insulation and ventilation needs.

### 5.1.3 Ambient Air Quality

Ambient air quality was a critical component of the baseline and impact assessment study. Air pollution during the construction phase is expected to arise from dust generation due to excavation, handling of materials, and vehicular emissions. During the operational phase, potential emissions are limited and primarily associated with diesel generators, forklifts, and minor fugitive emissions during handling of battery components.

Baseline sampling was carried out to determine the concentration of **PM<sub>10</sub>**, **PM<sub>2.5</sub>**, **SO<sub>2</sub>**, **NO<sub>2</sub>**, and **CO**. All values were within NEQS limits. The table below presents the baseline values and expected changes:

**Table 5.2: Ambient Air Quality Baseline and Projected Impact**

Parameter	Unit	NEQS Limit	Project Phase Impact	Remarks
PM <sub>10</sub>	µg/m <sup>3</sup>	150	+5–10 µg/m <sup>3</sup> (temporary)	From construction activities
PM <sub>2.5</sub>	µg/m <sup>3</sup>	75	+3–5 µg/m <sup>3</sup> (temporary)	Controlled with dust screens
SO <sub>2</sub>	µg/m <sup>3</sup>	120	Negligible	No significant source
NO <sub>2</sub>	µg/m <sup>3</sup>	80	Slight increase	From vehicular emissions
CO	mg/m <sup>3</sup>	5	No increase expected	Electric machinery used

The project is not expected to have a significant long-term impact on air quality. Nonetheless, dust suppression measures, use of electric tools, and proper material handling protocols will be adopted to ensure compliance during construction.

#### 5.1.4 Groundwater Quality

Groundwater is not the primary water source for this project, as the estate offers treated water for non-potable use. However, assessment of groundwater quality was essential to ensure that project activities do not result in contamination through leakage or improper disposal of chemicals or wastewater.

A groundwater sample was collected from a nearby tube well. Parameters tested included pH, TDS, BOD, COD, and selected heavy metals. The results confirmed that groundwater quality was suitable for industrial applications and posed no risk to human health or ecology under current conditions.

**Table 5.3: Groundwater Quality Baseline**

Parameter	Unit	NEQS Limit	Interpretation
pH	–	6.5 – 8.5	Neutral and suitable
Total Dissolved Solids (TDS)	mg/L	<1,000	Well within acceptable range
Biological Oxygen Demand (BOD)	mg/L	<80	Low organic load
Chemical Oxygen Demand (COD)	mg/L	<150	Compliant
Lead (Pb)	mg/L	<0.05	Not detected

Parameter	Unit	NEQS Limit	Interpretation
Chromium (Cr)	mg/L	<0.05	Not detected

During the operational phase, the facility will adopt a zero liquid discharge strategy, and any wastewater generated will be pre-treated and diverted to the industrial estate’s wastewater infrastructure. All storage tanks and chemical handling areas will be lined and banded to prevent accidental leakage into the soil or groundwater.

## 5.2 Predictive Tools for Impact Assessment

To ensure a robust and scientifically sound environmental impact assessment, a variety of predictive tools were employed to anticipate and evaluate the potential impacts of the proposed lithium battery assembly project. These tools offer structured, evidence-based frameworks for identifying environmental consequences and allow for comparison of alternative decisions. For this project, key tools applied included the Leopold Matrix, Stakeholder Consultations, and a Life Cycle Assessment (LCA) approach.

### 5.2.1 Leopold Matrix

The Leopold Matrix is one of the most widely used tools for evaluating environmental impacts in a structured and systematic way. It involves the cross-referencing of project actions (such as construction, operation, material handling, and waste generation) against various environmental parameters (such as air, water, soil, flora, fauna, and socioeconomics).

For the current project, a customized Leopold Matrix was developed based on identified activities and likely environmental receptors. Each interaction was scored based on **magnitude** and **importance**, with higher scores indicating more significant impacts. The matrix allowed for prioritization of impacts that require mitigation or monitoring.

**Table 5.4: Excerpt from the Leopold Matrix (Construction & Operation Phase)**

Environmental Component	Site Clearing	Construction	Equipment Operation	Waste Handling	Employment Generation
Air Quality	6 / 5	5 / 4	4 / 4	2 / 2	0 / 0
Soil Quality	4 / 3	3 / 3	2 / 2	5 / 5	0 / 0
Noise Environment	5 / 4	4 / 3	6 / 5	1 / 1	0 / 0

<b>Environmental Component</b>	<b>Site Clearing</b>	<b>Construction</b>	<b>Equipment Operation</b>	<b>Waste Handling</b>	<b>Employment Generation</b>
Groundwater	2 / 2	3 / 3	2 / 2	4 / 4	0 / 0
Flora & Fauna	3 / 2	1 / 1	1 / 1	0 / 0	0 / 0
Socioeconomic Impacts	0 / 0	1 / 2	2 / 2	1 / 1	7 / 7

Each score represents "Magnitude / Importance". Scores above 5 in either column indicate a significant impact requiring active mitigation. For instance, noise during equipment operation (6/5) and dust emissions during site clearing (6/5) were identified as key short-term impacts, while socioeconomic impacts from employment creation were positive (7/7).

### 5.2.2 Stakeholder Consultations

Stakeholder engagement serves as a valuable tool for identifying social and environmental concerns that may not be immediately evident through technical assessments alone. For this project, consultations were carried out with nearby residents, laborers, estate management officials, and community representatives. These interactions were informal and structured around open-ended discussions and guided questionnaires.

The key concerns raised by stakeholders included potential air and noise pollution during construction, traffic congestion, and expectations regarding local employment. In addition, there was significant interest in understanding how waste would be managed and whether any groundwater would be contaminated. These consultations informed both the impact identification and the design of the mitigation strategies.

Most stakeholders expressed support for the project, especially in light of its potential to generate jobs and stimulate local economic activity. Community acceptance was found to be high, especially when the proponent committed to transparent environmental practices and compliance with EPA guidelines.

Stakeholder input was also integrated into the Environmental Management Plan (EMP), ensuring that community concerns are addressed throughout the lifecycle of the project.

### 5.2.3 Life Cycle Assessment (LCA)

The Life Cycle Assessment (LCA) approach was applied in the impact assessment of the proposed lithium battery assembly project to ensure that the environmental implications of the project are understood across its entire operational value chain. Unlike traditional assessments that focus primarily on site-specific activities, LCA enables a comprehensive evaluation of environmental burdens associated with each stage of the product's life, from the sourcing of raw materials to the final stage where the battery leaves the facility. This ensures that decision-making accounts for both visible and embedded environmental impacts.

For the current project, a cradle-to-gate life cycle boundary was adopted. This included the stages from procurement of components (such as lithium cells, copper foil, separators, and printed circuit boards), internal manufacturing and assembly operations, internal transportation and packaging processes, up to the point where the final battery packs are ready for distribution. Post-consumer stages, including end-of-life battery disposal or recycling, were excluded as the project does not involve battery reclamation or collection. However, optional strategies for product stewardship were noted for future expansion.

The LCA methodology followed the principles of ISO 14040 and ISO 14044 standards. The goal and scope definition identified the main unit processes to be assessed, such as cell stacking, welding, battery housing, testing, packaging, and internal quality assurance procedures. The inventory analysis stage included the measurement of input resources such as electricity, compressed air, adhesive materials, insulation foams, and packing films, while outputs included solid waste, packaging waste, and minimal emissions. All data used was specific to this facility, combined with secondary data from LCA databases for upstream materials.

The impact assessment phase translated these inventory flows into environmental categories such as carbon footprint (CO<sub>2</sub>-eq), energy consumption (MJ), water use (liters), and solid waste generation (kg). Electricity consumption was identified as the dominant contributor to both carbon emissions and operational energy demand, especially due to HVAC needs for temperature-controlled assembly rooms and battery performance testing. The transportation of imported lithium cells also contributed significantly to the project's indirect emissions due to air and sea freight logistics.

The findings highlighted that, while the onsite emissions of the facility are minimal due to the absence of fuel combustion or chemical processing, embedded impacts in imported

components and energy use are significant. Strategies such as optimizing energy efficiency, using solar PV installations, and partnering with recycling firms for waste minimization can considerably reduce the overall environmental burden.

Furthermore, packaging waste was identified as a significant post-assembly output. To address this, the proponent is considering a closed-loop packaging reuse system, wherein suppliers and distributors collaborate to return and reuse shipping containers, cartons, and trays, thereby reducing the need for single-use materials.

In conclusion, the LCA confirmed that the proposed project has a low on-site environmental footprint, but certain upstream and downstream stages such as electricity consumption and logistics have measurable environmental consequences. The integration of efficient energy systems, renewable energy, and circular packaging models is therefore recommended to reduce the long-term life cycle impacts of the plant's operation. These insights from the LCA have been incorporated into the Environmental Management Plan (EMP) and sustainability objectives of the proponent.

### 5.3 Characteristics of Impacts

The characterization of impacts involves analyzing the nature, scale, duration, intensity, and reversibility of environmental and social changes expected as a result of the proposed project. These impacts have been classified according to the project lifecycle stages, specifically construction, operation, and post-operation or decommissioning, and evaluated in terms of whether they are direct or indirect, positive or negative, and temporary or permanent.

The proposed lithium battery assembly plant is not a highly polluting industrial unit in terms of emissions or effluents; however, given the sensitive nature of battery components and resource usage, a detailed understanding of key impacts is critical for long-term environmental management. The following subsections elaborate on the principal environmental, social, and cumulative impacts anticipated from the project.

#### 5.3.1 Key Environmental Impacts

The environmental impacts of the project are concentrated in specific areas including air quality, noise generation, solid waste generation, and resource consumption. During the construction phase, the most immediate impacts include dust emissions from land preparation, vehicular movement, and civil works. These impacts are of short-term, moderate intensity, and are largely reversible once the site is stabilized and paved.

Air emissions during the operational phase are minimal due to the electrically powered nature of the equipment and absence of chemical reactions in the assembly process. However, fugitive emissions may arise during the handling and testing of lithium battery cells. Proper enclosure of handling areas, coupled with localized ventilation and particulate filters, will mitigate these emissions.

Noise levels during construction are expected to be elevated due to the operation of excavators, concrete mixers, and transport vehicles. These will reduce considerably once construction is completed, as operational activities involve automated assembly lines and minimal heavy mechanical work. Noise will be managed through timing restrictions, equipment maintenance, and buffer plantation.

Solid waste generation includes packaging waste, rejected battery components, and general refuse. The majority of this waste is non-hazardous, but defective lithium cells are considered hazardous and will require special handling and disposal through licensed waste management contractors. Resource consumption, particularly electricity and cooling water, represents an indirect impact on the environment and underscores the need for efficient design and the potential integration of renewable energy solutions.

### 5.3.2 Socio-Economic Impacts

The socio-economic impacts of the proposed project are predominantly positive in nature, especially for the local communities and workforce around the Rawat Industrial Estate. During the construction phase, temporary employment will be generated for civil, mechanical, and electrical works, offering opportunities for both skilled and unskilled labor from nearby areas.

The operational phase is expected to create permanent job opportunities for engineers, technicians, logistics staff, and administrative personnel. This is likely to boost household incomes and contribute to local economic stability. Additionally, secondary benefits will be realized by nearby vendors, service providers, transporters, and small businesses catering to the plant workforce.

The project is not expected to involve any displacement of people, land acquisition issues, or interference with public infrastructure. The land is already designated for industrial use, and no resettlement or compensation is required. Moreover, the proponent has committed to corporate social responsibility (CSR) activities focusing on skill development, environmental awareness, and local community engagement, which will further strengthen the socio-economic profile of the area.

Concerns raised during stakeholder consultations regarding air pollution, traffic congestion, and water use have been addressed through design-stage interventions and environmental management plans. The presence of a formal complaint redress mechanism will allow for continued community engagement and resolution of future grievances.

### 5.3.3 Cumulative Impacts

Cumulative impacts arise when the effects of the proposed project are combined with the existing and potential future activities in the surrounding area. In this case, the Rawat Industrial Estate already hosts a number of industrial units engaged in logistics, manufacturing, packaging, and engineering services. While each individual unit may have a limited impact, the aggregate pressure on air quality, traffic volume, noise levels, and groundwater resources could become significant if not managed collectively.

The proposed battery assembly plant will add marginally to this overall load, particularly through solid waste and electricity demand. However, since the facility will not use significant chemical processes, emit industrial effluents, or engage in high-decibel manufacturing, its contribution to cumulative degradation is expected to be minor.

The cumulative stress on infrastructure, such as waste disposal systems and internal roads, is a concern. The proponent has coordinated with the Punjab Industrial Estates Management to ensure that the shared infrastructure, such as the central wastewater collection system and solid waste disposal services, remains adequate. The use of modern, energy-efficient systems and the adoption of internal sustainability practices by the project also mitigate the cumulative environmental load.

To ensure that cumulative impacts remain manageable, it is recommended that periodic joint monitoring by estate industries and environmental authorities be institutionalized. Shared initiatives for renewable energy, water reuse, and green zone development within the estate would further reduce the combined environmental footprint of the industrial area.

## Chapter 06

### Environmental Management and Monitoring Program (EMMP)

#### 6.1 Introduction

The Environmental Management and Monitoring Program (EMMP) is a structured framework designed to ensure that the environmental impacts identified during the Environmental Impact Assessment (EIA) process are systematically addressed through mitigation, monitoring, and adaptive measures. The EMMP plays a central role in operationalizing environmental compliance and sustainability objectives throughout the project's life cycle, from construction to full-scale operation and eventual decommissioning if applicable.

The purpose of the EMMP is not merely to respond to regulatory requirements, but to serve as an operational guide for managing risks, implementing best practices, and engaging with key stakeholders, including regulatory bodies, employees, service providers, and the surrounding community. It also ensures that environmental commitments made by the proponent are fulfilled responsibly and transparently.

##### 6.1.1 Purpose of the EMMP

The primary purpose of the EMMP is to translate the findings and recommendations of the EIA into actionable and enforceable procedures. It ensures that the mitigation measures proposed for potential environmental and social impacts are effectively implemented and monitored. The EMMP also acts as a performance evaluation tool, allowing project managers, environmental officers, and regulators to assess whether the project remains within acceptable environmental limits during its construction and operational phases.

In addition to environmental safeguards, the EMMP supports occupational health and safety (OHS) and promotes resource efficiency. It ensures that emissions, waste, noise, and other environmental outputs remain within National Environmental Quality Standards (NEQS) and are reported in accordance with the requirements of the Punjab Environmental Protection Agency (EPA).

Through periodic monitoring and reporting, the EMMP helps detect deviations from baseline conditions or performance benchmarks. It then guides corrective actions to bring project operations back into compliance, thus supporting long-term sustainability and legal adherence.

### 6.1.2 Phases of the EMMP

The EMMP is designed to cover all critical stages of the project. During the **construction phase**, the program focuses on minimizing physical disturbance, controlling dust and noise emissions, managing construction waste, and ensuring worker safety. Specific actions include dust suppression, safe storage of construction materials, proper disposal of construction debris, and avoidance of spillages from fuel and lubricant handling.

In the operational phase, the EMMP ensures the ongoing management of solid waste, safe handling and disposal of battery rejects, maintenance of air quality through dust and emission control, and periodic review of noise levels. It also monitors the performance of utility systems such as HVAC, backup generators, and internal drainage systems, ensuring that these do not become sources of environmental degradation.

The EMMP is also prepared to guide actions during the decommissioning or transition phase, although such a phase is not expected in the near term. Nonetheless, should the facility undergo closure or repurposing, provisions in the EMMP will guide soil restoration, dismantling of structures, safe disposal of residual materials, and documentation of environmental clearance.

The table below outlines key responsibilities by project phase:

**Table 6.1: EMMP Focus Areas by Project Phase**

<b>Project Phase</b>	<b>EMMP Focus</b>
Construction	Dust and noise control, erosion prevention, debris management, worker safety
Operational	Waste handling, air quality control, equipment maintenance, noise monitoring
Transition/Closure	Safe dismantling, soil remediation, removal of unused chemicals or batteries

### 6.1.3 Dynamic and Adaptive Approach

Environmental management is not a static process. The EMMP for this project is based on a dynamic and adaptive framework, which allows it to evolve in response to monitoring results,

technological advancements, changes in regulatory requirements, or feedback from stakeholders and local communities.

An adaptive approach means that mitigation strategies and monitoring frequencies may be revised over time based on the actual performance of the project. For instance, if ambient noise measurements consistently remain well below NEQS, the frequency of monitoring may be reduced in consultation with the EPA. Conversely, if dust emissions are observed to rise during dry months, intensified suppression strategies can be introduced, such as increasing watering intervals or installing dust screens.

This flexibility ensures that the EMMP remains relevant, cost-effective, and responsive to on-ground realities. Furthermore, the dynamic structure encourages a culture of environmental responsibility among staff and management by emphasizing continuous improvement, internal audits, and the integration of environmental performance into key performance indicators (KPIs).

To support this adaptive approach, a dedicated Environmental Management Unit (EMU) will be formed, comprising an Environmental Officer, Health and Safety Supervisor, and Waste Management Technician. This team will be responsible for maintaining documentation, conducting internal inspections, and reporting to the relevant regulatory bodies.

## 6.2 Description of Proposed Mitigation Actions

Mitigation measures are integral to reducing or eliminating adverse environmental effects arising from the project activities. Based on the impact assessment findings, M/s ACM Lithium Batteries (Pvt.) Ltd. has proposed a comprehensive set of mitigation actions tailored to each project phase. These measures are designed to ensure compliance with national environmental standards and promote best practices across air quality, waste management, noise control, and occupational safety domains.

The overall strategy involves integrating control measures into engineering design, enforcing standard operating procedures (SOPs), and training staff to follow environmentally responsible practices. Continuous monitoring, evaluation, and internal audits will be used to ensure effective implementation and timely corrective actions if needed.

### 6.2.1 Mitigation for Air Quality Impacts

Air quality is particularly sensitive during the construction phase due to the generation of particulate matter from excavation, material handling, and vehicular movement. The

operational phase of the battery assembly facility is comparatively cleaner, but minor emissions may result from standby generators and movement of forklifts or transport vehicles.

To mitigate these potential impacts, several actions have been planned. Water sprinkling will be regularly carried out on unpaved areas to suppress dust. Stockpiles of construction material such as sand and cement will be covered to prevent wind dispersal. All construction vehicles and machinery will be maintained to ensure emission levels remain within acceptable limits.

During operations, the use of electric forklifts and battery-powered tools will eliminate combustion-related emissions inside the facility. Local exhaust ventilation will be installed in testing and battery assembly zones to capture and filter any fugitive emissions. Emergency generators will meet EURO/NEQS emission standards and will be operated only during power outages.

The mitigation measures are summarized below:

**Table 6.2: Mitigation Measures for Air Quality**

Phase	Source of Emission	Mitigation Measure
Construction	Dust from ground activities	Water sprinkling twice daily, dust screens at perimeters
Construction	Emissions from vehicles	Use of tuned vehicles and low-sulfur diesel
Operation	Testing and battery handling	Local exhaust with particulate filters
Operation	Generator emissions	EURO-compliant gensets, enclosed operation areas
Operation	Movement of materials	Use of electric forklifts, efficient logistics scheduling

These efforts will ensure that dust and gaseous emissions remain within National Environmental Quality Standards (NEQS) throughout the project lifecycle.

### 6.3 Schedule for Implementation

To ensure the timely application of environmental mitigation measures, a phased implementation schedule has been developed. The schedule is aligned with key project milestones and construction packages. Pre-construction activities such as site clearing and

leveling will incorporate dust and noise mitigation from the outset, while more complex controls will be introduced during the main civil works and operational readiness stages.

Each mitigation measure is assigned a timeframe for commencement and completion, along with the responsible personnel or department. Continuous measures such as air quality monitoring, housekeeping, and waste segregation will continue throughout the life of the project.

**Table 6.3: Implementation Schedule of Mitigation Measures**

Activity	Mitigation Start	Duration	Responsible Unit
Site preparation and dust control	Before excavation begins	Until civil works end	Site Contractor
Noise management	Civil work commencement	Ongoing	HSE Supervisor
Solid waste segregation	Operational setup phase	Continuous	Waste Management Technician
Wastewater pre-treatment setup	Facility commissioning	One-time installation	Utility Engineer / Consultant
Tree plantation and landscaping	Post-civil works phase	2 months	Admin & Landscaping Department

This schedule will be integrated into the main project execution plan and monitored by the Environmental Management Team (EMT) to ensure compliance and accountability.

#### 6.4 Environmental Management Team (EMT) and Responsibilities

The effective implementation of the EMMP requires a dedicated Environmental Management Team (EMT) comprising trained personnel from various technical and administrative backgrounds. This team will be responsible for day-to-day monitoring, coordination of mitigation measures, documentation of compliance activities, and regular communication with the Punjab EPA and other stakeholders.

The EMT will operate under the supervision of the Project Director and will coordinate with departments such as procurement, HR, engineering, and maintenance to ensure environmental

compliance is embedded across operations. The EMT will also maintain environmental logs, incident registers, and monitoring reports.

The following table outlines the structure and core responsibilities of the EMT:

**Table 6.4: Roles and Responsibilities of the Environmental Management Team**

<b>Designation</b>	<b>Key Responsibilities</b>
Environmental Officer	Oversees implementation of EMMP, prepares reports, ensures NEQS compliance
HSE Supervisor	Conducts safety audits, noise assessments, and training of construction staff
Waste Management Technician	Monitors waste segregation, storage, and dispatch to approved vendors
Documentation Assistant	Maintains monitoring data, complaints, inspection records, and follow-ups
Utility Engineer	Ensures generator emissions, water systems, and HVAC remain environmentally safe

Regular team meetings and periodic third-party audits will support the EMT in maintaining transparency, consistency, and continual improvement in environmental performance.

### 6.5 Proposed Monitoring Program

The monitoring component of the EMMP is essential to ensure that all environmental aspects of the project are tracked, verified, and adjusted as needed. A structured monitoring program helps confirm compliance with national environmental regulations, detect emerging issues, and evaluate the effectiveness of the mitigation measures applied.

Environmental monitoring will be undertaken during both construction and operational phases, and will cover parameters such as air quality, noise levels, wastewater quality, groundwater condition, solid waste handling, and overall housekeeping practices. The data generated through this program will be compiled into environmental performance reports submitted to the **Punjab Environmental Protection Agency (EPA)**.

### 6.5.1 Monitoring Parameters

Specific environmental parameters have been selected for monitoring based on the nature of the project, the predicted impacts, and legal obligations under NEQS. These parameters will be measured at designated intervals using standard methods and certified laboratories where external testing is required.

The table below outlines the core monitoring parameters and their proposed frequency:

**Table 6.5: Monitoring Parameters and Frequency**

<b>Environmental Component</b>	<b>Parameter</b>	<b>Monitoring Frequency</b>	<b>Responsibility</b>
Ambient Air Quality	PM <sub>2.5</sub> , PM <sub>10</sub> , SO <sub>2</sub> , NO <sub>2</sub> , CO	Quarterly during operations	Environmental Officer / 3rd Party
Noise Levels	dB(A) at boundary and inside plant	Monthly	HSE Supervisor
Groundwater Quality	pH, TDS, COD, BOD, Metals	Bi-annually	Environmental Officer
Wastewater (if applicable)	BOD, COD, TSS, pH, Oil & Grease	Monthly (if wastewater generated)	Utility Engineer
Solid Waste Management	Segregation, Quantity, Disposal	Weekly internal log	Waste Management Technician
Rainwater System Function	Cleanliness, Storage, Overflow	Monthly	Facility Maintenance Team

All records will be maintained in environmental logbooks and made available for audit or inspection.

### 6.5.2 Performance Indicators

To assess the environmental performance of the facility, a set of Key Performance Indicators (KPIs) will be used. These indicators are linked to the most material impacts and provide a

measurable reference for evaluating ongoing performance. If any KPI consistently falls outside the target range, it will trigger an internal review and, if necessary, corrective action.

**Table 6.6: Environmental Performance Indicators**

KPI	Target / Threshold	Action if exceeded
PM <sub>2.5</sub> and PM <sub>10</sub> concentrations	Within NEQS limits (75 µg/m <sup>3</sup> & 150 µg/m <sup>3</sup> )	Review dust control, adjust traffic flow
Generator Emission Levels	Within NEQS standards	Maintenance check or filter replacement
Solid Waste Segregation Rate	Minimum 90% segregation at source	Retraining of staff, improve bin placement
Noise Levels (Boundary)	Not exceeding 65 dB(A) during daytime	Install acoustic barriers or reschedule activity
Rainwater Harvesting Overflow	Nil overflow or stagnant pooling	Clean filters and adjust inlet slope

These KPIs will be reviewed in monthly EMT meetings and summarized in quarterly compliance reports.

## 6.6 EMP Reporting and Review Procedures

The successful execution of the Environmental Management Plan requires transparent and consistent documentation. Regular reporting forms the backbone of environmental accountability and ensures that all data, incidents, and corrective actions are traceable and auditable.

The **Environmental Officer** will compile monthly and quarterly internal reports based on field observations, monitoring results, and departmental logs. These reports will include:

- Results of air, noise, and water sampling
- Summary of waste generation and disposal
- Deviations from EMP provisions
- Actions taken in response to non-compliance

- Recommendations for improvement

Quarterly reports will be formally reviewed by the Environmental Management Team (EMT), after which they will be submitted to the EPA Punjab and included in the organization's internal management review.

Additionally, an annual environmental performance review will be conducted, which will consolidate all findings and provide a year-on-year environmental footprint for the facility. This process supports continuous improvement, regulatory alignment, and transparent communication with stakeholders.

In the event of an environmental incident (e.g., chemical spill, unplanned discharge, or regulatory breach), the EMT will prepare an Incident Report within 24 hours, outlining root causes, immediate responses, and long-term corrective measures.

To ensure the long-term effectiveness of the EMP, the proponent will arrange periodic third-party audits by an EPA-accredited consultant, whose findings will help validate internal data and provide independent recommendations.

## EMMP For ACM Lithium Batteries Pt. Ltd

Sr. #	Aspects	Impacts	Mitigation Measures	Construction / Operation	Responsibility	Monitoring
1	Ambient Air Quality	Emissions from generator exhaust, vehicle movement, and minor fumes from soldering/testing units	Install emission control devices on standby generators; use of electric forklifts inside facility; prohibit open burning of packaging waste; conduct quarterly ambient air quality monitoring	Both	HSE Department	Environmental Consultant / EPA Punjab
2	Noise & Vibration	Noise from conveyors, forklifts, production and testing equipment, backup generator	PPEs such as ear plugs; soundproof generator housing; conduct activities during working hours; ensure machines are serviced regularly	Both	HSE Department	Environmental Consultant / EPA Punjab

3	Health & Safety	Worker exposure to electrical hazards, fire risks, battery handling accidents	Provide PPEs; first aid and fire safety training; install thermal detection and suppression systems; enforce workplace safety SOPs; clear signage; establish emergency assembly points	Both	HSE Department	Environmental Consultant / EPA Punjab
4	Wastewater	Domestic wastewater from staff toilets and kitchens; minor greywater	Treat in septic tank with soak pit; desludging schedules; ensure PEQS compliance; prevent discharge into storm drains	Operation	HSE Department	Environmental Consultant
5	Solid Waste Generation	Cardboard, plastic packaging, e-waste from rejected cells, damaged battery components	Segregate waste at source; store hazardous waste in sealed containers; partner with EPA-approved disposal contractors; reuse packaging material where feasible	Both	HSE / Waste Management Team	Environmental Consultant / EPA Punjab

6	Odor	Odor from damaged battery cells or exposed raw materials	Store rejected cells in sealed bins; cover raw materials; provide face masks to production floor workers	Operation	HSE Department	Environmental Consultant / EPA Punjab
7	Energy Requirement	High energy demand from HVAC, battery testing, automation systems	Use energy-efficient machinery; conduct internal energy audits; automate shutdown of idle systems; use solar panels for admin blocks and outdoor lighting	Operation	Maintenance + HSE	Internal Energy Audit Report
8	Employment (Socioeconomic)	Changes in local employment trends	Prefer hiring local labor and technicians; offer skill training and internships to nearby communities	Operation	Proponent	N/A
9	Education (Socioeconomic)	Awareness gap on battery handling and safety	Coordinate with local educational institutions to deliver safety awareness and technical training programs	Operation	Proponent	NGO / Consultant Survey

10	Public Health	Potential long-term exposure to chemical and fire hazards	Provide health coverage for employees; first aid units on-site; conduct health and hygiene awareness in communities; display emergency contacts and provide drinking water	Operation	HSE + Admin Department	EPA Punjab / Proponent Review
11	Cultural Impact	Risk to local norms from non-local labor influx	Maximize local hiring to ensure cultural harmony; orientation and code of conduct briefing for outside hires	Construction	Proponent	NGO Survey / Consultant
12	Sanitation Awareness	Improper waste disposal in surrounding areas	Conduct awareness programs on electronic and general waste handling; initiate CSR sanitation campaigns	Operation	Proponent / Local NGO	NGO Reports / Environmental Consultant
13	Battery Storage & Handling	Risk of fire, chemical leakage, thermal runaway	Store batteries in ventilated, fire-rated containers; follow UN38.3 storage standards; fire	Operation	HSE Officer + Warehouse Team	Consultant / Facility Inspection Logs

			extinguishers and alarms to be placed strategically; thermal cut-off sensors			
14	Chemical Handling	Inhalation or skin contact with residues or leaked electrolyte	Use of face shields, gloves, chemical SOPs, and spill kits; regular HSE training; eyewash stations in testing areas	Operation	HSE Department	Environmental Consultant / EPA Punjab
15	Fire Safety System	Fire due to flammable lithium or short circuit	Smoke and heat detectors; Class D extinguishers; clear fire escape routes; monthly inspections and fire drills every six months	Both	Facility Manager + Admin	Internal Monthly Logs / EPA Audit
16	Transportation Impact	Noise, congestion, emissions from logistics and delivery vehicles	Limit heavy vehicle entry during peak hours; encourage electric transport for intra-site movement; use covered vehicles for batteries	Operation	Logistics Head + Admin	Emissions Log + Compliance Audit
17	Emergency Preparedness	Poor response to accidents or fire could cause injury/loss	Maintain ERP; conduct regular fire, evacuation, and spill drills; post	Both	HSE Department	Drill Logs / Incident Reports

			emergency contact lists at visible locations; ensure full readiness			
18	Occupational Health	Worker fatigue, repetitive strain, EMF exposure	Rotate tasks; ergonomic workstations; conduct annual medicals; minimize exposure to high EMF near testing chambers	Operation	HR + HSE	Health Reports + HR Logs
19	Lighting & Ventilation	Poor lighting or air circulation affecting productivity and safety	Install adequate LED lighting; ensure air exhausts and duct systems are maintained; clean filters regularly	Operation	Admin / Maintenance	Monthly Facility Checks
20	Visual / Aesthetic Impact	Dust and poor visual appeal for nearby industrial units	Use green netting during construction; establish green belt inside compound; properly dispose of materials and maintain clean surroundings	Construction	Site Engineer + Admin	Visual Observations

21	Rainwater Harvesting	Waterlogging, drainage issues due to poor design	Design recharge wells and collection pits; install silt traps and mesh filters; conduct post-rain inspections	Operation	Civil Engineer + HSE	Routine Visual Checks
22	GHG / Carbon Emissions	CO <sub>2</sub> emissions from energy use and logistics	Monitor carbon footprint; install solar panels on roof; reduce generator reliance; encourage energy-efficient systems and behavioral changes	Operation	HSE + Energy Consultant	Annual GHG Audit

## Key Notes for ACM Batteries

1. The project is located in an industrial estate with centralized utility and waste infrastructure, reducing the need for independent effluent treatment or hazardous waste incineration.
2. The operational design emphasizes automation, low-emission technologies, and high energy efficiency, minimizing environmental exposure.
3. Any defective or rejected lithium cells will be stored in a secure hazardous waste area and handed over only to licensed disposal facilities.
4. A complaint redressal mechanism will be established for community members or stakeholders to report environmental grievances.
5. Compliance with NEQS, EPA guidelines, and best industrial practices remains a core operational principle of M/s ACM Lithium Batteries (Pvt.) Ltd.

## Chapter 7

### Stakeholders Consultation

#### 7.1 Introduction

Stakeholder consultation is a critical part of the Environmental Impact Assessment (EIA) process for any project. For the proposed project by M/S ACM Lithium Batteries (Pvt.) Ltd., a series of consultations were held with various stakeholders from the local community, government agencies, and other relevant groups to gather their feedback on the project's potential social, economic, and environmental impacts. The consultations aimed to provide a platform for stakeholders to voice their concerns, suggestions, and expectations regarding the project.

#### 7.2 Methodology of Consultation M/s ACM Lithium Batteries (Pvt.) Ltd.

The EIA team conducted public consultations through group meetings and individual discussions. A Comprehensive questionnaire was developed in order to conduct the survey. The primary focus was to engage local communities and gather their perspectives on the proposed construction of the facility, its potential benefits, and any concerns related to environmental impacts. The consultations targeted stakeholders including local residents, government officials, and business owners from the surrounding area. Public discussions were held at various locations near the project site, and stakeholders from local communities, educational and health institutions, shops, and other facilities were consulted. The team also made initial visits to the project site and held reconnaissance meetings to understand the local context better.

#### 7.3 Stakeholder Identification

A three-tier approach was adopted for stakeholder identification, which considered the various levels at which stakeholders could be impacted by the project. The stakeholders were classified at the provincial level (e.g., Environmental Protection Agency (EPA), Agriculture Department, Wildlife Department), district level (e.g., local government bodies), and village level (e.g., local residents, shopkeepers, school representatives, etc.). The consultations continued throughout the project lifecycle, ensuring that feedback was integrated into the environmental management plan. Regular engagement with these stakeholders is crucial to maintain transparency and responsiveness to their concerns.

#### 7.4 Proponent's Environmental Management Team

M/s ACM Lithium Batteries (Pvt.) Ltd. management assured that all necessary mitigation measures would be implemented to minimize any potential environmental impacts during the construction and operation phases of the project. The proponent's Environmental Management Team will oversee the adoption of these measures, including maintaining the aesthetics of the area and addressing concerns related to environmental degradation.

#### 7.5 Responsible Authority

The responsibility for overseeing the implementation of the proposed mitigation measures lies with the management of M/S ACM Lithium Batteries (Pvt.) Ltd.. The company is committed to adhering to all environmental regulations and ensuring that the project's impact on the surrounding community and the environment is minimized.

#### 7.6 Other Departments and Agencies

For the impact analysis, detailed meetings were held with local community leaders, educational institutions, health facilities, and NGOs. These discussions helped identify key issues related to the project and its potential effects. All relevant concerns were incorporated into the Environmental Management Plan to ensure a holistic approach to mitigating the project's impacts.

#### 7.7 Environmental Practitioners and Experts

The team of environmental consultants conducted site visits and consultations with stakeholders from nearby villages. They gathered information on the socio-economic impacts of the project and incorporated feedback from different professionals, including local business owners, farmers, teachers, and health professionals. The consultations with women were also conducted, although some hesitated to provide personal information due to social constraints.

#### 7.8 Affected and Wider Community

No specific community was found to be directly affected by the project within the study area. The consultations with the local population revealed a general positive response toward the project. Stakeholders emphasized that the project could bring tangible benefits, such as job creation and local development, while ensuring that mitigation measures were taken to preserve the environment.

## 7.9 Consultation Findings

The results from the consultation meetings with stakeholders indicate a strong overall support for the project. The local community members expressed positive feedback regarding the project's potential to bring socio-economic benefits to the area, particularly in terms of employment opportunities and business growth. Many respondents felt that the construction of the project would improve the local infrastructure, contribute to social mobility, and increase the importance of the area.

However, there were also concerns raised regarding the potential environmental impacts, especially in relation to the potential effects on the area's aesthetic value and the environment. Some participants were worried about the impact on the scenic beauty of the area, but the project proponents assured that mitigation measures, such as land reclamation and maintaining the aesthetics of the area, would be implemented to address these concerns.

## 7.10 Stakeholder Feedback

The responses from stakeholders, summarized below, provide a more detailed picture of their views:

### 7.10.1 Sample Size

20 sample size was selected by the Team of consultants for conducting the socioeconomic survey. Women were also consulted for the said survey; some of their names are mentioned in the above list of respondents while most of them were not willing to give personal information.

### 7.10.2 Statistical Analysis

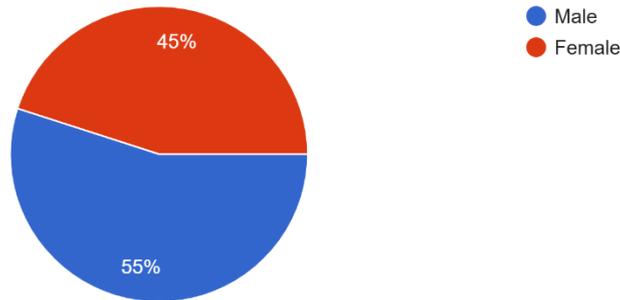
Two Different statistical software excel and SPSS have been used for the statistical analysis of the data collected during the visit of study site villages through questionnaires.

### 7.10.3 Results and Discussion

#### **Gender**

The consultations involved 20 respondents, including both 11 male and 9 female participants.

Gender  
20 responses

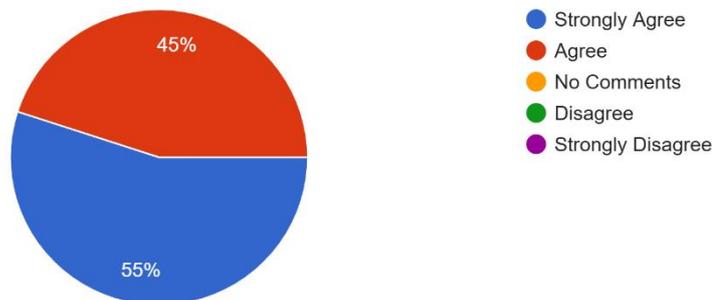


*Figure 1: Gender of the Respondents*

### **Project Support and Importance**

The majority of the respondents (11), both male and female, expressed strong support for the proposed project. Most (9) agreed that the construction of the facility would increase the importance of the area, contributing to its overall growth and development. Participants were optimistic about the project's potential to raise the profile of the local community and enhance its standing within the region. The support for the project reflected a shared belief that it would bring significant benefits to the community.

Are you in favor of the proposed construction?  
20 responses



*Figure 2: Respondents in favor of the Project*

Will the project increase the importance of the area?  
20 responses

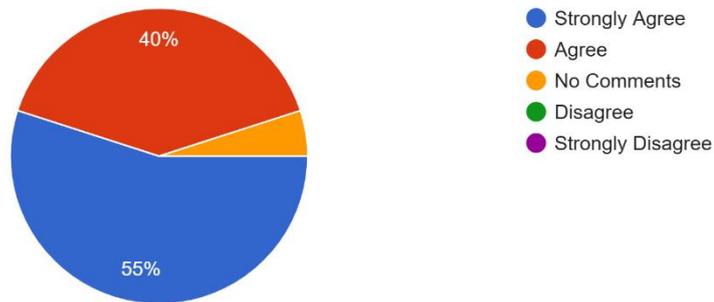


Figure 3: Respondents' Views on the Impact of the Project on the Importance of the Area

### Improvement of Living Standards

While many respondents believed that the project would improve the living standards of the area, a few raised concerns. Approximately, 17 respondents strongly agreed or agreed that the project would result in better infrastructure, more employment opportunities, and improved services, which could enhance the overall quality of life. However, 3 individuals disagreed, possibly due to concerns over potential negative environmental impacts or uncertainties about the project's long-term benefits. Despite these reservations, the majority of the community seemed confident that the project would lead to better economic prospects.

Will the project help to improve the living standards of the area?  
20 responses

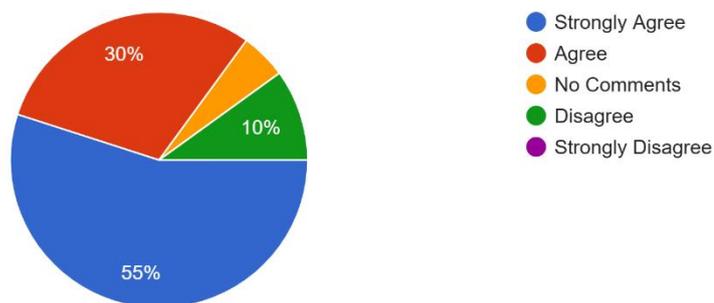


Figure 4: Respondents' Views on the Impact of the Project on the living standards of Area

### Environmental Impact Concerns

When asked about the environmental impact of the project, responses were varied. 14 respondents strongly disagreed and 3 disagreed that the project would have any negative effect on the environment, 1 showed concern regarding its potential to disrupt area's aesthetic value. 2 responders were neutral and given no comments.

Will the project affect the environment of the area?  
20 responses

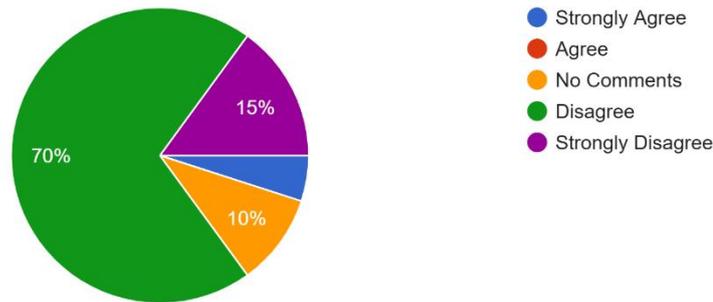


Figure 5: Respondents' Views on the Impact of the Project on the Environment of Area

### Satisfaction with the Project

In terms of satisfaction, a substantial number of participants expressed their contentment with the project and its potential benefits. 18 respondents indicated their approval, citing the job creation and economic growth the project would bring. Their positive outlook on the project reflected their anticipation of tangible improvements in their community. However, 2 individuals, were neutral regarding the project satisfaction.

Level of satisfaction?  
20 responses

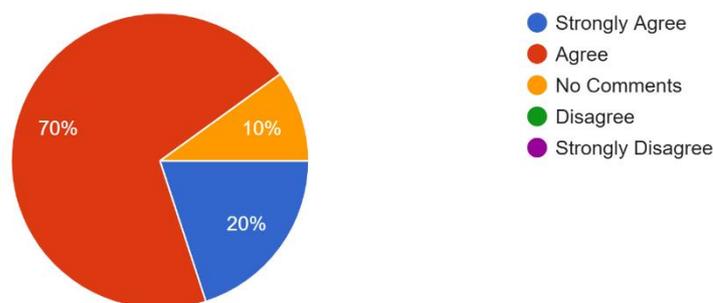


Figure 6: Respondents' Level of Satisfaction Regarding the Proposed Project

## Conclusion

The stakeholder consultation process for the M/S ACM Lithium Batteries (Pvt.) Ltd. project demonstrated strong support for the initiative from the local community, with a clear recognition of its potential to boost the area's economic development. While environmental concerns were noted, the project proponents have committed to implementing mitigation measures to address these issues and maintain local aesthetic and environmental values. Continuous engagement with stakeholders throughout the project's lifecycle is crucial to ensure that any emerging concerns are promptly addressed.

## Chapter 08

### Conclusion and Recommendations

The Environmental Impact Assessment (EIA) for the proposed lithium battery assembly plant by M/s ACM Lithium Batteries (Pvt.) Ltd., located in the Rawat Industrial Estate, Islamabad, has been conducted in accordance with the Punjab Environmental Protection Act and relevant national environmental guidelines. The objective of the assessment was to evaluate the potential environmental and social impacts associated with the project and to propose feasible mitigation and monitoring strategies to ensure sustainable implementation.

The proposed project aims to establish a state-of-the-art battery assembly facility that meets the growing demand for energy storage solutions, particularly in the context of electric mobility, renewable energy integration, and backup power systems. The project aligns with national priorities for clean energy, industrial modernization, import substitution, and job creation. The facility will involve the import, assembly, and packaging of lithium-ion battery packs using automated systems, quality-controlled assembly lines, and environmentally conscious production methods.

The EIA process has revealed that the project does not involve high-risk chemical processing, effluent generation, or large-scale extraction of natural resources. As a result, the overall environmental footprint of the project is considered low to moderate. However, impacts related to air quality, solid waste management, resource consumption (particularly electricity), and noise generation have been identified and thoroughly assessed. Based on this assessment, an Environmental Management and Monitoring Program (EMMP) has been developed to mitigate, monitor, and manage these impacts through specific interventions, defined responsibilities, and performance indicators.

Air quality concerns, especially during the construction phase, have been addressed through the incorporation of dust suppression measures, emissions controls on machinery, and scheduling of construction activities. During operations, the use of electric forklifts, enclosed testing booths, and compliant backup generators will ensure emissions remain within National Environmental Quality Standards (NEQS). Solid and hazardous waste streams, including

packaging waste and rejected battery components, will be handled through structured segregation, storage, and disposal protocols, in collaboration with licensed waste handlers.

Socially, the project is expected to generate substantial positive benefits. It will create employment opportunities, promote skill development, and stimulate ancillary business activity in the industrial zone. Stakeholder consultations conducted during the EIA revealed general community support, with stakeholders expressing interest in job opportunities, traffic management, and environmental responsibility. These concerns have been directly incorporated into project planning and the CSR strategy of the proponent.

Importantly, the EIA highlights the facility's commitment to long-term environmental performance through the inclusion of a rainwater harvesting system, planned green areas, and provision for energy-efficient operations. The use of the Life Cycle Assessment (LCA) approach further illustrates the project's alignment with sustainability principles by accounting for upstream and downstream environmental impacts.

## Recommendations

In view of the findings of this EIA, and with the proposed mitigation measures and monitoring protocols in place, it is recommended that the project be granted environmental approval, subject to adherence to the following recommendations:

1. **Strict Implementation of EMMP:** All mitigation measures outlined in the Environmental Management and Monitoring Plan should be implemented in both letter and spirit, with clear responsibilities assigned and periodic reviews conducted by the Environmental Management Team (EMT).
2. **Compliance with NEQS:** The facility must continuously ensure that all discharges, emissions, and noise levels remain within NEQS limits. Environmental sampling should be conducted at prescribed intervals and records made available for inspection by the EPA.
3. **Hazardous Waste Management:** All rejected lithium cells and battery waste classified as hazardous must be stored in sealed, designated containers and disposed of through authorized hazardous waste handlers only.
4. **Sustainable Resource Use:** Energy and water use should be optimized through ongoing efficiency improvements. The potential for integrating renewable energy such as rooftop solar panels should be actively explored during future expansion.

5. **Community Engagement and CSR:** The proponent should establish a transparent complaint redress mechanism for the local community and regularly engage in Corporate Social Responsibility (CSR) initiatives focusing on environment, education, and public health.
6. **Third-Party Audits and Capacity Building:** Periodic third-party environmental audits should be conducted, and environmental awareness training should be provided to staff, contractors, and suppliers involved in the project.
7. **Adaptive Environmental Management:** The EMMP should remain a dynamic document, capable of adapting to new challenges, improved technologies, and lessons learned from operational experience. Regular updates and feedback loops should be institutionalized.

### Final Remark

The proposed lithium battery assembly plant represents a forward-looking industrial development that supports national energy and sustainability goals while introducing minimal environmental burden when managed properly. With the full and effective implementation of the EIA recommendations, the project has the potential to serve as a model for environmentally responsible, clean-tech industrial investment in Pakistan.