

EIA- JK Sugar Mills (Pvt.) Limited-Distillery

EXECUTIVE SUMMARY

Company Name: M/s JK Sugar Mills (Private) Limited

Title of Project: JK Sugar Mills (Private) Limited – Distillery

Location of Project: Chak No. 36-B/NP, Mahi Chowk Road (10 KM off KLP Road), Sadiqabad, District Rahim Yar Khan, Punjab

PROJECT PROPONENT	PROJECT CONSULTANT
Mr. Maqsood Ahmad Malhi (Company Secretary) JK Sugar Mills (Private) Limited, 61-A, Main Gulberg, Lahore Contact No. +92-4235750018 Email: maqsoodmalhi@jksugarmills.com	Ecogreen Company (Pvt.) Ltd. Second Floor Plot No.7 A-Block Commercial Area, Canal View Society, Lahore Contact No: 042-35294298, 32355915 info@ecogreen.com.pk

Description of Project:

This executive summary of Environmental Impact Assessment (EIA) Report presents a brief account of foreseeable environmental and social impacts likely to emanate from the project ***JK Sugar Mills (Private) Limited- Distillery*** at Chak No. 36-B/NP, Mahi Chowk Road (10 KM off KLP Road), Sadiqabad, District Rahim Yar Khan, Punjab. The project is proposed to establish ENA Grade Ethanol Distillery based on Vinasse Incineration Technology with a Zero Liquid Discharge (ZLD).

This Project will be the very first of its kind in Pakistan based on spent wash incineration technology resulting in Zero Liquid Discharge and eliminate environmental impacts associated with spent wash disposal. The Vinasse is combusted in a specially designed spent wash boiler to generate steam and renewable electrical energy to ensure environmentally sustainable operations.

The project will be housed in a privately purpose build industrial estate and subsequently, it is intended to seek regulatory approval for this project under Special Economic Zones Act, 2012 (*amended 2015*), Special Economic Zones Rules 2013 (*amended 2017*) and the subsequent SESEZ Regulations 2020 issued by the Board of Investment.

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Zero Liquid Discharge (ZLD) Technology:

The proposed distillery will adopt a Zero Liquid Discharge (ZLD) system based on vinasse (spent wash) concentration and incineration technology to ensure that no untreated process effluent is discharged outside the facility. Vinasse generated from the distillation process, characterized by high organic load and dissolved solids, will be concentrated using a multi-effect evaporation (MEE) system. The concentrated vinasse will then be utilized as fuel in a specially designed incineration boiler, where its calorific value is recovered for steam generation.

The steam produced from the incineration boiler will be used to meet the process and utility requirements of the distillery, thereby improving overall energy efficiency and reducing dependence on conventional fuels. Process condensate generated from the evaporation system will be collected and treated through an appropriate condensate polishing and treatment system for reuse in process operations, cooling systems, or other utility applications. Other wastewater streams, including boiler blowdown, cooling tower blowdown, equipment washings, and domestic wastewater, will be separately collected and treated through combined effluent treatment plant. Treated water will be reused within the plant to the maximum extent possible, minimizing freshwater demand for landscaping or other non-potable purposes, subject to regulatory requirements.

Air emissions arising from boiler operation will be mitigated through the installation of an Electrostatic precipitator (ESP) whereas ash handling and storage operations will be controlled through the use of enclosed ash silos and covered conveyor belt systems. The silos will be integrated with a dust collection and handling system designed to minimize fugitive particulate emissions during ash transfer, storage, and loading activities. The system is expected to achieve a particulate removal efficiency of approximately **98%**, thereby reducing dust emissions, maintaining workplace and ambient air quality, and supporting compliance with applicable environmental standards and regulatory requirements.

Through the integration of evaporation, vinasse incineration, condensate recovery, wastewater treatment, and water reuse systems, the project will achieve a Zero Liquid Discharge (ZLD) status, ensuring that liquid effluents are either reused within the facility or converted into recoverable resources, thereby minimizing environmental impacts and supporting sustainable operation of the project without burdening the utilities infrastructure of the region.

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Distillery:

Distillery plant produces ethanol from the **sugarcane** molasses (a by-product of sugar cane processing). The instant project is proposed with state-of-the-art **incineration-based technology** for the treatment of distillery spent wash. The concentrated spent wash will be subjected to controlled combustion in an incineration boiler, resulting in the generation of steam and energy recovery. This system ensures **zero liquid discharge (ZLD)** and eliminates the need for large-scale wastewater disposal systems such as wetlands. **ENA grade, Fuel Grade** and **Industrial grade ethanol** will be produced which is cheaper and environment friendly as compared to fossil fuels. Fossil fuel emits roughly **85 to 95 gCO₂eq/MJ** (grams of carbon dioxide equivalent per megajoule) over its entire lifecycle. Ethanol over its lifecycle can emit **80% to 90%** lesser carbon dioxide than gasoline. Advanced production methods utilizing biomass waste for energy can bring these emissions down significantly, with some facilities even achieving net-negative carbon footprints. The ethanol produced in the proposed facility will be supplied locally as well as exported in the international markets. Ethanol is used in different industries like Pharmaceutical, Chemical, Cosmetic, Detergent and Solvent Industries and also blending with Petrol as a Fuel.

The report describes the various actual and potential environmental impacts pertaining to both phases of the project, i.e. construction phase and the operation phase with reference to their extent and magnitude. Environmental Impact Assessment (EIA) study of the project has been conducted in accordance with the **Punjab Environmental Protection (Amendment) Act 2012** and **The Punjab Environmental Protection (Review of Initial Environmental Examination/ Environmental Impact Assessment) Regulations, 2022**.

Screening

The proposed project falls in **Schedule II** of The Punjab Environmental Protection (Review of Initial Environmental Examination/ Environmental Impact Assessment) Regulations, 2022. It can be categorized under **Category B: Manufacturing and Processing** specifically **Category B (3) i.e. "Sugar Mills and Distilleries"** or **Category H: Urban Development & Tourism** specifically **Category H (5) i.e. Industrial Estates (including export processing zones)**. However, as it is a Sole Enterprise project it is befitting to categorize according to the nature of industrial activity under **Category B (3)**. Both the categories have similar Environmental

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Assessment requirements hence an Environmental Impact Assessment Study has been conducted and report is being presented for submission of application in EPA Punjab to obtain Environmental Approval/NOC.

Project Objectives

The main objective of the project is;

- To develop a modern, exclusive, private industrial estate.
- To promote value-added production of ENA Grade industrial Ethanol and related products through the proposed distillery facility.
- To maximize resource efficiency through the adoption of renewable energy and waste-to-energy technologies, thereby reducing reliance on conventional energy sources.
- To implement environmentally sustainable practices, including Zero Liquid Discharge (ZLD), resource recovery, and energy generation from process by-products.
- To create direct and indirect employment opportunities and contribute to the socio-economic development of the surrounding communities.
- To ensure compliance with applicable environmental, health, safety, and regulatory requirements while maintaining sustainable operations.
- To support national industrialization and renewable energy objectives through the development of an integrated industrial ecosystem based on circular economy principles.

Site Alternatives

In total Four sites were considered for this proposed project, out of which three sites were rejected due to various reasons (explained in detail further in the report) thus the proposed site has been selected for the project due to its strategic location in close proximity to the source of raw material (molasses), which will ensure efficient and shorter transportation routes. In addition, the selection of the site in proximity of an established industrial setting helps in optimizing the use of existing infrastructure and utilities, minimizing the need for new land development and associated environmental disturbance. Collectively, these factors support improved operational efficiency and enhanced environmental sustainability of the project.

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Salient Features of the project:

Company Name	JK Sugar Mills (Private) Limited
Project Name	JK Sugar Mills (Private) Limited-Distillery
Location	Chak No. 36-B/NP, Mahi Chowk Road (10 KM off KLP Road), Sadiqabad, District Rahim Yar Khan, Punjab.
Coordinates of Project	Lat-28°17'53.62"N and Long 69°50'9.35"E
Proponent Name	Mr. Maqsood Ahmad Malhi
Project Cost	Approx. PKR 18.8 billion
Environmental Budget	Approx. PKR 2 million
Area of the Project	Total Area: 454 Kanal 18 Marlas (Approximately 56.86 Acres)
Products	ENA Grade, Fuel Grade & Industrial Grade Ethanol
By- Product	1. Anhydrous Fuel Ethanol / Dehydrated Alcohol - $\geq 99.5\%$ purity. 2. A-Grade Extra Neutral Alcohol (ENA) - alcohol $\geq 96\%$ purity. 3. -Grade (Rectified Spirit (RS) - 94-95% purity). 4. Fusel Oil 5. 35% Granular Potash K ₂ O (Potassium Oxide). 6. Electrical Energy
Production Capacity	230,000 LITERS/DAY ENA GRADE ETHANOL
Manpower	During Construction 100-150 During operation 400-500
No. of Boilers	01 Nos of capacity 60 Ton/hr
Technology of Boiler	Slop Type Boiler Vinsasse + Bagasse fired
Fuel of Boilers	75% of spent wash along with 25% of Bagasse Semi liquid spent wash with (55-60 brix) will be fed to boiler as fuel mixed with bagasse for steam generation)
Water Source	Rain water (through harvesting), Sugar Mill (condensate and other), Canal water or Ground water in case necessary
Electricity generation and its utilization	Proposed Renewable Energy Generation: upto 6 MW Energy requirement of the project: • 1.5 MW for plant • 500 KW for multi effect evaporator

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	• 1 MW for boiler • 500 KW granular ash fertilizer • 300 KW for Residential colony • 500 KW auxiliaries and lighting Total energy requirement: 4.3 MW
Water requirement	• Main process water 80 tons per hour • Cooling tower 15 tons per hour • RO & others 15 tons per hour
Wastewater:	ZLD (Zero Liquid Discharge) Technology is proposed in this project. Approximately 2,600 ton per day waste water will be produced out of which 600 tons will be converted into semi solid (55 – 60 Brix) for usage in the vinasse boiler and remaining 2,000 tons will be recycled for re-processing through condensate polishing unit.
RO plant	60 tons per hour
RO-Reject	15 tons per hour
Period of Construction/ Establishment	Approx. 02 Year
Solid waste	Solid waste generated during construction will primarily consist of excavated soil, concrete debris, scrap metal, packaging materials, and domestic waste from the workforce. All waste will be segregated and disposed of as per area practice to minimize environmental impacts. During operation, solid waste will include spent RO membranes, exhausted filter media, maintenance waste (such as scrap metal, used filters, and oily rags), packaging materials, laboratory waste, and domestic solid waste generated from offices and staff facilities. These wastes will be segregated at source and managed through reuse, or disposal by authorized waste management agencies in accordance with applicable environmental regulations and the project's waste management procedures.
Boiler Ash Storage and Utilization System	Installation of Silos coupled with conveyor system for storage at designated area as per layout plan.

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	The proposed system has an aggregate storage capacity of approximately 6000 tons which is approximately 100 days of storage as per generation rate of 60 tons per day. The associated ESP, dust collection and handling system is expected to achieve a removal efficiency of approximately 98%, ensuring effective control of particulate emissions and compliance with applicable environmental standards Boiler Ash in form of Granular Potash will be collected and will be used in agriculture as bio-Fertilizer.
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Project Description

The proposed project is an exclusively private state-of-art industrial estate for the installation of distillery/ethanol plant.

The project involves the establishment of a state-of-the-art distillery designed for the production of Ethanol, incorporating advanced environmental and energy-efficient technologies. A key feature of the facility is the adoption of vinasse (spent wash) incineration technology coupled with a Zero Liquid Discharge (ZLD) system. The spent wash generated from the distillation process will be concentrated and utilized as fuel in a vinasse boiler, enabling recovery of thermal energy in the form of steam for process and utility requirements.

The project is based on the principle of resource efficiency and waste-to-energy utilization, where industrial by-products are converted into usable energy, thereby reducing reliance on conventional fossil fuels. The integrated ZLD system ensures that all process effluents are treated, recycled, or reused within the facility, eliminating any liquid discharge outside the plant boundary.

project will be equipped with necessary infrastructure and utilities required for the operation of the distillery, including water supply, steam generation systems, condensate recovery, wastewater treatment facilities, and air emission control systems. Environmental management measures, including efficient water reuse, emissions control, and solid waste handling, will be incorporated to ensure compliance with applicable environmental regulations.

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Overall, the project represents a single-activity centered on a renewable energy-driven, ZLD-based distillery, designed to promote sustainable industrial operations through energy recovery and environmental protection.

In the process of Distillery molasses will be used as raw material for production of ethanol that are by product of sugar mills. The molasses contains 45-48 % of total sugar, which is converted in to ethanol by fermentation process. First molasses is diluted by adding water and adjust the total dissolved solids up to 7-8%, then yeast is added in diluted molasses solution and fermentation process takes place. As process goes on glucose is converted in to ethyl alcohol and carbon dioxide. After sufficient conversion of glucose into ethyl alcohol this solution is then passed through distillation columns. Based on the temperature difference ethyl alcohol will be separated from solution and condense into liquid form. The wastewater from distillery column called spent wash will be used as fuel in boiler.

Key Environmental Benefits

- ✓ Renewable fuel production
- ✓ Reduction in greenhouse gas emissions
- ✓ Elimination of spent wash disposal
- ✓ Waste-to-energy recovery
- ✓ Support for sugarcane value chain
- ✓ Potassium rich biofertilizer generation
- ✓ Sustainable operations without reliance on regional utilities infrastructure
- ✓ Local employment generation

Major impacts and recommended mitigation measures

Environmental impact evaluation actually grows out of scoping and baseline study of the project. In principle, EIA assigns various quantified values to different levels of all the impacts affecting the project. This step is generally considered as the most technical in nature and therefore is the most difficult and controversial part of the EIA. Impacts anticipated during construction and operational phase may include noise, air emissions, water conservation and pollution, soil contamination (physical), community, workers' safety and employment conflicts (socio-economic)

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Table 1: Summary of Impacts and Mitigation Measures

IMPACT	MITIGATION MEASURE	
	CONSTRUCTION PHASE	OPERATION PHASE
<i>Solid waste generation</i>	• Segregation of construction waste (soil, concrete debris, steel, wood, packaging materials) at source. • Reuse of excavated soil within estate for leveling, road works, and backfilling • Recycling of scrap materials (steel, metal, wood, cardboard) through authorized recyclers. • Disposal of inert construction waste as per area practice. • Provision of designated, covered waste storage areas within construction site. • Proper handling and storage of construction waste (paints, oils, solvents, chemical containers) • Regular housekeeping and removal of debris to avoid site congestion. • Dust control from dry waste and debris	• Segregation of operational waste including organic waste, packaging waste, maintenance waste • Dedicated covered and impermeable waste storage facilities within plant premises • Routine internal waste collection system and housekeeping within plant area • Implementation of Waste Management Plan (WMP) with tracking of all waste sources. • Training of operational staff on ZLD compliance, waste minimization, resource recovery, and safe handling of distillery by-products

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	handling. • Maintenance of waste disposal records and contractor logs • Worker training on safe construction waste handling practices	
Wastewater generation	• Provision of temporary sanitation facilities (portable toilets) for workers • Collection and proper disposal of domestic wastewater from construction camps • Prevention of direct discharge of construction runoff into nearby drains or soil • Installation of sedimentation pits for construction runoff control • Proper storage of fuels, oils, and chemicals to avoid contamination of water • Avoid contamination of surface water due to construction activities • Stormwater management through temporary drains and silt traps (if any) • Training of workers on prevention of water pollution	• Complete Zero Liquid Discharge (ZLD) system ensuring no untreated effluent is discharged outside the facility • Segregation of wastewater streams: process condensate, cooling water blowdown, domestic sewage, and boiler blowdown • Treatment of high-strength distillery effluent (spent wash/vinasse) through evaporation / concentration in vinasse boiler system • Recovery and reuse of condensate from evaporators and process units back into the system • Treatment of domestic sewage through CETP • Reuse of treated wastewater for cooling towers, washing, and gardening within unit • Vinasse concentration and conversion into

		boiler fuel / energy recovery system • Treatment of boiler blowdown and auxiliary wastewater in ZLD system before recycling • No liquid discharge outside plant boundary under any operating condition (ZLD compliance)
Air pollution	• Regular water sprinkling on exposed surfaces, haul roads, and stockpiles to suppress dust emissions • Covering of construction materials and debris during transportation and storage • Limiting vehicle speeds within the project site to minimize dust generation. • Proper maintenance of construction machinery and vehicles to reduce exhaust emissions • Avoidance of unnecessary idling of construction vehicles and equipment. • Prompt removal of debris and waste from work areas. • Covering trucks transporting soil, sand, and	• Installation of appropriate air pollution control equipment (Electro static precipitator) on the vinasse-fired boiler to control particulate matter emissions • Regular operation and maintenance of the vinasse boiler and air pollution control systems to ensure optimum combustion efficiency. • Use of efficient combustion practices to reduce emissions of particulate matter other combustion-related pollutants • Continuous monitoring and periodic stack emission testing in accordance with applicable regulatory requirements • Enclosed handling and storage of ash and

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	other fine materials • Scheduling earthworks to minimize exposure of bare surfaces where practicable • Provision of personal protective equipment (PPE) to workers in dusty areas • Regular site inspections to identify and address dust-generating activities	other dusty materials to prevent fugitive dust emissions • Regular inspection of fuel handling, vinasse concentration, and combustion systems to prevent abnormal emissions • Development and implementation of preventive maintenance schedules for boilers, pumps, and process equipment. • Strict prohibition of open burning of any waste within the facility. • Development of a greenbelt/plantation around the facility boundary to assist in dust attenuation and improve local air quality
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Conclusion

The EIA report contains a description of the proposed project, environmental baseline, associated anticipated environmental impacts due to proposed project activities and suggested mitigation measure to reduce (if not eliminate) the impacts so that these can be within acceptable limits. An implementation mechanism for mitigation measures in the form of an Environmental Management Plan for both construction and operational phase has also been included in this study. It is further concluded that *all potential environmental concerns associated with the proposed project have been thoroughly identified and adequately addressed in this report. So, the proponent may apply for and seek environmental approval for this proposed project from the competent authority.*



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1 LEGAL FRAMEWORK

1.1 Legal Framework

This chapter provides an overview of the environmental legislation, policies and guidelines that may have relevance to the proposed project. These include national environmental policy, legislation and guidelines, and international conventions and guidelines. Instant project will be required to adhere to the relevant requirements of the policies and legislation during the proposed project activities, which has also been incorporated in the mitigation measures and the EMP provided in the EIA.

1.2 Constitutional Provision

According to the Constitution of Pakistan, the legislative powers lie with the federal parliament and the legislative assemblies of the four provinces of Pakistan. The Fourth Schedule of the constitution provides two lists of issues. One list, the Federal Legislative List, includes issues on which only the federal government has legislative powers. The second list, the Concurrent Legislative List includes issues on which both the federal and the provincial governments have legislative powers. If a legislation passed by a provincial assembly comes into conflict with a law enacted by the national assembly, then according to the constitution, the federal legislation will prevail over the provincial legislation to the extent of the inconsistency. The subject of 'environmental pollution and ecology' is included in the concurrent list of the constitution. Thus, allowing both the federal and provincial governments to enact laws on the subject.

1.3 National Environmental Policies

1.4 National Environmental Policy, 2005

The National Environmental Policy (NEP) was approved by the Pakistan Environmental Protection Council (PEPC) in its 10th meeting on 27th December 2004 under the chairmanship of the Prime Minister of Pakistan and thereafter approved by the Cabinet on 29th June 2005.

NEP is the primary policy of Government of Pakistan that addresses the environmental issues of the country. The broad Goal of NEP is, "To protect, conserve and restore Pakistan's environment in order to improve the quality of life of the citizens through sustainable development". The NEP identifies the following set of sectoral and cross-sectoral guidelines to achieve its Goal of sustainable development.

Sectoral Guidelines

Water and sanitation, Air quality and noise, Waste management, Forestry, Biodiversity and Protected areas, Climate change and Ozone depletion, Energy efficiency and renewable, agriculture and livestock, and Multilateral environmental agreements.

Cross Sectoral Guidelines

The NEP suggests the following policy instruments to overcome the environmental

problems throughout the country:

- Integration of environment into development planning,
- Legislation and regulatory framework,
- Capacity development,
- Economic and market-based instrument,
- Public awareness and education, and
- Public private civil society partnership,

1.5 National Conservation Strategy

Before the approval of National Environmental Policy (NEP) the National Conservation Strategy (NCS) was considered as the Government's primary policy document on national environmental issues. The Strategy approved by the Federal Cabinet in March 1992 and was also recognized by International Financial Institutions, principally the World Bank at the moment this strategy just exists as a national conservation program. The NCS identifies 14 core areas including conservation of biodiversity; pollution prevention and abatement; soil and water conservation; and preservation of cultural heritage and recommends immediate attention to these core areas in order to preserve the country's environment.

NCS does not directly apply to projects. However, instant project should ensure that the project should not add to the aggravation of the 14 core environmental issues identified in the NCS and mitigation measures should be adopted to minimize or avoid any contribution of the project in these areas.

1.6 National Environmental Action Plan-Support Programme (NEAP-SP)

The Government of Pakistan and United Nations Development Programme (UNDP) have jointly initiated an umbrella support program called the "National Environmental Action Plan-Support Programme (NEAP-SP)" signed in October 2001 and implemented in 2002. The development objective supported by NEAP-SP is environmental sustainability and poverty reduction in the context of economic growth.

1.7 Policy & Procedures for The Filing, Review and Approval of Environmental Assessments

The Policy & Procedures for the Filing, Review and Approval of Environmental Assessments, prepared by the PEPA under the powers conferred upon it by the Pakistan Environmental Protection Act, provide the necessary details on the preparation, submission, and review of the Initial Environmental Examination (IEE) and the Environmental Impact Assessment (EIA). It provides schedules of proposals that require either an Initial Environmental Examination (IEE) or an Environmental Impact Assessment (EIA).

1.8 Provincial Environmental Legislation

The Legislative assembly of Punjab province reviewed and accepted the PEPA 1997 as Punjab's provincial act with some amendments on 18th April 2012 & 25th October 2017 respectively. This act has been approved to provide protection, conservation, rehabilitation and improvement of the environment for the prevention and control of pollution and promotion of sustainable development in the whole of Punjab.

The definition of environmental law can be derived from the legal definition of 'environment'. In Section 2(x) of the Punjab Environmental Protection Act 1997 (Amended on 2017) environment is defined to include air, water, land, and layers of the atmosphere; living organisms and all organic, inorganic matter; the ecosystem and ecological relationships; buildings, structures, roads, facilities and works; all social and economic conditions affecting community life; and the interrelationship between any of the factors in sub clauses (a) to (f). From this definition, an environmental law can be considered to include all laws that are designed to, or that directly or indirectly affect, the management of natural resources including the control of pollution of these natural resources.

By this definition, environmental laws include a) laws that have been specifically enacted to protect the environment such as the PEPA 2017, and laws relating to subject such as forest, water resources, wildlife, land, agriculture, health, and town planning.

1.9 Punjab Environmental Protection Act 1997 (Amended 2012)

The Punjab Environmental Protection Act, 1997 (Amended 2012) is the basic legislative tool empowering the government to frame regulations for the protection of the environment. The PEPA is broadly applicable to air, water, soil, marine and noise pollution, as well as the handling of hazardous waste. Penalties have been prescribed for those contravening the provisions of the Act. The powers of the Provincial Environmental Protection Agency were also considerably enhanced under this legislation, and they have been given the power to conduct inquiries into possible breaches of environmental law either of their own accord, or upon the registration of a complaint.

Under section 12 of PEPA, (1) No proponent of a project shall commence construction or operation unless he has filed with the Provincial Agency an initial environmental examination or, where the project is likely to cause an adverse environmental effect, an environmental impact assessment, and has obtained from the Provincial Agency approval in respect thereof.

PEPA shall review the IEE & EIA and accord approval subject to such terms and conditions as it may prescribe or require. The agency shall communicate within four (04) months its

approval or otherwise from the date EIA is filed failing which the EIA shall deemed to have been approved.

1.10 Punjab Environmental Protection (Review of Initial Environmental Examination and Environmental Impact Assessment) Regulations, 2022

Punjab Environmental Protection (Review of Initial Environmental Examination and Environmental Impact Assessment) Regulations, 2022 provide the necessary details on the preparation, submission, and review of the IEE and the EIA reports as required by the section 12 of Punjab Environmental Protection Act 1997 (amended on 2017). These regulations categorize the projects which require an IEE or an EIA on the basis of anticipated degree of environmental impacts.

Categorization: In accordance with the applicable Punjab Environmental Regulations " Punjab Environmental Protection (Review of Initial Environmental Examination and Environmental Impact Assessment) Regulations, 2022 ", the project **falls under projects requiring an Environmental Impact Assessment**. Therefore, EIA of the project is being carried out.

Preliminary scrutiny: Regulation 8 states that the agency shall review the report and inform within 10 working days to proponent for submission of any additional information at any stage during the review process.

Review: Regulation 10 states that the agency shall review the EIA report within 45 days after issuing confirmation of completeness Under clause (a) of sub regulation (1) of regulation 8. It shall also conduct an experts committee meeting or solicit views from concerned advisory committee.

Validity: Regulation 16 defines the validity period of approval of an IEE or EIA to be three years from date of issue and construction must start within three years of report approval. A three-year extension at a time may be granted upon the agency's discretion with or without the submission of a fresh IEE or EIA.

1.11 The Punjab Environmental Quality Standards (PEQS 2016)

One of the functions of Pak EPA under the provision of Pakistan Environmental Protection Ordinance PEPO 1983 was to issue National Environmental Quality Standards for municipal and industrial discharge as liquid effluent and gaseous emissions and motor vehicular exhaust and noise. Pak EPA issued a Statutory Regulatory Order (S.R.O) in 1994. It required all units coming into production after July 1, 1994, to apply immediately with new standards. Those already in operation at the time of S.R.O were required to comply from July 1, 1996. The Pak EPA was not able to implement the NEQS effectively for many reasons, including lack of implementation capacity and resistance from industry.

With the PEPA, 1997 the Pak EPA revised the NEQS with full consultations of the private sector, industrialist, trade and business associations and NGOs. The municipal and liquid

industrial effluent standards cover 32 parameters. The standards for industrial gaseous emissions specify limits for 16 parameters and the standards for motor vehicles prescribe maximum permissible limits for smoke, carbon monoxide and noise. Revised standards cover discharge limits for effluents into inland waters, sewage treatment plant and the sea. The NEQS are primarily concentration based. Unfortunately, the limits on industrial effluents are neither industry specific nor do they have any relationship with the quantum of production.

On the other hand, following the promulgation of the Punjab Environmental Protection Act, 1997 (Amended 2012), Punjab EPA has notified its Environmental Quality Standards known as – Punjab Environmental Quality Standards (PEQS) in 2016 vide various notifications. Management of instant project is committed to comply with the applicable PEQS in true letter and spirit.

One of the functions of the Punjab EPA under the provision of Punjab Environmental Protection Act 1997 (Amended 2012) was to issue PEQS for various pollutants. The PEQS are uniform standards applicable to various situations. At the time of this study, EPA Punjab has published the PEQS for municipal and liquid industrial effluents, ambient air quality, industrial gaseous emissions, noise, ground water, drinking water and vehicular emissions standards. For liquid effluent, there are 32 parameters showing permissible levels of pollutants before its discharge into inland water or sewage treatment. For gaseous emissions, there are 16 parameters. The Punjab Environmental Quality Standards for Ambient Air, drinking water Quality and Noise (SO(G) EPD/7-26/2013) are also in force and their compliance is mandatory. PEQS for Soil Quality or indoor air quality have not been prescribed so far.

1.12 National Environmental quality Standards (Self-Monitoring and Reporting by Industry) Rules, 2001

These rules classify the industrial units for monitoring and reporting their liquid effluent and gaseous emissions into three and two categories, respectively. According to each category they define the priority parameters to be monitored and reported to PEPA according to a specific frequency based on working conditions. This monitoring and reporting are in addition to the monitoring conditions as required by the conditions of approval of EIA. The sampling for testing must be carried out according to Environmental Samples Rules, 2001 and be sent to PEPA certified environmental testing laboratories only.

1.13 Cutting of Tress (Prohibition) Act, 1975

This Act prohibits cutting or chopping of trees without permission of the Forest Department. Proponent shall ensure that no trees are cut within the Right of Way of the proposed project, except deemed necessary and with the approvals of associated department.

1.14 Canal and Drainage Act, 1873

Canals are defined as channels, pipes and reservoirs constructed and maintained by the Government for the supply for storage of water. Under section 27 of the Act a person desiring to have a supply of water from a canal for purposes other than irrigation shall submit a written application to a Canal Officer who may, with the sanction of the Provincial Government give permission under special conditions.

1.15 Antiquities Act 1975 & The Punjab Heritage Foundation Act, 2015

The protection of cultural resources in Pakistan is ensured by the Antiquities Act of 1975. Antiquities have been defined in the Act as ancient products of human activity, historical sites, or sites of anthropological or cultural interest, national monuments etc. The act is designed to protect antiquities from destruction, theft, negligence, unlawful excavation, trade and export.

The law prohibits new construction in the proximity of a protected antiquity and empowers the Government of Pakistan to prohibit excavation in any area, which may contain articles of archaeological significance.

The project area for the EIA contains no notified archaeological site as protected under this act. Furthermore, the project site is unlikely to contain any buried antiquity. However, the project staff will be instructed before ground preparation and earthworks to report any archaeological artifact or what may appear to be an archaeological relic to the project management. In case of such a discovery, appropriate action will be taken.

1.16 Land Acquisition Act, 1894

The Land Acquisition act (LAA) of 1894 amended from time to time has been the policy governing land acquisition, resettlement, and compensation in the country. The LAA is the most commonly used law for acquisition of land and other properties for development projects. It comprises of 55 sections pertaining to area notifications and surveys, acquisition, compensation and appointment awards and disputes resolution, penalties, and exemptions.

1.17 Pakistan Penal Code (1860)

The Pakistan Penal Code (1860) authorizes fines, imprisonment or both for voluntary corruption or fouling of public spring or reservoirs so as to make them less fit for ordinary use.

The Pakistan Penal Code (PPC) 1860 deals specifically with the pollution of water in Chapter XIV on public health and safety. Here, "fouling" or "corrupting" the water of a public spring or reservoir is listed as an offence, punishable with up to three months in prison and/or a fine of 500 rupees (Section 277). This provision is limited in scope, since it applies only to

reservoirs and public springs, and the terms "fouling" and "corrupting" are not defined. But provisions of PEPA 1997 (Sections 6 and 7) and the NEQS may be applied to facilitate enforcement of Section 277. Other sections of this chapter may be interpreted to include the protection of water resources, including Section 268 on public nuisance, Section 269 on negligence likely to spread infectious disease, and Section 284 on negligent conduct with respect to the possession and handling of poisonous substances.

Similarly, Chapter XVII on offences against property contains certain provisions that may be interpreted to include the protection of water resources. Sections 425-440 deal with "mischief", defined as damage to property resulting in destruction or loss of utility. Section 430 provides specifically for mischief caused to irrigation works, while Section 431 deals with damage to roads, bridges, rivers or channels. Meanwhile, Chapter XXIII, Section 511 on attempted offences could also be interpreted to include offences related to the "fouling" or "corrupting" of water.

Under Section 278 of the PPC, the punishment for "making [the] atmosphere noxious to health" is a maximum fine of 500 rupees. In addition, certain sections of Chapter XIV on public health and safety concerning "public nuisance" may be interpreted to include air and noise pollution from vehicles, as well as emissions (Sections 268, 278, 290 and 291).

1.18 Punjab Wildlife (Protection, Preservation, Conservation and Management Act, 1974 (Amended on 2007))

No person shall be in possession of any wild animal unless he be in possession of a certificate of lawful possession granted in respect thereof by the officer authorized in this behalf, provided that any person importing any wild animal, trophy or meat of a wild animal of a kind specified in the Second Schedule in accordance with the provisions of this Act or acquiring such animal, trophy or meat in accordance with the terms of a permit issued under this Act shall apply to the authorized officer for such certificate within thirty days from the date of importing or acquiring the animal, trophy or meat.

1.19 National Environmental Guidelines

1.20 The Pakistan Environmental Assessment Procedures 1997

The Pakistan Environmental Protection Agency prepared the Pakistan Environmental Assessment Procedures in 1997. They are based on much of the existing work done by international donor agencies and Non-Governmental Organizations (NGO's). The package of regulations prepared by PEPA includes:

- ☐ Policy and Procedures for Filing, Review and Approval of Environmental Assessments.
- ☐ Guidelines for the Preparation and Review of Environmental Reports.
- ☐ Guidelines for Public Consultation.
- ☐ Guidelines for Sensitive and Critical Areas; and
- ☐ Sectoral Guidelines for various types of projects.

1.21 Guidelines for Operational Safety, Health and Environmental Management, December 1996

These guidelines are the outcome of a study commissioned by the Directorate General Petroleum Blocks, Ministry of Petroleum and Natural Resources, Government of Pakistan. The guidelines list down the relevant laws related to the operational health, safety and environment and also recommends environmental controls and management practices to be adopted.

1.22 Guidelines for Public Consultation

These guidelines are a part of a package of regulations and guidelines. It provides assistance throughout the environmental assessment of project by involving the public which can lead to better and more acceptable decision-making.

1.23 IFC Performance Standards

International Finance Corporation (IFC), a member of the World Bank Group, is the largest global development institution focused on the private sector in developing countries. IFC's Sustainability Framework applies to all investments and advisory clients whose projects go through IFC's credit review process.

IFC's Performance Standards define clients' roles and responsibilities for managing their projects and the requirements for receiving and retaining IFC support. The standards include requirements to disclose information. The Performance Standards may also be applied by other financial institutions electing to apply them to projects in emerging markets.

The eight Performance Standards establish standards that the client is to meet throughout the life of an investment by IFC or other relevant financial Institution.

- ☐ Performance Standard-1: Social and Environmental Assessment and Management System.
- ☐ Performance Standard-2: Labor and Working Conditions.
- ☐ Performance Standard-3: Pollution Prevention and Abatement.
- ☐ Performance Standard-4: Community Health, Safety and Security.
- ☐ Performance Standard-5: Land Acquisition and Involuntary Resettlement.
- ☐ Performance Standard-6: Biodiversity Conservation and Sustainable Natural Resource Management.
- ☐ Performance Standard-7: Indigenous People.
- ☐ Performance Standard-8: Cultural Heritage.

1.24 IFC Environmental, Health & Safety Guidelines

IFC has also developed Environmental, Health, and Safety (EHS) Guidelines. These guidelines are technical reference documents with general and industry specific examples of Good International Industry Practice (GIIP).

The EHS Guidelines are required to adhere by IFC clients under Performance Standard 3 on Pollution Prevention and Abatement.

1.25 International Conventions & Treaties

International Convention on Biodiversity

The International Convention on Biodiversity was adopted during the Earth Summit of 1992 at Rio de Janeiro. The Convention requires parties to develop national plans for the conservation and sustainable use of biodiversity, and to integrate these plans into national development programmes and policies. Parties are also required to identify components of biodiversity that are important for conservation, and to develop systems to monitor the use of such components with a view to promote their sustainable use.

1.26 The Convention on Conservation of Migratory Species of Wild Animals, 1979

The Convention on the Conservation of Migratory Species of Wild Animals (CMS), 1979, requires countries to take action to avoid endangering migratory species. The term "migratory species" refers to the species of wild animals, a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries. The parties are also required to promote or co-operate with other countries in matters of research on migratory species.

The Convention contains two appendices. Appendix I contain the list of migratory species that are endangered according to the best scientific evidence available. For these species, the member states to the Convention are required endeavor to:

- ☐ Conserve and restore their habitats.
- ☐ Prohibit their hunting, fishing, capturing, harassing and deliberate killing.
- ☐ Remove obstacles and minimize activities that seriously hinder their migration.
- ☐ Control other factors that might endanger them, including control of introduced exotic species.

1.27 Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

This convention came into effect on 03 March 1973 in Washington. In all 130 countries are

signatory to this convention with Pakistan signing the convention in 1976. The convention requires the signatories to impose strict regulation (including penalization, confiscation of the specimen etc.) regarding trade of all species threatened with extinction or that may become so, in order not to endanger further their survival.

The Convention contains three appendices. Appendix I include all species threatened with extinction which are or may be affected by trade. The Convention requires that trade in these species should be subject to strict regulation. Appendix II include species that are not necessarily threatened presently but may become so unless trade in specimens of these species is subject to strict regulation. Appendix III includes species which any contracting party identifies as subject to regulations in trade and requires other parties to cooperate in this matter.

1.28 International Union for Conservation of Nature and Natural Resources (IUCN) Red List

The red list is published by IUCN and includes those species that are under potential threat of extinction. These species have been categorized as:

- ☐ Endangered: species that are seen to be facing a very high risk of extinction in the wild in the near future, reduction of 50% or more either in the last 10 years or over the last three generations, survive only in small numbers, or have very small populations.
- ☐ Vulnerable in Decline: species that are seen to be facing a risk of extinction in the wild, having apparent reductions of 20% or more in the last 10 years or three generations.
- ☐ Vulnerable: species that are seen to be facing a high risk of extinction in the wild, but not necessarily experiencing recent reductions in population size categories.
- ☐ Data Deficient: species that may be at risk of extinction in the wild but at the present time there is insufficient information available to make a firm decision about its status.

1.29 International and National Environment and Conservation Organizations

International environmental and conservation organizations such as IUCN and the Worldwide Fund for nature (WWF) have been active in Pakistan for some time. Both these organizations have worked closely with government and act in an advisory role with regard to the formulation of environmental and conservation Policies. Since the convening of the Rio Summit, a number of national environmental NGO's have also been formed, and have been engaged in advocacy, and in some cases, research. Most prominent national environmental NGO's, such as the Sustainable Development Policy Institute (SDPI), Strengthening Participatory Organization (SPO), Shehri, and are the members of the Pakistan National Committee (PNC) of IUCN.

As mentioned earlier, environmental NGO's have been particularly active in advocacy, as

EIA- JK Sugar Mills Pvt. Limited-Distillery

proponents of sustainable development approaches. Much of the government's environmental and conservation policy has been formulated in consultation with leading NGO's, who have also been involved in drafting new legislation on conservation.

2 INTRODUCTION

2.1 Purpose of the Report

For any development project to be initiated in the province of Punjab, it is mandatory to obtain Environmental Approval from EPA Punjab under **Section-12** of the ***Punjab Environmental Protection (Amendment) Act, 2012*** by filing an Initial Environmental Examination (IEE) or Environmental Impact Assessment (EIA) before EPA Punjab, as may be defined in *the Punjab Environmental Protection (Review of Initial Environmental Examination/Environmental Impact Assessment) Regulations, 2022*. This Report presents the Environmental Impact Assessment (EIA) Study for Establishment of privately purpose build industrial estate by JK Sugar Mills (Private) Limited and its main/core project is installation of Distillery unit employing vinasse incineration technology and Zero Liquid Discharge mechanisms, mainly waste to renewable energy by using spent wash as fuel for boiler. For this purpose, the proponent engaged environmental consultants; **Ecogreen Company (Private) Limited** to conduct EIA Study of aforesaid project. The purpose of this study is to identify the environmental baseline i.e. physical, biological and socio-economic/cultural conditions and assess all possible impacts arising during the construction and operation phase of project and to find out appropriate measures for their mitigation, to either eliminate those impacts or to bring them to acceptable level and formulation of Environmental Management Plan (EMP) for implementation of the project in environment friendly manner.

This EIA Report is prepared by critical examining environmental factors which might be affected due to said project implementation. This report provides the basis for a determination of degree of environmental impacts of project. This report provides relevant information, as required under the officially approved format, to help the decision makers i.e. EPA Punjab in deciding the instant application for grant of Environmental Approval/NOC.

2.2 Identification of the Project & Proponent

The details of proponent of aforesaid project are given below:

Table 2: Details of Proponent

Details of Proponent	
Name & Address	Mr. Maqsood Ahmad Malhi (Company Secretary)
Address	61-A, Main Gulberg, Lahore
Contact No.	+92-4236677020
Email	maqsoodmalhi@jksugarmills.com

2.3 Consultant's Details

The proponent of said project engaged **M/s Ecogreen Company (Pvt) Limited** to carry out the EIA Study of aforesaid project in accordance with EPA guidelines. For this purpose, the details of experts working on this assignment are given below in Table-3.

Table 3: Consultant Details

Consultant Details	
Consultant	Ecogreen Company (Pvt) Limited
Address	Second Floor Plot # 7, A Block Commercial Area, Canal View Society, Lahore
Contact No.	042-32355915
Focal Person	
Name	Kiran Irshad
Designation	Lead Environment Professional
Contact No.	0320-0800221
Email	kiran@ecogreen.com.pk

To assist the Team lead in the preparation of EIA Report of the respective project the company nominated the following experts. The details of the experts are given below in **Table-4**.

Table 4: List of Experts

Name	Qualification	Expertise
Dr. Areej Tahir	PhD Environmental Sciences	Environmental Impact Assessment, Quantitative Pollutants assessment, alternative technology assessment.
Farhan Awan	MS Project Management, LLB, PGD in Environmental Laws	Environmental Legislation and Policy Expert. Project implementation and execution.

2.4 Brief description of Nature Size & Project Location

The proposed project involves the establishment of a 230,000 liters per day (LPD) Distillery within privately purpose build industrial estate spread over an area of **454 Kanals 18 marlas**.

The project is designed for the production of fuel-grade ethanol and using molasses and other approved feedstocks through an efficient and environmentally sustainable production process.

A key feature of the project is the adoption of Vinasse Boiler Technology, whereby concentrated vinasse generated during the distillation process will be utilized as a fuel for steam and energy generation. This approach promotes resource recovery, reduces waste generation, and minimizes reliance on conventional fossil fuels. In addition, the facility will operate under a Zero Liquid Discharge (ZLD) system, ensuring that process effluents are treated, recycled, and reused within the plant, with no liquid discharge to external water bodies or land.

The project components include feedstock storage facilities, fermentation, distillation and dehydration units, vinasse concentration and combustion systems, boilers and utilities, wastewater treatment and recycling facilities, product storage tanks, internal road network, administrative buildings, and other ancillary infrastructure required for plant operation. The proposed development is expected to contribute to industrial growth, renewable energy utilization, employment generation, and sustainable economic development within privately purpose build industrial estate. The project is located in Chak No. 36-B/NP, Mahi Chowk Road (10 KM off KLP Road), Sadiqabad, District Rahim Yar Khan, Punjab as shown in the Figure 1. Having coordinates of site are; Lat-28°17'53.62"N and Long 69°50'9.35"E. The location of the aforesaid project is:



Figure 1: Google Map of the Project



Figure 2: Project Location

3 SCREENING

For the prediction and mitigation of impacts associated with project implementation at an early stage of project development, it is pre-requisite under the environmental laws to undertake Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA) Study as the case may be. As per the statutory notification of The Punjab Environmental Protection (Review of Initial Environmental Examination and Environment Impact Assessment) Regulations, 2022 made under Section 12 of Punjab Environmental Protection Act, 1997 (Amended 2012), which is reproduced as under;

"No proponent of a project shall commence construction or operation unless he has filed with the Government Agency designated by Federal Environmental Protection Agency or Provincial Environmental Protection Agencies, as the case may be or where the project is likely to cause an adverse environmental effect an Environmental Impact Assessment (EIA) and has obtained from the Government Agency approval in respect thereof."

The proposed project falls in **Schedule II** of The Punjab Environmental Protection (Review of Initial Environmental Examination/ Environmental Impact Assessment) Regulations, 2022. It can be categorized under **Category B: Manufacturing and Processing** specifically **Category B (3) i.e. "Sugar Mills and Distilleries"** or **Category H: Urban Development & Tourism** specifically **Category H (5) i.e. Industrial Estates (including export processing zones)**. However, as it is a Sole Enterprise project it is befitting to categorize according to the nature of industrial activity under **Category B (3)**. Both the categories have similar Environmental Assessment requirements hence an Environmental Impact Assessment Study has been conducted and report is being prepared for submission of application in EPA Punjab to obtain Environmental Approval/NOC.

4 SCOPING

4.1 Spatial and temporal boundaries of Environmental Assessment

The said project is proposed and located in Chak No. 36-B/NP, Mahi Chowk Road (10 KM off KLP Road), Sadiqabad, District Rahim Yar Khan, Punjab and will be installed by adopting proper mitigation measures to avoid disturbance to local environment. No environmental sensitive area is present within area of influence that could be impacted due to current project installation.

4.2 Important issues and concerns raised during consultation

During consultation it was observed that maximum of people was in favor of project and following issues and concerns were raised. In chapter 10 Stakeholder Consultation it is mentioned in detail. During survey following concerns of the local community, Government Departments and Environmental Practitioners and experts were noted:

- Locals should be preferred for the job opportunities.
- Wastewater should be treated and dispose off properly (if any)
- Solid waste should be managed effectively by adopting the standard practices of the area.
- Cleanliness of the area should be ensured.
- An effective EMMP should be designed and enforced with true spirit.
- Health of the workers should be ensured.
- Plantation should be carried out at extensive scale.
- Noisy activities should be confined.
- Indigenous trees around the facility should be planted to control air pollution.
- Tree cutting should be avoided to the extent possible.

4.3 Significant impacts and factors to be determined

Main impacts and factors to be determined are

- Job opportunities for locals
- Tree cutting and plantation at designated green areas
- Occupational Health and safety
- Emergency preparedness
- Site Security
- Traffic Management
- Hygiene management

- Control Air emissions
- Confined noisy activities
- Resource conservation
- Excessive water consumption
- Energy efficient techniques must be adopted
- Proper site restoration after construction



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5 CONSIDERATION OF ALTERNATIVES

5.1 Site Alternatives

For the instant project, three other alternative sites were considered as follows;

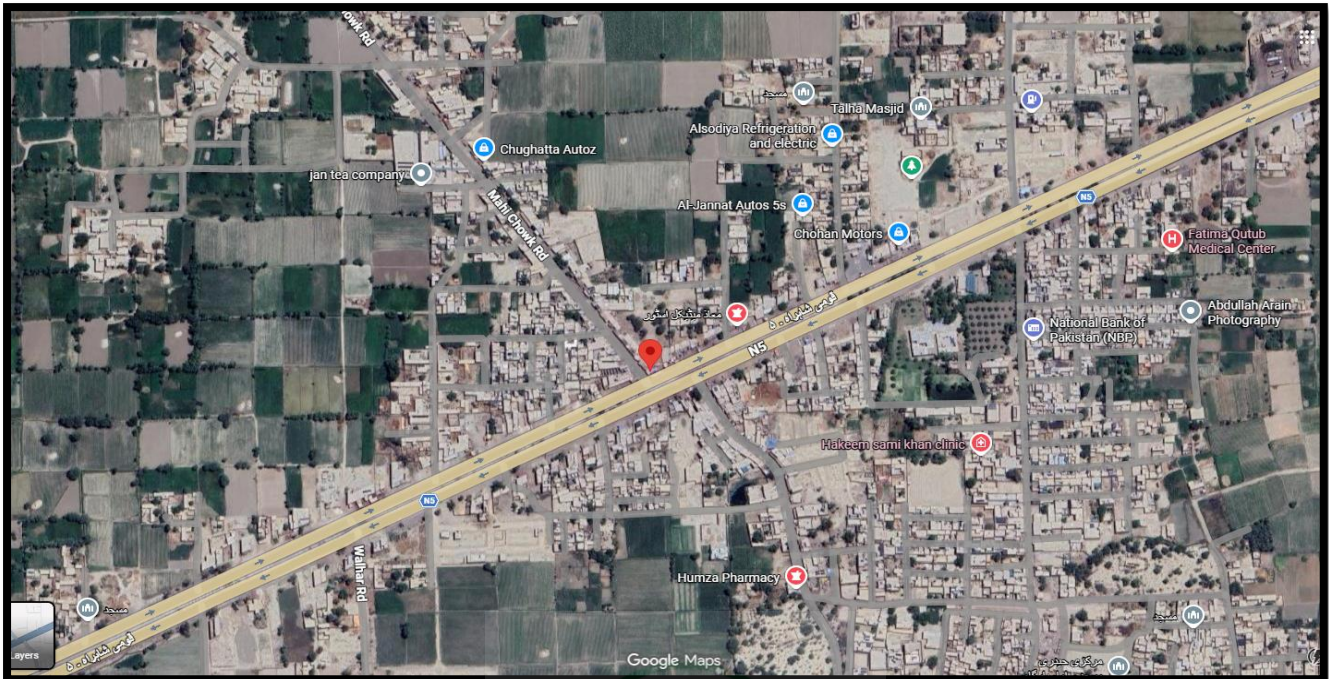


Figure 3: Site Alternative 1

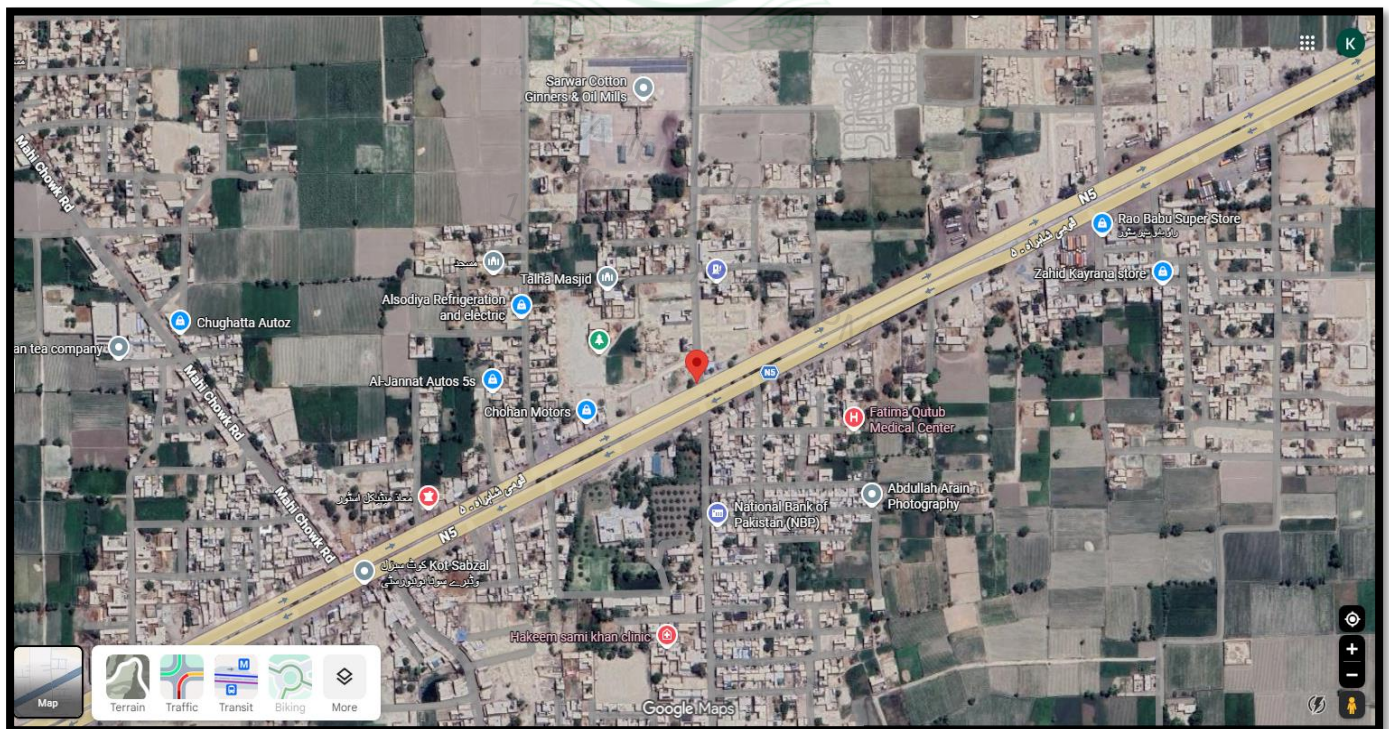


Figure 4: Site Alternative 2



Figure 5: Site Alternative 3

5.2 Their Selection and Rejection Criteria

- These sites were rejected due to following reasons:
- Insufficient land available for the proposed facility.
- High risk of seasonal flooding.
- Inadequate water availability.
- Absence of reliable power and utility connections.
- Unsuitable soil bearing capacity.
- High land acquisition and development cost.
- Presence of environmentally sensitive areas nearby.
- Existing incompatible land use.
- Limited scope for future expansion.
- Complex land ownership or legal disputes.
- Restricted access for construction equipment.
- Potential conflict with local development plans

5.3 Selected Site

The selected site is suitable for JK Sugar Mills (Private) Limited-Distillery due to the following reasons:

- The site is owned by JK Sugar Mills (Private) Limited and there is no dispute associate with the landownership
- The site is located at a suitable distance from community. Hence minimizing / eliminating any nuisance to locals.
- The site is surrounded by agricultural area which complements the nature of the proposed industry.
- The site is in close proximity of Unit 2 of JK Sugar Mills (Pvt) Limited and other group owned sugar mills which ensures easy and sustainable access to raw material i.e. molasses.
- The site is accessible through main roads and infrastructure of that area is fully developed.
- The site is at a suitable distance away from national highway and ensures no disturbance to traffic or congestion due to vehicular movement related to the project activities.

Keeping in view these requirements and the availability of land required for the instant project, this site is best suited for the construction of aforementioned plant. It is envisaged that, there is no protected or environmentally sensitive area present in the vicinity of the project area that could be impacted due to the establishment of the said project. Accordingly, the selected site is ideally suited for the development of the distillery plant as the site is located near to Sugar Mills.

5.4 Design/technology alternatives, their selection and rejection criteria

As part of the project planning process, different technological options for the proposed distillery were evaluated with respect to environmental performance, resource efficiency, regulatory compliance, operational sustainability, and long-term economic viability. The principal alternative considered was a conventional distillery with spent wash treatment and disposal systems versus the proposed Vinasse-Based Distillery with Zero Liquid Discharge (ZLD) and Vinasse Boiler Technology.

5.5 Alternative 1: Conventional Distillery Technology (Rejected Option)

In a conventional distillery, molasses-based ethanol production generates large volumes of spent wash (vinasse), characterized by high organic load, dark color, and elevated BOD/COD concentrations. Traditionally, spent wash is managed through treatment systems followed by disposal, land application, composting, or partial utilization as boiler fuel.

While conventional technology requires comparatively lower initial capital investment, it presents several environmental and operational challenges:

- Generation of substantial quantities of liquid effluent requiring extensive treatment.
- Increased risk of soil and groundwater contamination in the event of improper handling or disposal.
- Higher freshwater demand due to limited wastewater recycling and reuse.
- Dependence on external fuels for steam and power generation.
- Greater environmental compliance burden due to effluent management requirements.
- Potential odor, storage, and transportation issues associated with spent wash handling.
- Lower resource recovery and circular economy benefits.
- Considering increasingly stringent environmental regulations and sustainability requirements, conventional distillery systems are less desirable for modern industrial developments.

5.6 Alternative 2: Vinasse-Based Distillery with ZLD Technology (Selected Option)

The proposed project adopts an advanced **Vinasse Boiler Technology integrated with a Zero Liquid Discharge (ZLD) system**. Under this approach, vinasse generated from the distillation process is concentrated and utilized as a fuel in a dedicated boiler for steam generation and energy recovery. Process condensate and treated wastewater are recycled and reused within the facility, eliminating liquid effluent discharge.

The proposed **Vinasse-Based Distillery with ZLD Technology** was selected because it:

- Eliminates liquid effluent discharge through a Zero Liquid Discharge (ZLD) system.
- Converts vinasse, a process by-product, into a valuable energy resource.
- Generates upto **6 MW of renewable power**, with **4.3 MW consumed internally**.

- Reduces dependence on external electricity and fossil fuels.
- Promotes circular economy principles through resource recovery and waste minimization.
- Conserves freshwater through wastewater recycling and condensate reuse.
- Ensures superior environmental performance and regulatory compliance.
- Supports sustainable industrial development within the privately purpose build industrial estate

Table 5: Technology Alternative

PARAMETER	CONVENTIONAL DISTILLERY	VINASSE-BASED DISTILLERY WITH ZLD (SELECTED OPTION)
EFFLUENT GENERATION	High volumes of spent wash requiring treatment and disposal	No liquid discharge outside the facility (ZLD)
ENVIRONMENTAL RISK	Moderate to high due to wastewater management requirements	Significantly reduced environmental risk
WATER CONSUMPTION	Higher freshwater demand	Reduced freshwater demand through recycling and reuse
ENERGY RECOVERY	Limited or negligible	Energy recovered through vinasse combustion
POWER GENERATION	Generally dependent on grid electricity and external fuel sources	Generates upto 6 MW of renewable power from vinasse
INTERNAL ENERGY UTILIZATION	No significant self-generation	Approximately 4.3 MW utilized internally for plant operations
SURPLUS ENERGY	None	Excess power available for future use
FUEL REQUIREMENT	Greater dependence on external fuels	Reduced dependence on conventional fuels
RESOURCE EFFICIENCY	Moderate	High

REGULATORY COMPLIANCE	Highly challenging due to effluent disposal requirements	Easier compliance through ZLD operation
WASTE MINIMIZATION	Limited	Extensive waste reduction and resource recovery
SUSTAINABILITY PERFORMANCE	Moderate	High
LONG-TERM ENVIRONMENTAL LIABILITY	Relatively higher	Significantly lower
CAPITAL COST	Lower initial investment	Higher initial investment
OPERATIONAL SUSTAINABILITY	Moderate	High

5.7 Environmental Alternatives, their selection and rejection criteria

As part of the environmental assessment process, various environmental management alternatives were evaluated to identify the most sustainable and environmentally acceptable option for the proposed distillery project. The evaluation considered potential impacts on water resources, air quality, land resources, waste generation, energy consumption, regulatory compliance, and overall environmental sustainability.

5.8 Alternative 1: Conventional Environmental Management Approach (Rejected Option)

Under a conventional environmental management approach, the distillery would rely on conventional wastewater treatment systems with partial effluent treatment and disposal, external fuel sources for energy generation, and limited recovery of process by-products. Although such systems may involve lower initial investment costs, they present greater environmental risks and resource consumption.

The major limitations of this alternative include:

- Generation of large quantities of high-strength wastewater requiring treatment and disposal.
- Increased risk of soil and groundwater contamination from effluent handling and disposal activities.
- Higher freshwater consumption due to limited wastewater recycling and reuse.
- Greater dependence on external energy sources and fossil fuels.

- Increased greenhouse gas emissions associated with conventional fuel consumption.
- Reduced resource recovery from process by-products.
- Higher environmental compliance burden and long-term environmental liabilities.

Consequently, this alternative was considered less favorable from both environmental and sustainability perspectives.

5.9 Alternative 2: Integrated Environmental Management with Vinasse Utilization and ZLD (Selected Option)

The proposed project adopts an integrated environmental management approach based on **Vinasse Boiler Technology and Zero Liquid Discharge (ZLD)** principles. Under this system, vinasse generated during ethanol production is concentrated and utilized as a fuel for steam and power generation, while process wastewater is treated, recovered, and reused within the facility.

Key environmental benefits of the selected alternative include:

- Elimination of liquid effluent discharge outside the project boundary.
- Conservation of freshwater resources through wastewater recycling and condensate reuse.
- Conversion of vinasse into a useful energy source, reducing waste generation.
- Generation of upto **6 MW of renewable energy**, with **4.3 MW utilized internally**.
- Reduced dependence on conventional fossil fuels and grid electricity.
- Lower greenhouse gas emissions through waste-to-energy recovery.
- Improved compliance with environmental regulations and best international practices.
- Reduced risk of contamination of soil, groundwater, and surface water resources.
- Promotion of circular economy and sustainable industrial development principles.

Table 6: Environmental Alternatives

ENVIRONMENTAL ASPECT	CONVENTIONAL ENVIRONMENTAL MANAGEMENT	INTEGRATED ZLD & VINASSE UTILIZATION SYSTEM (SELECTED OPTION)
WASTEWATER MANAGEMENT	Treatment followed by disposal/handling	Complete Zero Liquid Discharge (ZLD)
LIQUID EFFLUENT DISCHARGE	Present	Eliminated
WATER CONSERVATION	Limited	Extensive recycling and reuse
GROUNDWATER POLLUTION RISK	Moderate to High	Minimal
SURFACE WATER POLLUTION RISK	Moderate to High	Negligible
ENERGY SOURCE	Grid electricity and conventional fuels	Renewable energy from vinasse
POWER GENERATION	None or limited	Upto 6 MW
INTERNAL ENERGY SUPPLY	Dependent on external sources	Approximately 4.3 MW supplied internally
RESOURCE RECOVERY	Limited	High
GREENHOUSE GAS REDUCTION	Limited	Enhanced through waste-to-energy utilization
REGULATORY COMPLIANCE	More challenging	Strong compliance with environmental standards
ENVIRONMENTAL SUSTAINABILITY	Moderate	High
LONG-TERM ENVIRONMENTAL LIABILITY	Higher	Significantly lower

5.10 Economic Alternatives, their selection and rejection criteria

The economic feasibility of the proposed project was assessed by comparing a conventional distillery configuration with the proposed **Vinasse-Based Distillery integrated with Zero Liquid Discharge (ZLD) and Energy Recovery Technology**. The assessment considered capital investment, operating costs, resource utilization efficiency, energy consumption, environmental compliance costs, and long-term economic sustainability.

Alternative 1: Conventional Distillery Technology (Rejected Option)

Under this alternative, the distillery would operate using conventional production processes with limited recovery of by-products and reliance on external fuel and electricity sources. Although the initial capital investment would be comparatively lower, the project would incur higher operating and environmental management costs over its operational life.

The key economic limitations of this alternative include:

- High expenditure on external fuel and electricity requirements.
- Increased costs associated with treatment, handling, transportation, and disposal of spent wash (vinasse).
- Higher freshwater consumption resulting in increased water procurement and treatment costs.
- Greater environmental compliance and monitoring costs.
- Limited resource recovery from process by-products.
- Exposure to fluctuations in energy prices and utility tariffs.
- Reduced overall operational efficiency and long-term profitability.

5.11 Alternative 2: Vinasse-Based Distillery with ZLD and Energy Recovery (Selected Option)

The proposed project incorporates vinasse concentration, combustion, and energy recovery systems integrated with a Zero Liquid Discharge (ZLD) facility. Although this option requires a higher initial capital investment, it offers substantial long-term economic advantages through resource recovery, energy self-sufficiency, and reduced environmental management costs.

The major economic benefits of the selected alternative include:

- Generation of Upto **6 MW of electrical power** through vinasse-based energy recovery.
- Utilization of approximately **4.3 MW for internal plant operations**, reducing electricity procurement costs.
- Reduced dependence on conventional fuels and external power sources.
- Lower wastewater disposal and environmental management costs due to ZLD operation.
- Reduced freshwater demand through condensate recovery and water recycling.
- Improved resource efficiency through utilization of process by-products.
- Enhanced operational sustainability and long-term economic viability.
- Reduced exposure to future increases in energy and utility costs.

Table 7: Economic Alternative

Economic Parameter	Conventional Distillery	Vinasse-Based Distillery with ZLD (Selected Option)
Initial Capital Cost	Lower	Higher
Operating Cost	Higher over project life	Lower over project life
Electricity Requirement	Fully dependent on external supply	Significant self-generation capability
Power Generation	None	Upto 6 MW
Internal Power Utilization	Not applicable	Approximately 4.3 MW
Fuel Consumption	Higher dependence on purchased fuels	Reduced through vinasse utilization
Waste Management Cost	Higher	Lower due to resource recovery
Water Procurement Cost	Higher	Reduced through recycling and reuse
Environmental Compliance Cost	Relatively higher	Lower due to ZLD compliance
Resource Recovery	Limited	Extensive
Long-Term Profitability	Moderate	Higher
Exposure to Utility Price Fluctuations	High	Reduced
Economic Sustainability	Moderate	High

6 DESCRIPTION OF THE PROJECT

6.1 General

This section covers the project comprehensively. It holds salient features including; location, project site layout, objectives, process employed, cost and magnitude of operation, etc.

6.2 Project Objectives

The primary objective of privately purpose build industrial estate is to establish an integrated industrial and commercial development that promotes sustainable economic growth, industrial diversification, employment generation, and investment attraction within the region

- ✓ To develop a modern privately purpose build industrial estate providing state-of-the-art infrastructure and utilities for industrial, commercial, and supporting facilities.
- ✓ To promote value-added industrial activities, including the production of ethanol and related products through the proposed distillery facility.
- ✓ To maximize resource efficiency through the adoption of renewable energy and waste-to-energy technologies, thereby reducing reliance on conventional energy sources.
- ✓ To implement environmentally sustainable practices, including Zero Liquid Discharge (ZLD), resource recovery, and energy generation from process by-products.
- ✓ To create direct and indirect employment opportunities and contribute to the socio-economic development of the surrounding communities.
- ✓ To ensure compliance with applicable environmental, health, safety, and regulatory requirements while maintaining sustainable operations.
- ✓ To support national industrialization and renewable energy objectives through the development of an integrated industrial ecosystem based on circular economy principles
- ✓ sector activities can be counted as some secondary or indirect objectives of the project.

6.3 Alternatives

Site Alternatives

Three different sites were considered and rejected because of these reasons:

Rejected Sites	Selected Site
• Site located too close to a residential area. • Insufficient land available for the proposed facility. • Poor road connectivity for heavy vehicle movement. • High risk of seasonal flooding. • Inadequate water availability. • Absence of reliable power and utility connections. • Unsuitable soil bearing capacity. • High land acquisition and development cost. • Presence of environmentally sensitive areas nearby. • Existing incompatible land use. • Limited scope for future expansion. • Complex land ownership or legal disputes. • Restricted access for construction equipment. • High groundwater table.	• The site is owned by JK Sugar Mills (Private) Limited and there is no dispute associate with the landownership • The site is located at a suitable distance from community. Hence minimizing / eliminating any nuisance to locals. • The site is surrounded by agricultural area which complements the nature of industry which is agro based. • The site is in close proximity of Sugar Mill Unit 2 of JK Sugar Mills (Pvt) Limited and other group owned sugar mills which ensures easy and sustainable access to raw material i.e. molasses. • The site is accessible through main roads and infrastructure of that area is fully developed.

- Potential conflict with local development plans

6.4 Technology Alternative

Industrial method of preparation of ethanol

There are three methods to get ethanol, industrially. The methods are outlined below.

- By hydration of alkenes.
- By fermentation of carbohydrates.

By Hydration of Alkenes

Alkenes can be obtained by the cracking of petroleum can be easily converted into alcohols by hydration in the following two ways.

a. By the direct addition of water.

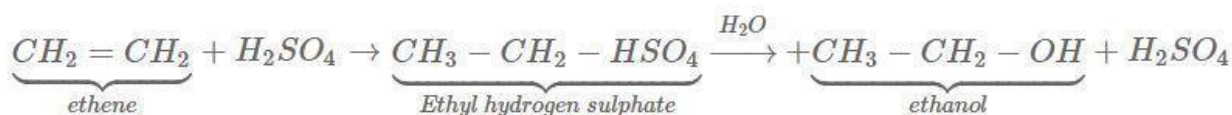
Alkenes can be converted into alcohols by direct addition of water in the presence of the phosphoric acid which acts as the catalyst.

b. By the indirect method of hydration.

Alkenes are directly hydrated at high temperature and pressure to form alcohols. This reaction is carried out in presence of acid like H₃PO₄.



Hydration of unsymmetrical alkenes follow Markovnikov's rule. Alkenes can also be hydrated indirectly in presence of Conc. H₂SO₄.



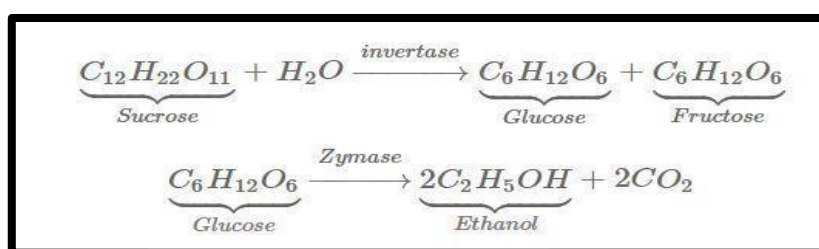
c. Fermentation

Fermentation is defined as the slow process of decomposition of large and complex organic molecules into simpler ones by the action of different enzymes. It is a complex biochemical process which is regarded as one of the oldest methods of manufacture of alcohol.

By this method ethyl alcohol can be manufactured using two types of raw material molasses and starch.

a. From Molasses.

Molasses is dark colored mother liquor obtained after crystallization of sugar. It contains carbohydrates like sucrose, glucose, fructose etc. in significant quantity. Molasses is first hydrolyzed with water to form the dilute solution which is then mixed with yeast, a unicellular fungus containing enzymes like zymase, invertase, diastase etc). The different steps involved in this process are.



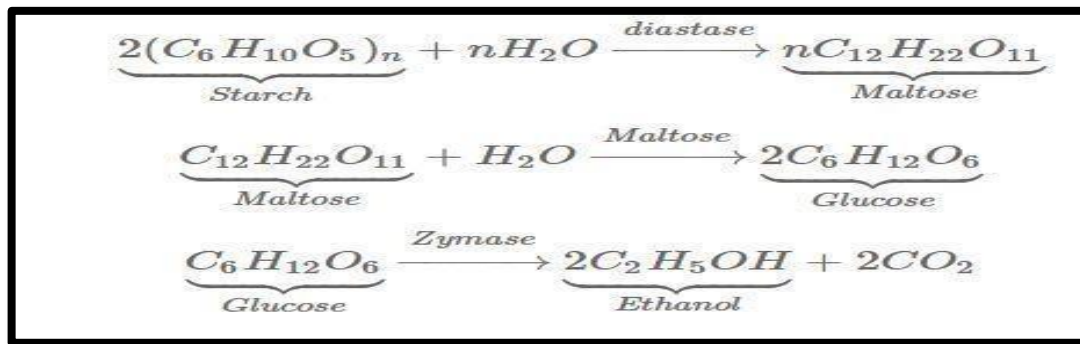
The alcohol obtained from molasses is called "wash" which contains the low percentage of ethyl alcohol (15- 30%). When impure ethyl alcohol is subjected to fractional distillation, pure alcohol is obtained containing the purity of about 90-97%. This alcohol is called 'rectified spirit'.

b. from starch.

Ethyl alcohol also is manufactured from starch containing food grains like millet, rice, wheat, maize, buckwheat etc. In this method, food grains are cooked at first to release starch granules. The solution is diluted with water and the resulting solution is called 'mash'.

'Mash' is mixed with malt which is germinated barely containing a unicellular plant, yeast. Yeast contains different enzymes required for fermentation.

The fermented liquor obtained by this method is called 'wash' which is subjected to fractional distillation to obtain pure alcohol having the purity of about 90-97% and is called 'rectified spirit'.



The above-mentioned processes are efficient and effective in many ways but the proposed plant works under the fermentation process using molasses as a raw material. As JK Sugar Mills (Private) Limited is a sugar manufacturing industry thus, molasses is produced as a by-product in a larger manner. Apart from wasting they are utilizing it in the other way for the production of ethanol and generating capital from it. The process is feasible as spent wash produced is being used as fuel for steam generation in the boiler. This process seems to be cost effective and efficient in the view of the proponent as other methods are expensive and their energy consumption is high and have environmental concerns.

6.5 Project Location and Layout

The proposed site for the JK Sugar Mills (Private) Limited-Distillery is located at Chak No. 36-B/NP, Mahi Chowk Road (10 KM off KLP Road), Sadiqabad, District Rahim Yar Khan, Punjab. The coordinates of site are; Lat-28°17'53.62"N and Long 69°50'9.35"E given in below Figure 6. The layout map of project is attached as Annexure III.



Figure 6: Google Map Showing Proposed Site



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6.6 Land Use on the Site

The land use on proposed project is open agricultural land. The pictorial evidence of the proposed project location is shown in Figure 7.



Figure 7: Project Site

6.7 Road Access

The site is accessible through Kacha Road at distance of 20m. The road access of project is attached below:

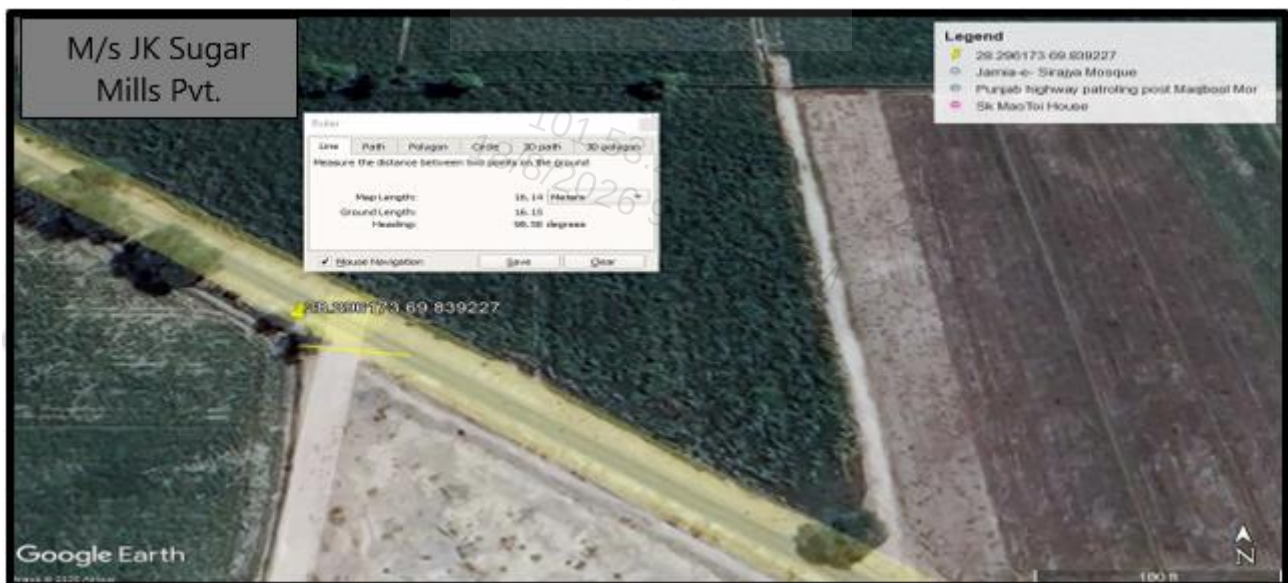


Figure 8: Road Access Map of Proposed Site

6.8 Vegetation Features

Landscaping/ Tree plantation is present in surroundings of project area. During operation phase, green belts will be developed and it will serve as a useful green buffer.



Figure 9: Tree Plantation around Project Site

6.9 Cost and Magnitude of Operation

The estimated cost of aforesaid project is **approximately PKR 18.8 billion**. Purchase of raw material, operation and maintenance of production machinery are the costly activities involved in the operation phase of said project. Equipment safety will be assured if these operations are carefully managed. However, budget will be allocated for purchase and maintenance of standardized PPEs for workers and for waste management and environmental enhancement. Despite these costs, this project was found to be financially feasible. Magnitude of operations includes:

- Applying for and getting all necessary approvals and contracts
- Installation of machinery
- Installation of firefighting equipment
- Marking of emergency exits and assembly points
- Tree plantation and landscaping

The allocated environmental budget is 2 million. The allocated environmental budget will be spent on landscape/green zone management, solid waste management, wastewater treatment

plant and its maintenance along with Environmental monitoring. The proponent will plant indigenous and Ornamental plants to increase the aesthetic value of the area. Thus, the project is also a source of employment for locals and would help in economic development activities of the area.

6.10 Schedule of Implementation

The proponent intended to complete the construction in a period of a year.

Table 5: Schedule of Implementation

Sr.	Activities	12 Months			12 Months		
		4M	4M	4M	4M	4M	4M
1.	Detailed Designing						
2.	Mobilization of Contractors						
3.	Demolition of existing hall						
4.	Preparation of site						
5.	Civil Works						
6.	Installation of facilities						

6.11 Project Description

The proponent has planned to establish an Ethanol/Distillery Plant by M/s JK Sugar Mills (Private) Limited for the production of alcohol, having a total area of **454 Kanals 18 Marlas**, with a production capacity of 230,000 liters per day ethanol. The layout map is attached herewith as Annex-III.

The distillery operations will produce about **2000 Tons of Spent Wash per day** with solids concentration of about **14.51% w/w**. This raw spent wash will be concentrated to **60% w/w solids** in a standalone multiple-effect evaporation plant using low-pressure steam.

The multiple-effect evaporation plant will have a minimum of **five effects with forced circulation bodies** to optimize performance. Thus, the concentrated spent wash generation will be approximately **600 Tons per day** or **25 Tons per hour** during operation with C molasses.

The estimated **gross calorific value** of the concentrated spent wash is **1584 kcal/kg**. This concentrated spent wash will be fired in the boiler along with bagasse to generate the required steam.

The condensate generated in the concentration plant will be treated in a **condensate polishing unit**

and reused in the distillery plant, thus making the plant a “**Zero Liquid Discharge**” (ZLD) system.

6.12 Raw Materials and Chemicals

The molasses is the raw material that is produced as a by-product of sugar processing and following chemicals are required for distillation process;

1. Molasses (MT)
2. Sulphuric acid (Kg)
3. Diammonium Phosphate (DAP) (Kg)
4. Antifoam (Kg)
5. Urea (Kg)
6. Calgon (Kg)
7. Anti Foam
8. Anti-scalent for distillation
9. Sodium fluoride (Kg)
10. Phosphoric acid (Kg)
11. Yeast (Kg)
12. Caustic Soda (Kg)
13. Soda Ash (Kg)



6.13 Final Product

Industrial Grade Ethanol/ENA Grade Ethanol/Fuel Grade Ethanol

6.14 Process Description

The proposed project involves production of ethanol from molasses through fermentation and distillation, followed by treatment of spent wash using **incineration technology** and process flow chart;

1. Molasses Storage and Handling
2. Molasses Dilution
3. Fermentation
4. Distillation Process
5. Concentration of Spent Wash (**Mechanical Evaporation through Steam Multi effect evaporation**)
6. Incineration of Concentrated Spent Wash

PROCESS FLOW CHART

Production of Ethanol from Molasses through Fermentation and Distillation, followed by Treatment of Spent Wash using Incineration Technology

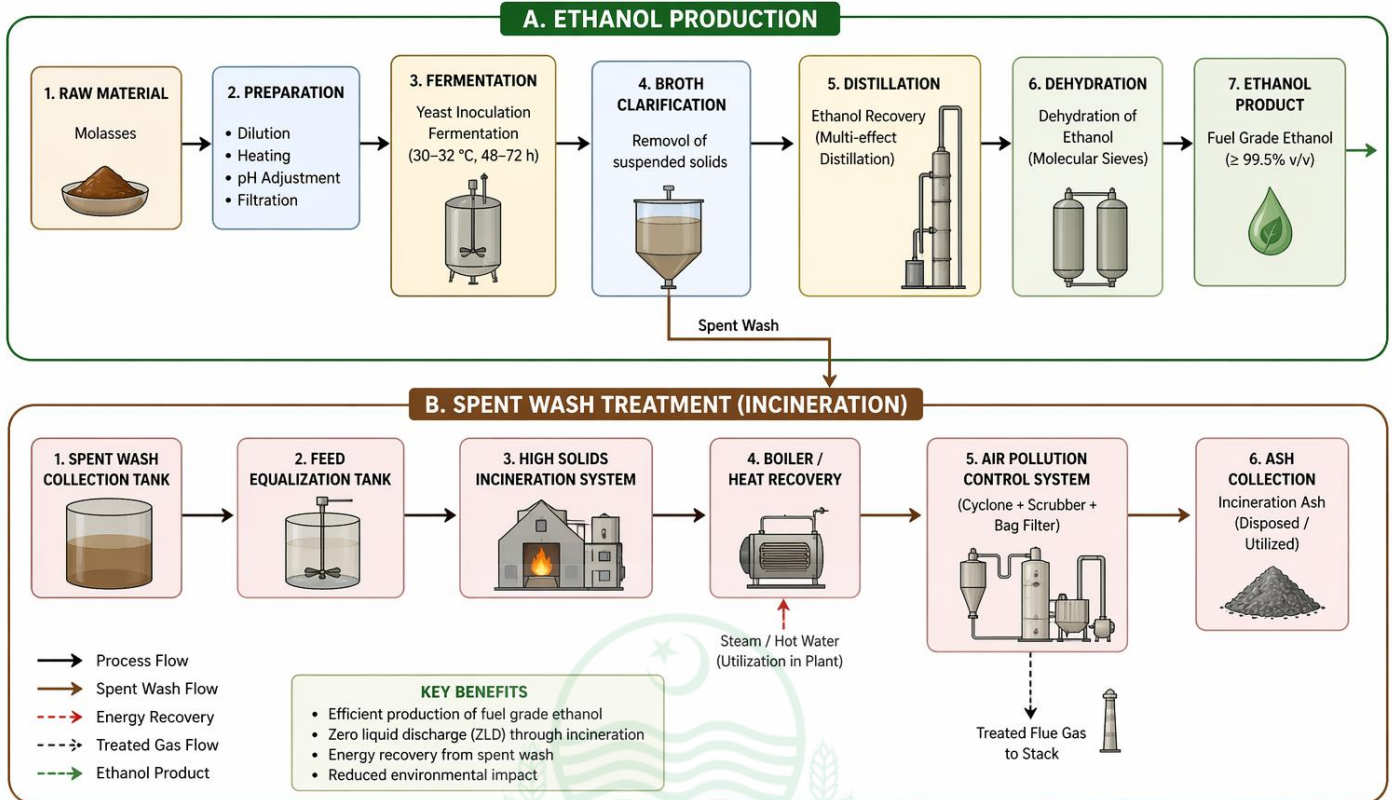


Figure 10: Process Flow

The spent wash generated from distillation will be concentrated using multiple effect evaporators (MEE). The concentrated spent wash will then be fed into an **incineration boiler**, where it will be combusted at high temperature. The heat generated during incineration will be utilized for steam generation, which will be reused in the distillation process. The ash generated from incineration will be safely disposed of or utilized as soil conditioner, subject to environmental standards.

6.15 Molasses Storage and Handling

The molasses will be taken from JK Sugar Mills (Private) Limited (Unit-II) and other sugar mills of the group and stored in the molasses tanks (total 5 Nos) having capacity of 20,000 tons each. In this step, arrangement should be made for temperature monitoring and pumps for circulation in case abnormal rise of temperature will be occurred. Forecasting Emergency arrangement in case of fire or internal burning of molasses.

6.16 Molasses Dilution

Molasses is a thick viscous by product of the sugar industry which is acidic in nature, rich in salt and contain sugar which could not be crystallized. Molasses from bulk storage transferred will be to

molasses receiving tank and diluted with process water. In which molasses brix reduced to 30 to 33 from 90 that is required for Refermentation/fermentation process.

6.17 Pre-fermentation Process:

In this step, yeast culture will be developed and then added to fermentation for alcohol production. Pre- fermentation is an exothermic reaction in which temperature will be controlled by cooling water circulating in cooler.

6.18 Fermentation Process

The pre fermented media is shifted to fermentation section during plant start up. In this step, diluted molasses 67% of 30 Brix and 33% prefermenter added, fermenter filled within 14 to 16hrs and left for reaction which is completed in about 40 hrs. Ethanol production is between 7.5 to 9.0 % depending upon molasses sugar, feed brix which is then transferred to distillation for purification.

6.19 Distillation:

In this step produced ethanol from fermentation and purified in distillation with the help of steam and vacuum by multistage distillation column from C-510,511,520,530,540,560,561,550. The ethanol vapors are condensed and cooled to room temperature.

6.20 Incretion or Mechanical evaporation

The vinasse or spent wash coming from distillation columns goes to settling/storage pits where the spent of 13-14 brix feed of Mechanical evaporation section where the Brix of Spent wash is increased by 55-60 by continuous evaporation and final product of Spent wash of 55-60 brix feed to the Boiler and remaining water recovered will be pass through RO and reused for process, cooling tower makeup and gardening

6.21 Final Storage

The ethanol is separated at distillation, cooled in cooler and then stored in daily storage tanks placed in receiver room. Two daily storage tanks having capacity of 216 Tons and two tanks having capacity 13 Tons are proposed. After daily storage tanks the ethanol will shift to Ethanol Main Storage area wherein a total of five (05) final storage tanks is proposed. Three tanks having a capacity of 4400 Tons each, one tank of 1200 tons and one tank of 400 Tons are proposed.

6.22 List of Machinery

The list of machines is in below Table.

Table 8: List of Machines

FERMENTATION HOUSE						
Sr.#	Item	Description	Particulars	Quantity	Make	Remarks
1	--	Molasses Storage Tanks	Capacity=20000 tons eac	5 Nos.		
2		Molasses Supply Pump	Capacity=150 Ton / hr	4 Nos.	Local	
3	--	Molasses Supply Pump	Capacity=70-80 Ton / hr	6 Nos.	Local	
4	P-306 A/B	Dilution Pumps	Capacity= 80 m ³ / hr	2 Nos.		
5	R-411-13	Pre Fermenters Tanks	Capacity= 350m ³	3 Nos.		
6	P-411-13	Circulation Pumps	Capacity= 250 m ³ / hr	3 Nos.	Imported /Local	Sterling Gmbh/Ksb Pakistan
7	E-411-13	Heat Exchangers	Plate Type	3 Nos.		NKR, Pakistan
8	R-421-428 /430	Fermentation Tanks (S.	Capacity= 800 m ³	9Nos.		
9	P-421-428	Circulation Pumps	Capacity= 550 m ³ / hr	8 Nos.	Imported/ Local	Sterling Gmbh/Ksb Pakistan
10	E-421-428	Heat Exchangers	Plate Type	8 Nos.		NKR, Pakistan
DISTILLATION HOUSE						
11	C-500	Vacuum scrubber.	Packing column.	1 Nos.	Local	
15	C-510	Stripping column.	SS TRAYS	1 Nos.	Local	
16	C-511	Degassing column.	SS TRAYS	1 Nos.	Local	
17	C-520	Concentration column.	SS TRAYS	1 Nos.	Local	
18	C-521	Lutter column.	SS TRAYS	1 Nos.	Local	
19	C-530	Purifying column.	SS TRAYS	1 Nos.	Local	
20	C-540	Rectifying column.	SS & COPPER TRAYS	1 Nos.	Local	
21	C-550	Refining column.	SS & COPPER TRAYS	1 Nos.	Local	
22	C-560	Low grade alcohol concentration column.	SS TRAYS	1 Nos.	Local	
23	C-561	Lightening recycled alcohol	SS TRAYS	1 Nos.	Local	
1	--	Steam Boiler (Water type) fitted with accessories e.g. Oil bur Gas Burner, Air Heate Economizer etc.	Capacity= 35 Ton / Working Pressure 45 bar	1 Nos.	Local	

2	--	Feed Water Tank	Capacity = 500 Ton	1 Nos.	Local	
3	--	Feed Water pump	Capacity= P# 01: 60 Ton P# 02: 60 Ton/hr	2 Nos.	Local	
4	--	Condensate Tank	Capacity = 400 Ton	1 Nos.	Local	
5	--	Water Lift Pumps	Capacity= 50 Ton / hr	2 Nos.	Local	
6	--	I.D. Fan	Capacity= 2200 m ³ /min	1 Nos.		
7	--	F.D. Fan		1 Nos.		

POWER HOUSE

1	--	Shinko Steam Turbine Shinko Japan Toyodenki Generator (T.G.)	Capacity = 7000 KW, 45 or 5500 KW/HR	1 Set	Japan	

COOLING TOWERS

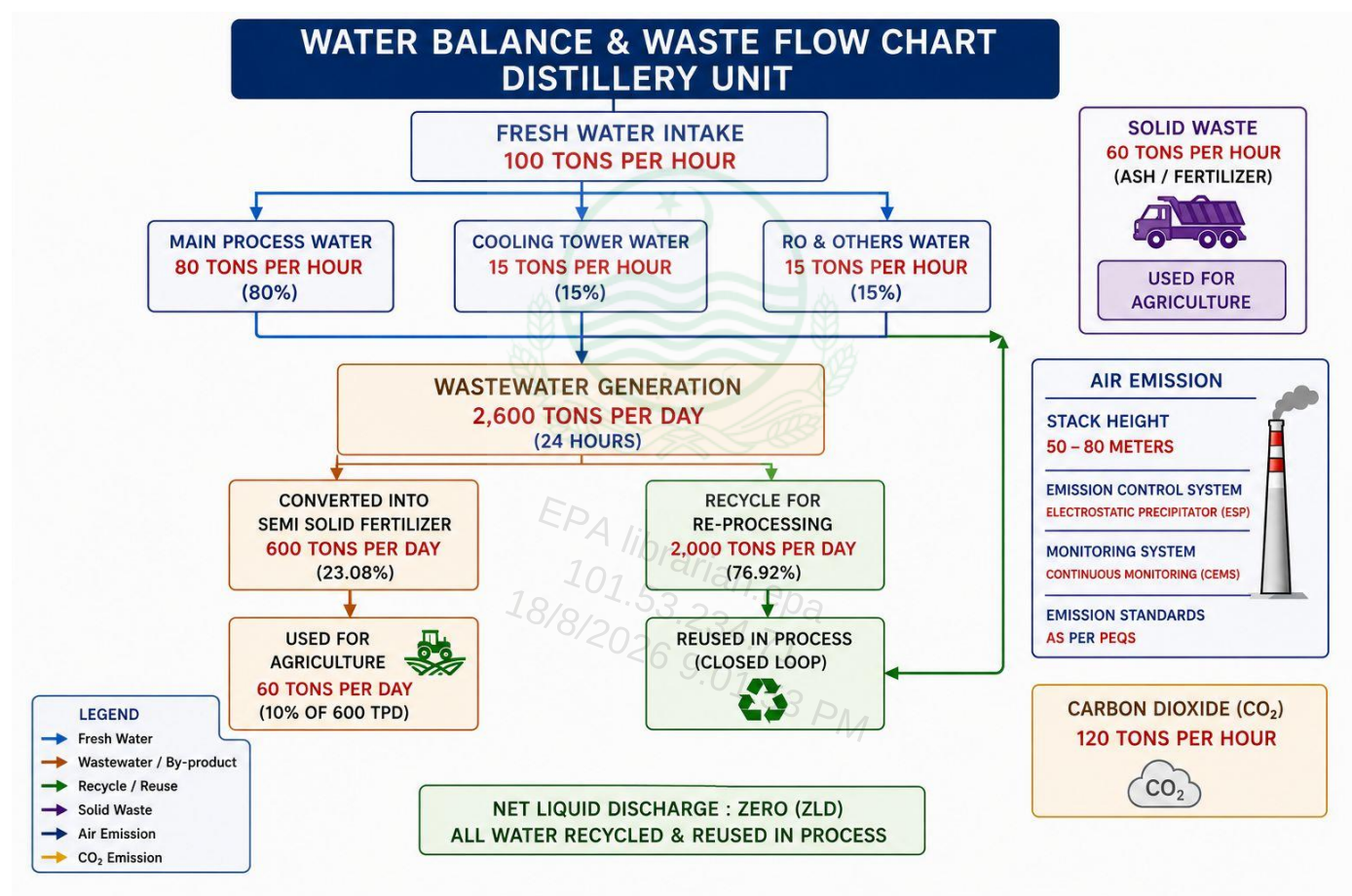
Sr.No.	Item	Description	Particulars	Quantity	Make	
1	--	Cooling Tower comple fitted with Grids & Louvers	Capacity= 1400 m ³ / hr	1 Nos.	Adk Enterprises Lahore, Pakistan	
2	--	Injection Pumps (Cooling tower # 01)	Capacity= 800 m ³ / hr	3 Nos.	KSB PUMPS (PAK.)	
3	--	Cooling Tower comple fitted with Grids & Lou	Capacity= 2100 m ³ / hr	1Nos.	Adk Enterprises Lahore, Pakistan	
4	--	Injection Pumps (Cooling tower # 02 &	Capacity= 800 m ³ / hr	4 Nos.	KSB PU (PAK.)	
5	--	Cooling tower fans motors		5 Nos.		

6.23 Supplies

Following supplies will be required for Distillation process.

6.24 Water Requirement

The water requirement mainly for the proposed project is for domestic use and process water main water requirement for process 100 tons per hour, requirement of cooling tower 15 tons per hour, and for RO & others will be 15 Tons per hour. Waste water generation is expected to be 2,600 ton per day for 24 hours (600 tons will be converted into semi solid for use in Slop boiler and remaining 2,000 tons will be re-cycle for re-processing through condensate polishing unit). Any additional water requirement will be fulfilled by ground water from irrigation canal.



6.25 Provision of Continuous Emission Monitoring System (CEMS):

The proposed distillery will be equipped with a **Continuous Emission Monitoring System (CEMS)** installed on the main vinasse incineration boiler stack downstream of the Electrostatic Precipitator (ESP). The CEMS will continuously monitor stack emission parameters to verify compliance with the Punjab Environmental Quality Standards (PEQS). The system will facilitate

real-time emission monitoring, regulatory reporting, operational optimization, and timely corrective actions to ensure effective environmental performance.

6.26 Power Requirement

Renewable Electricity generation resulting from the project is expected to be upto 6 MW and its expected utilization is as follows;

- 1.5 MW for process
- 500 KW for multi effect evaporator
- 1 MW for boiler
- 500 KW granular ash fertilizer
- 500 KW auxiliaries and lighting

Total power requirement is estimated around 4.3MW

6.27 Manpower

During construction phase, 100-150 workers will be hired including local, skilled and technical staff as well. During operational phase, 400-450 workers will be hired that include both permanent staff and daily wagers.

6.28 Personnel Protective Equipment

Following Personnel Protective equipment will be provided to the workers for their safety:

- Protective Helmets
- Protective Goggles
- Ear Plugs
- Protective leather/rubber shoes
- Gloves-leather, canvas, rubber and plastic
- Protective shields
- Overcoats
- Surgical masks

6.29 Management Plans

For the management of the wastewater, noise, solid waste and air emissions following measures will be adopted;

6.30 Combined Effluent Treatment Plant

A Combined Effluent Treatment Plant (CETP) will be established within the project premises to collect, treat, and manage wastewater generated from various plant operations, including process condensate, utility blowdown, equipment washing, wastewater, and domestic sewage. The CETP will be designed to achieve the required treatment standards and facilitate maximum recovery and reuse of treated water within the facility.

Treated effluent and recovered condensate will be recycled for process requirements, cooling systems, utility operations, and greenbelt irrigation. The CETP will operate in conjunction with the project's Zero Liquid Discharge (ZLD) system, ensuring that no untreated wastewater is discharged into the environment.

The integration of the CETP with the vinasse concentration and energy recovery system will significantly reduce the environmental footprint of the distillery by minimizing freshwater consumption, preventing contamination of surface and groundwater resources, and ensuring compliance with applicable environmental regulations and Pak EPA requirements.

6.31 Air Emissions

During construction, dust emissions will be controlled by water sprinkling. Proper tuning of vehicles carried out on the regular basis in order to control the air pollution. The material prone to wind will be covered with tarpaulin.

During operation phase, project includes installation of silos and ESP for controlling emission coupled with an adequate ash handling and conveyor system. The aggregate ash storage capacity of approximately **6000 tons** is proposed within the project premises. These silos are designed to minimize fugitive dust generation during material handling, transfer, and storage operations. The associated dust collection system will be equipped with high-efficiency particulate control equipment, achieving a removal efficiency of approximately **98%**, thereby ensuring effective capture of airborne dust at the source. This arrangement will significantly reduce particulate emissions to the atmosphere, improve workplace air quality, and ensure compliance with applicable environmental standards and PEQS requirements. Proper operation and maintenance of the system will further ensure sustained performance and minimal environmental impact.

6.32 Solid Waste

Solid waste generated from the proposed distillery project will mainly include process residues such as boiler ash from vinasse combustion, packaging waste, maintenance waste (used oil, filters, and lubricants), and general municipal-type waste from administrative and operational areas. **Boiler Ash Storage and Utilization System:** Boiler ash in form of Granular potash expected to be generated at the rate of **60 tons per day** will be collected in a dry form will be used as bio fertilizer in agriculture. Recyclable waste streams such as paper, plastic, and scrap

metal will be segregated at source and sent to contractor. A proper Solid Waste Management Plan (SWMP) will be implemented to ensure waste minimization, safe handling, and compliance with Pak EPA requirements, thereby reducing environmental risks and promoting resource recovery within privately purpose build industrial estate.

6.33 Integration of IFC Performance Standards and Sustainable Development Goals (SDGs) **Integration with IFC Performance Standards**

The proposed privately purpose build industrial estate comprising a modern distillery based on vinasse incineration and Zero Liquid Discharge (ZLD) technology, has been planned in accordance with internationally recognized environmental and social management principles. The project demonstrates alignment with the relevant IFC Performance Standards as summarized below.

Table 9: IFC Performance

IFC Performance Standard	Project Integration
PS 1: Assessment and Management of Environmental and Social Risks and Impacts	An Environmental Impact Assessment (EIA) has been conducted to identify potential impacts and establish mitigation measures through an Environmental Management Plan (EMP) and environmental monitoring program. The project will provide safe and healthy working conditions,
PS 2: Labor and Working Conditions	occupational health and safety measures, employee training, emergency preparedness, and compliance with applicable labor laws.
PS 3: Resource Efficiency and Pollution Prevention	The project incorporates Zero Liquid Discharge (ZLD), vinasse incineration, renewable energy recovery, wastewater recycling, ash utilization, efficient water management, and air emission control systems to minimize environmental impacts.
PS 4: Community Health, Safety and Security	Appropriate operational controls, emergency response planning, traffic management, and pollution control measures will be implemented to protect neighboring communities.
PS 5: Land Acquisition and Involuntary Resettlement	The project will comply with applicable legal requirements relating to land acquisition. Any land-related matters will be

IFC Performance Standard

Project Integration

managed in accordance with national regulations and international good practices.

PS 6: Biodiversity

Conservation and Sustainable Management of Living Natural Resources

The project site has been selected to minimize ecological impacts, while pollution prevention measures and proper waste management will protect surrounding environmental resources.

PS 7: Indigenous Peoples

No Indigenous Peoples, as defined under IFC PS7, are anticipated to be affected by the proposed project.

PS 8: Cultural Heritage

Construction activities will incorporate chance-find procedures to safeguard any archaeological or cultural resources encountered during site development.

6.34 Contribution to the United Nations Sustainable Development Goals (SDGs)

The proposed project contributes directly to several Sustainable Development Goals (SDGs) through sustainable industrial development, renewable energy utilization, efficient resource management, and environmental protection.

Table 10: Sustainable Development Goals

Sustainable Development Goal

Project Contribution

SDG 6 – Clean Water and Sanitation

Implementation of Zero Liquid Discharge (ZLD), wastewater recycling, and efficient water conservation practices.

SDG 7 – Affordable and Clean Energy

Recovery of thermal energy through vinasse incineration, reducing dependence on conventional fossil fuels.

SDG 8 – Decent Work and Economic Growth

Creation of employment opportunities, promotion of industrial investment, and contribution to regional economic development.

SDG 9 – Industry, Innovation and Infrastructure

Development of a modern industrial facility utilizing advanced distillery and environmental technologies.

Sustainable Development

Goal

Project Contribution

SDG 12 – Responsible

Consumption and Production

Resource recovery through ash utilization, wastewater reuse, renewable energy generation, and circular economy practices.

SDG 13 – Climate Action

Improved resource efficiency, energy recovery, and pollution control measures contributing to reduced environmental impacts.

SDG 15 – Life on Land

Proper waste management, air emission control, and pollution prevention measures protecting terrestrial ecosystems.



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7 DESCRIPTION OF THE ENVIRONMENT

7.1 General

This section describes the baseline conditions, which shows the clear-cut picture of existing environmental resources; physical, ecological, and socio-economic environment of the Project area. Information on these aspects has been derived from field visits to the project area as well as information obtained through visits to the Government departments and other relevant agencies.

The primary data was collected by surveying the project area and its nearby vicinity. The secondary data regarding physical parameters (topography, geology, seismology, hydrology and climatology) was obtained by visiting relevant departments and their official websites. The biological parameters (flora and fauna) were also studied in the project area. The vegetation of project area was studied by preparing a floristic list based on visual observation. The species were recorded with reference to their historical existence in the project area.

Information on wildlife fauna species (mammals, amphibians, reptiles, birds, etc.) in the assessment area was compiled based on opportunistic observation, gathering the existing information and consultation with local experts, community members and government departments. The socio- economic aspects were studied and analyzed by conducting detailed socio-economic surveys.

7.2 BASELINE PHYSICAL ENVIRONMENT

This part examines the physical resources such as topography, soil, climate, surface and ground water resources and quality, ambient air quality and geology of not only the Project site but also the city as a whole to assess whether the project under assessment can or does have any impacts on any of these parameters. The description of physical environment of *Rahim Yar Khan* city and the project site is presented in the following sub sections.

7.3 Topography and Geography

The district lies between *27°40'-29°16' North latitude and 60°45'-70°01' East longitude*. The riverain area of the district lies close to eastern bank of river Indus and Punjab. Rahim Yar Khan District is bounded on the north by Muzaffargarh District, on the east by Bahawalpur District, on the south by Jaisalmer district (India) and Ghotki District of Sindh province, and on the west by Rajanpur District. The topography of project area is flat. The site selected for

project "**JK Sugar Mills (Private) Limited-Distillery**" is located at Chak No. 36-B/NP, Mahi Chowk Road (10 KM off KLP Road), Sadiqabad, District Rahim Yar Khan, Punjab. The coordinates of the site are; **Latitude 28°17'53.62"N and Longitude 69°50'9.35"E**.

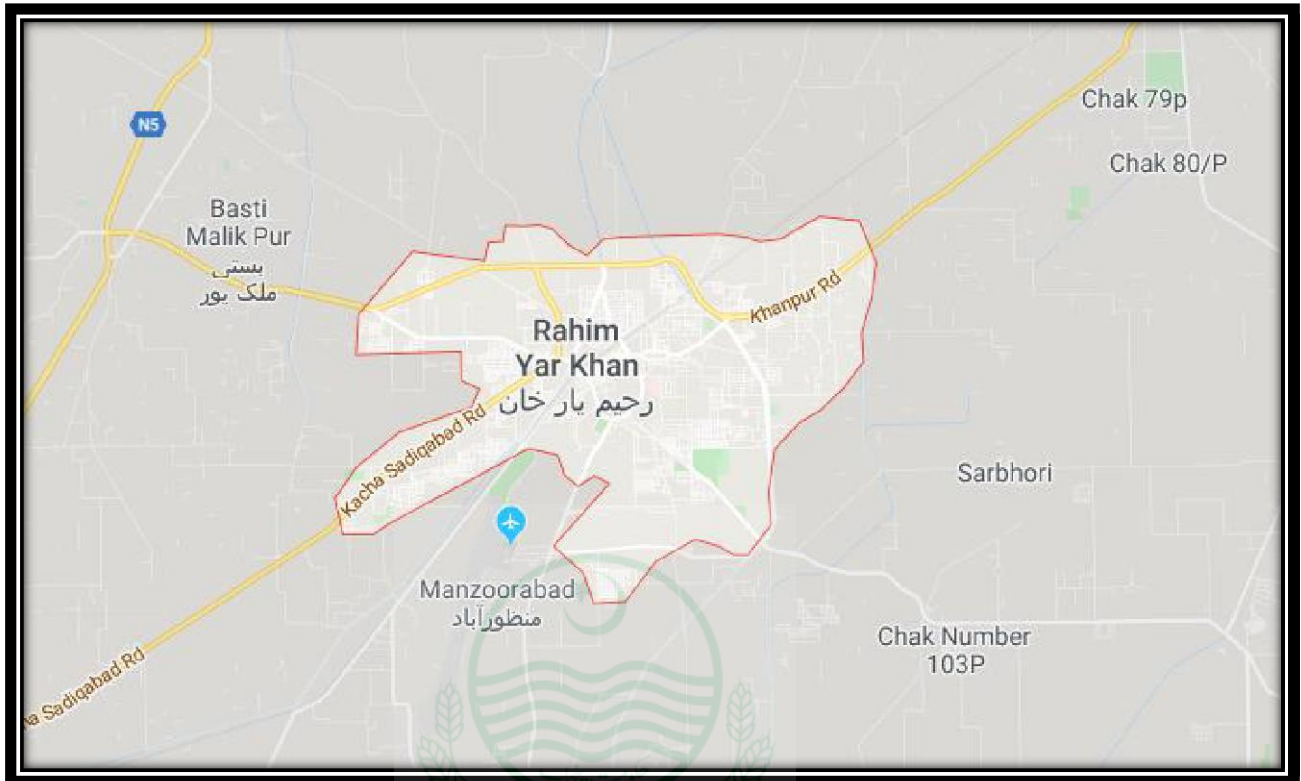


Figure 11: Map of Rahim Yar Khan District

This district is divided into three main physical features: (a) Riverside area, b) canal-irrigated area, and (c) desert area which is called Cholistan. The Riverside area of the district lies close on the southern side of the Indus River mainly falling in the river bed. The canal-irrigated area lies on the south and is separated by main Minchan Bund. The approximate height of the irrigated area is *150 to 200 meters (490 to 655 ft)* above sea level. The third part of the area, called Cholistan, lies in the south of the irrigated tract up to the Indo-Pak border. The surface of the desert consists of a succession of sand dunes rising at places to a height of 150 meters (492 ft) and covered with the vegetation peculiar to sandy tracts.²

7.4 Demography

At the time of the 2017 census, the district had a population of 4,807,762, of which 2,461,780 were males and 2,345,413 females. Rural population is 3,776,779 while the urban population is 1,030,983. The literacy rate was 46.62%.

7.5 Seismicity

A seismic hazard analysis is based on both the geological and seismological history of the region, including recent and historical seismicity (earthquake catalogue), supplemented with available paleo- seismological information.

Pakistan is an earthquake prone country. A number of earthquakes have hit Pakistan resulting in losses of life and property. Pakistan Meteorological Department (PMD) presently has a network of eleven seismic stations. By using recorded data the seismicity and zoning maps of Pakistan have been developed by PMD. Seismic Zoning Map of Pakistan showing Proposed Project site area is presented as Figure, indicating zones according to the Building Code of Pakistan - 2007. The project site falls in Seismic Zone 2A/minor to moderate damage zone according to the Seismic Zoning Map of Pakistan.

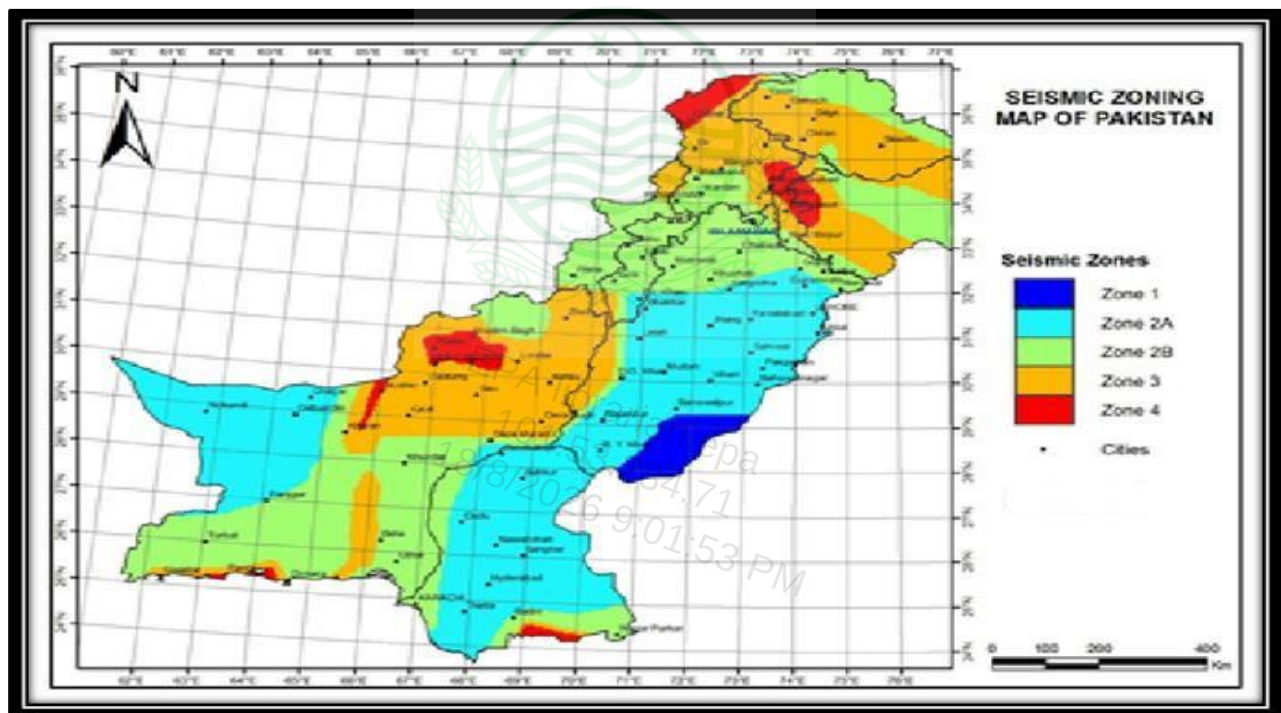


Figure 12: Seismic Zoning of Pakistan

7.6 Climate

The climate here is "desert." During the year, there is virtually no rainfall in Rahimyar Khan. As per the Köppen-Geiger classification, the prevailing weather conditions in this region are categorized under BWh. In Rahimyar Khan, the average annual temperature is 26.9 °C | 80.4

°F. Precipitation here is about 174 mm / 6.9 inch per year. Rahim Yar Khan is in the northern hemisphere. Summer begins at the end of June and ends in September. The hottest month is June, where average highs routinely exceed 40°C (104.0 °F). The wettest month is July, with heavy rainfalls and evening thunderstorms with the possibility of cloudbursts. The coolest month is January with dense fog. The city's highest maximum temperature was 48.3°C (118.9 °F) recorded on May 30, 1944 and 48°C (118°F) was recorded on June 9, 2007. The lowest temperature recorded in Rahim Yar Khan is -1°C, recorded on 13 January 2022.

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature (°C)	12.3	15.4	20.6	26.5	31.1	33.9	31.5	30.7	29.7	25.5	18.9	13.7
Min. Temperature (°C)	5.3	8.4	13.6	18.8	23.4	27.3	26.9	26.3	24.3	18	10.7	6
Max. Temperature (°C)	19.3	22.4	27.7	34.2	38.9	40.6	36.2	35.1	35.1	33	27.1	21.4
Avg. Temperature (°F)	54.1	59.7	69.1	79.7	88.0	93.0	88.7	87.3	85.5	77.9	66.0	56.7
Min. Temperature (°F)	41.5	47.1	56.5	65.8	74.1	81.1	80.4	79.3	75.7	64.4	51.3	42.8
Max. Temperature (°F)	66.7	72.3	81.9	93.6	102.0	105.1	97.2	95.2	95.2	91.4	80.8	70.5
Precipitation / Rainfall (mm)	24	24	37	17	20	36	189	159	73	12	4	12

Figure 13: Temperature and Rate of Precipitation

7.7 Surface Water Quality

No surface water body/reservoir is located within 2 km of study area. No impact is being envisaged due to installation of above-said project.

7.8 BASELINE BIOLOGICAL ENVIRONMENT

The biological environment consists of the flora and fauna present at the study as well as project area. There are no endangered or IUCN Red list species reported from the area. The detail of each parameter is given below.

7.9 Flora and Fauna

The flora of the district characterizes two major ecological divisions, northern and southern. The botanical life found in the northern half is like that of the rest of the irrigated tracts at

central Punjab. The arid land, referred to as the Cholistan desert, has a lot of wild life including Wild cats, the Chinkara deer, jackals, foxes, badgers, porcupines, squirrels, gerbils, wild rats, poisonous snakes, hog deer etc.

7.10 BASELINE SOCIO-ECONOMIC ENVIRONMENT

This section provides collective information about the existing socio-economic and environmental condition of the project area within the Area of Influence (AOI). The different types of socio- economic aspects were covered such as demographic profile, occupation, education and health facilities. This data helped in identifying major interventions for the development of Environmental Management Plan (EMP). The study also helped to assess the positive or adverse impacts on local community.

This topic provides an overview of the baseline information relating to the socio-economic environment of the project area and the AOI. The socio-economic study gives information about the demographic profile, occupation, education and health facilities in the project area.

7.11 Healthcare Facility

Healthcare services are provided to the citizens by hospital. Moreover, there are a number of private clinic near Project site



Figure 14: Nearby Healthcare Facilities

7.12 Educational Facilities

Following schools are present in project area vicinity; as shown in Figure: below;

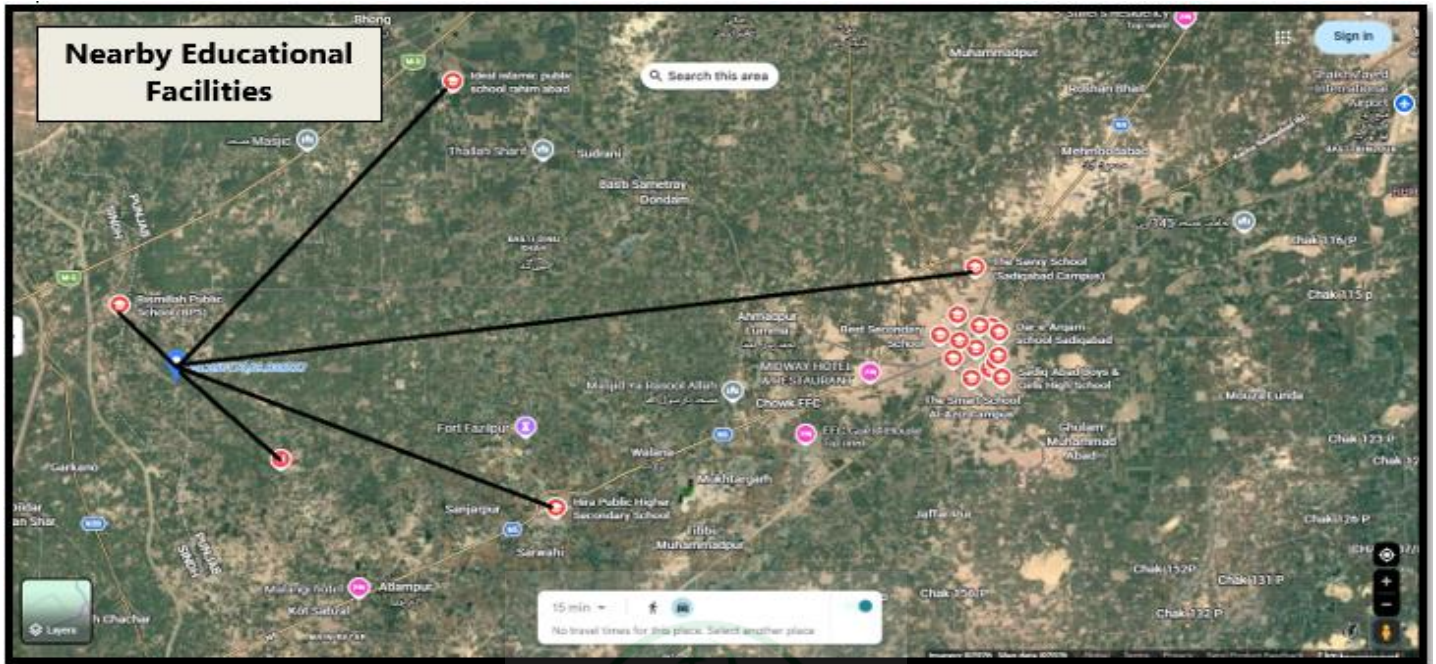


Figure 15: schools of Proposed Project Location

7.13 Road Access

Project site is accessible through Kacha- Road at the distance of 0.66km as shown below in figure:

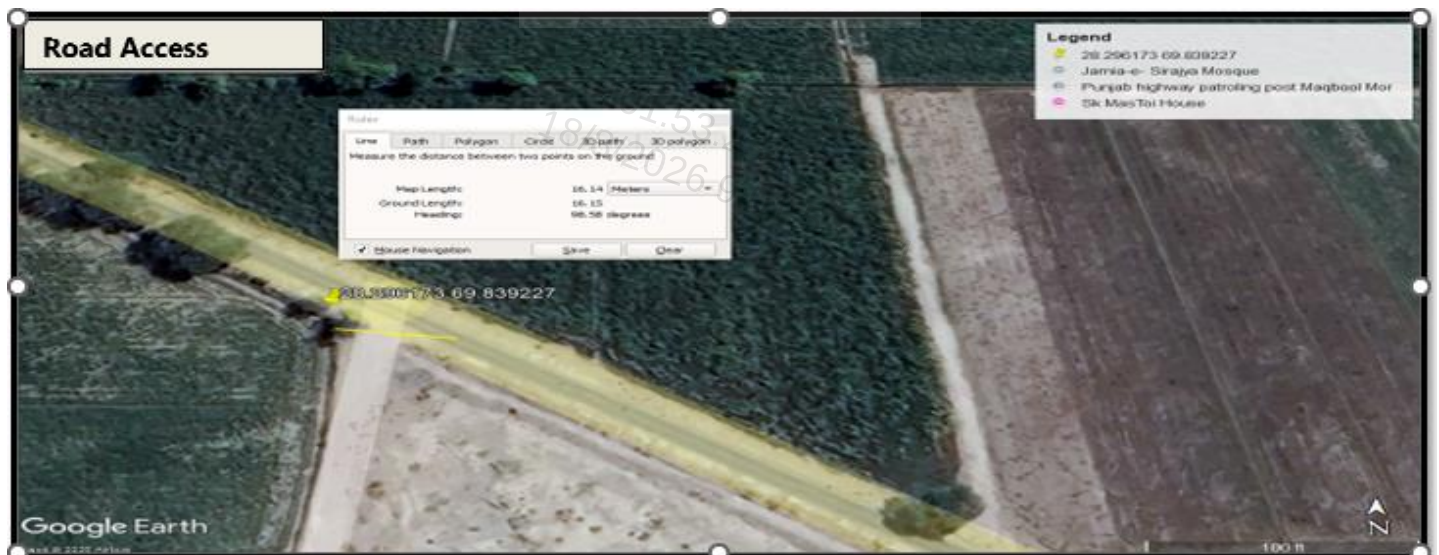


Figure 16: Nearby Road of proposed Project

7.14 LAB REPORTS OF ENVIRONMENTAL ANALYSIS

Solution Environmental & Analytical Laboratory (SEAL) was engaged to carry out environmental monitoring of ambient air quality, ground water quality and noise level in the project area. Laboratory analysis reports of ambient air quality, ambient noise and surface water analysis results are annexed at Annex-V of this EIA Report and the detail information related to the testing results is given below:

7.15 Sampling Sites

The sampling was carried out at the project site which is identified to collect samples of water, noise and air for testing according to the testing guidelines of Punjab-EPA.

Table 11: Sampling Sites Details

Sr#	Particulars	Details
1	Parameters of Monitoring	Ambient Noise, Ambient Air and Ground Water Quality
2	Sampling Sites	01 (One)

7.16 Ambient Air Quality

In order to determine the air quality of the project area, environmental monitoring was carried out by SEAL being EPA certified Laboratory and having the requisite air sampling device and expertise for collection of samples. The primary air pollutants to be monitored are; Carbon Monoxide (CO), Oxides of Nitrogen (NO_x), Sulphur Dioxide (SO₂), Particulate Matter (PM) and Ozone (O₃).

To determine the air quality of the area ambient air monitoring was done on spot (spot sampling) and the results obtained are given below in **Table-12**.

Table 12: Ambient Air Monitoring

S. No	Parameters	Method/ Equipment Used	Unit	Results	PEQS
1.	Carbon Monoxide (CO)	40 CFR Part 50, App C (US-EPA)	mg/m ³	3.88 mg/m ³	5 mg/m ³ (8 hours)
2.	Sulfur Dioxide (SO₂)	EQSA-0197-114 (US-EPA)	µg/m ³	51.7 µg/m ³	120 µg/m ³

3.	Oxides of Nitrogen as NO & NO₂	40 CFR Part 50, App F (US-EPA)	µg/m ³	53.9 µg/m ³	40 µg/m ³
4.	Particulate Matter PM_{2.5}	40 CFR Part 50, App J (US-EPA)	µg/m ³	31.8 µg/m ³	35 µg/m ³
5.	Particulate Matter PM₁₀	40 CFR Part 50, App J (US-EPA)	µg/m ³	137.9 µg/m ³	150 µg/m ³

7.17 Noise

Noise level monitoring or measurement is a process to measure the magnitude of Noise in industries. Prolonged exposure to loud noises (75 dB over eight hours a day for years) can lead to hearing loss. Therefore, noise level should fall under the prescribed Punjab Environmental Quality Standards (PEQS). Noise level measurements had been carried out within the selected site. This analysis showed that values are much below the limit prescribed under the Punjab Environmental Quality Standards (PEQS).

Table 13: Noise Monitoring Results

Measurement Point	Limit values (PEQS)	Noise level in dB(A) Leq	Remarks
North Boundary	75dB(A)	68.2 dB(A)	Within Prescribed Limits
South Boundary	75dB(A)	67.9 dB(A)	Within Prescribed Limits
East Boundary	75dB(A)	66.5dB(A)	Within Prescribed Limits
West Boundary	75dB(A)	68.6 dB(A)	Within Prescribed Limits

Center of the Site	75dB(A)	67.4 dB(A)	Within Prescribed Limits
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7.18 Water Resource

Ground water is the principal source of municipal water supply in RYK. Ground water samples were collected from project site. Water samples were tested for physio-chemical parameters (Temperature, pH, TDS, EC, Color, Odour and Taste). The ground water was being used in the study area for domestic purposes. To check the quality of the water in the area ground water was collected and analyzed by SEAL Water quality monitoring results of project area are given below in **Table-14**.

Table 14: Groundwater Monitoring Results

	Parameters	Method	Unit	Result	PEQS
1.	pH	APHA 4500-H ⁺ B	mg/l	7.70	6.5-8.5
2.	Total Dissolved Solids (TDS)	APHA 2540 C	mg/l	430	1000
3.	Chloride	4500-APHA CI-B	mg/l	47.09	250
4.	Fluoride	APHA 4500-F- D	mg/l	0.004	1.5
5.	Taste	APHA 2120 B	Object/unobj.	Unobject.	Unobject un
6.	Odor	APHA 2120 B	Object/unobj.	Unobject.	Unobject un
7.	Colour	APHA 2120 B	TCU	0.10	15
8.	Nitrates (as NO₃-)	APHA 4500-NO ₃ - E B	mg/l	0.3	50
9.	Nitrite (as No₂-)	APHA 4500-NO ₂ - E B	mg/l	0.002	3

10.	Lead	APHA-Pb B	mg/l	BDL	0.05
11.	Total Hardness as CaCO₃	APHA 2340 C	mg/l	7.6	500
12.	Turbidity	APHA 2130 B	NTU	1.0	5
13.	Zinc	APHA 3500-Zn B	mg/l	BDL	5
14.	Aluminum	APHA 3111 D	mg/l	0.21	0.2
15.	Chromium	APHA 3500-Cr B	mg/l	0.0	0.050
16.	Cadmium	APHA 3500-Cd D	mg/l	BDL	0.01
17.	Copper	APHA 3500-Cu D	mg/l	0.0840	2
18.	Boron	APHA 4500-B C	mg/l	0.0051	0.300
19.	Barium	APHA 3111 B	mg/l	0.0046	0.700
20.	Antimony	APHA 3114 C	mg/l	0.0032	0.020
21.	Arsenic	APHA 3114 C	mg/l	0.012	0.050
22.	Cyanide	APHA 4500-CN'D	mg/l	0.0046	0.05
24.	Nickel(Ni)	APHA 3111 B	mg/l	0.0037L	0.020
25.	Residual Chlorine	APHA 4500-Cl ₂	mg/l	0.194	0.2-0.5
26.	Total Coliform	APHA 9222 B	Number/100ml	0	0/100 ml
27.	Thermo Coliform	APHA 9222 B	Number/100ml	0	0/100 ml
28.	E.coli	APHA 9222 C	Number/100ml	0	0/100 ml

PEQS = Punjab Environmental Quality Standards

BDL (Below Detection Limit)

APHA = American Public Health Association

7.19 SUITABILITY OF THE SITE

As the site is surrounded by various other industrial activities and no relocation is required for establishment of current project. The site does not fall in environmental sensitive area and all commodities are at a suitable distance from project site as they will not impact by the construction activities even locals will get more benefits and job opportunities. No replacement, relocation and rehabilitation are required for the development of above-said project.



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8 IMPACT ASSESSMENT

8.1 General

This section discusses the potential environmental impact due to JK Sugar Mills (Private) Limited-Distillery. The impacts may include; soil contamination, water resources depletion, biological resources disturbance and socio-economic impacts and, where applicable, identifies mitigation measures that will reduce significantly, if not eliminate, its adverse impact. The assessment carried out in this Section is based on potential impacts on overall environmental receptors within the project area.

8.2 Methodologies for Impact Identification

This section discusses the project's potential environmental impact of above-mentioned unit. The adverse impact may occur on; the area's geomorphology, soil, water resources, air resource, biological resources and socio-economic condition and where applicable, identifies mitigation measures that will reduce significantly, if not eliminate, its adverse impact. The assessment carried out in the sub-sections below is based on potential impacts on overall environmental receptors within the project area. Impacts are evaluated on the basis of magnitude, immediacy and sustainability.

The said project will not pose any adverse impact or threat on any component of the environment. The impact assessment criteria are given below along with their impacts:

Table 15: Impact Significance Criteria

Impact	Criteria
No Impact	When the proposed activity will have no impact
Long Term	When the impact is of high intensity with high spread and high duration or of high intensity with medium spread and medium duration
Moderate Term	When the impact is of moderate intensity with high spread and high duration or of high intensity with low/ moderate spread and low duration
Short Term	When the impact is of low intensity but with moderate spread and moderate duration or of moderate intensity
Insignificant	When the impact is of low intensity, low spread and low duration
Adverse	When the impact is of large intensity, spread easily and long-term
Beneficial	When the impacts are positive and improve the environmental conditions

Table 16: Impact Matrix Checklist for Designing Phase

Design / Planning Activity	Air Quality	Water Resources	Soil / Land	Noise	Waste Generation	Energy / Resources	Socio-economic
Site selection & land acquisition (454 Kanals 18 Marlas)	Low	Low	Medium (land conversion)	Low	Low	Low	Medium (land use change, employment potential)
Process design (230 KLPD distillery)	Medium (future boiler emissions considered)	Medium (effluent load design for ZLD)	Low	Low	Low	High (efficiency optimization)	High (industrial development)
Vinasse-based boiler design (6 MW system)	High (stack emissions considered in design)	Low	Low	Medium	Low	High (energy recovery system)	High (surplus power 2 MW export potential)

ZLD system design (evaporation + recycling)	Low	High (critical water balance planning)	Low	Low	Medium (brine/sludge design)	High (water reuse efficiency)	Medium
Silo & dust control system design	High (dust control engineering required)	Low	Low	Low	Medium	Medium	Medium
Chemical storage & handling design (acids/caustic/CIP)	Medium	High (spill prevention design)	Medium	Low	Medium	Medium	High (safety compliance)
Fermentation unit design (CO₂ management)	Medium (CO ₂ emission control planning)	Low	Low	Low	Low	Medium	Medium
Utilities design (boiler, cooling)	Medium	Medium	Low	Medium	Low	High	High

towers, compressors)							
Stormwater & drainage system design	Low	Medium (runoff control)	High (erosion prevention)	Low	Low	Medium	Medium
Waste management system design (solid waste/ash/sludge)	Low	Low	Medium	Low	High (waste handling planning)	Medium	High
Greenbelt & landscaping design	Low	Medium (water requirement)	High (soil stabilization)	Low	Low	Medium	High (aesthetic & buffer)

Low impact → minor/no design concern

Medium impact → requires mitigation in design stage

High impact → critical design consideration (must be engineered in system)

Table 17: Impact Matrix Checklist for Construction Phase

Construction Activity	Air Quality	Water Resources	Soil / Land	Noise	Waste Generation	Traffic / Transport	Health & Safety
Site clearance, excavation & grading (454 Kanals 18 Marlas)	Medium (dust generation)	Low	High (soil disturbance, erosion)	Low	Low	Low	Medium
Foundation & civil works (buildings, tanks, boiler house)	Medium (cement dust)	Low	Medium	High (machine noise)	Medium (construction debris)	Low	High
Construction of vinasse boiler & power house (6 MW system)	Medium	Low	Low	High	Low	Low	High (heavy equipment risk)
Erection of silos (dust control)	High (fugitive dust risk)	Low	Low	Medium	Medium	Low	High

system – 60 TPD handling)	during installation)						
Installation of ZLD system (evaporators, condensers, pipelines)	Low	High (risk of spills during installation)	Low	Low	Medium	Low	High (chemical/mechanical hazard)
Chemical storage tanks installation (acids/caustic/CIP)	Low	High (spill risk)	Medium	Low	Medium	Low	High
Machinery installation (fermentation, distillation units)	Low	Low	Low	Medium	Low	Low	High
Transportation of materials & equipment	Medium (vehicular	Low	Low	Medium	Low	High (traffic load)	Medium

	emissions)						
Construction workforce camp setup	Low	Medium (domestic wastewater)	Medium	Low	Medium	Low	Medium
Welding, cutting & hot works	Medium (fumes)	Low	Low	High	Medium	Low	High (fire risk)
Fuel storage & handling (diesel, lubricants)	Medium	Medium (spill risk)	Medium	Low	Medium	Medium	High
Landscaping & greenbelt development	Low	Medium (water use)	High (soil improvement)	Low	Low	Low	Low

Level Meaning

Low Minor, easily manageable impact

Medium Moderate impact requiring mitigation

High Significant impact requiring strict control measures

Table 18: Impact Matrix Checklist for Operational Phase

Operational Activity	Air Quality	Water Resources	Soil / Land	Noise	Waste Generation	Energy / Resources	Occupational Health & Safety
Fermentation process (ethanol production)	Medium (CO ₂ release)	Low	Low	Low	Low	High (process efficiency)	Medium (CO ₂ exposure risk)
Vinasse boiler operation (6 MW energy generation)	High (stack emissions)	Low	Low	Medium	Low	High (energy generation)	High (burn/pressure risk)
Power generation & internal consumption (4 MW use)	Medium	Low	Low	Medium	Low	High (self-sufficiency)	Medium
Surplus power export (2	Low	Low	Low	Low	Low	High (energy	Low

MW to grid/SEZ use)						recovery benefit)	
ZLD system operation (evaporation , condensate reuse)	Low	High (water recycling)	Low	Medium	Medium (sludge/brine)	High (water efficiency)	High (chemical exposure risk)
Silos & dust collection system (60 TPD handling)	Low (controlled emissions 85-90% efficiency)	Low	Low	Low	Medium	Medium	Medium
Chemical handling (acids, caustic, CIP systems)	Low	High (spill risk if mishandled)	Medium	Low	Medium	Medium	High (chemical burns risk)
ETP/ZLD sludge handling	Low	Medium	Medium	Low	High	Medium	Medium

Boiler maintenance & ash handling	Medium	Low	Medium	Medium	High (ash generation)	Medium	High (heat exposure)
Storage & logistics (raw materials, ethanol product)	Medium (vehicle emissions)	Low	Low	Medium	Low	Medium	Medium
Cooling towers & utilities operation	Medium (water vapor/chemicals)	Medium (water demand)	Low	Medium	Low	High	Medium
Greenbelt & landscaping maintenance	Low	Medium	High (positive impact)	Low	Low	Medium	Low

Level Meaning

Low Negligible impact, routine monitoring

Medium Manageable with standard controls

High Requires strict mitigation and continuous monitoring

Table 19: LEOPOLD MATRIX – DISTILLERY PROJECT (OPERATION PHASE)

Environmental Component	Project Activity	Severity (S)	Probability (P)	Significance (S×P)	Impact Interpretation
Air Quality	Vinasse boiler operation (6 MW)	9	8	72	High
Air Quality	Fermentation CO ₂ emissions	5	7	35	Medium
Air Quality	Material handling (silos 60 TPD)	6	6	36	Medium
Water Resources	ZLD system operation (evaporation, reuse)	4	6	24	Medium
Water Resources	Chemical handling/spills	7	4	28	Medium
Soil / Land	Ash disposal from boiler	6	5	30	Medium
Soil / Land	Sludge from ZLD/ETP	6	5	30	Medium
Noise Environment	Boiler & turbine operation	5	7	35	Medium
Noise Environment	Material transport & logistics	6	6	36	Medium
Solid Waste	Boiler ash generation	6	7	42	Medium-High
Solid Waste	Chemical containers, maintenance waste	5	6	30	Medium
Energy / Resources	6 MW vinasse energy generation	8	9	72	Positive Impact (High Benefit)
Energy / Resources	4 MW internal use efficiency	7	9	63	Positive Impact

Energy / Resources	2 MW surplus export	7	8	56	Positive Impact
Occupational Health & Safety	Chemical handling (acids/caustic)	8	6	48	High
Occupational Health & Safety	Confined spaces (tanks/reactors)	10	5	50	High
Occupational Health & Safety	Working at height (silos/stacks)	9	6	54	High
Occupational Health & Safety	Electrical maintenance	9	5	45	High

Score Range Impact Level

1-20	Low
21-40	Medium
41-60	High
61-80	Very High / Critical



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Table 20: RESIDUAL IMPACT MATRIX – OPERATION PHASE (AFTER MITIGATION)

Environmental Component	Project Activity	Residual Severity (S)	Residual Probability (P)	Significance (S×P)	Residual Impact Level
Air Quality	Vinasse boiler (6 MW) with APC system	5	4	20	Low-Medium
Air Quality	Fermentation CO ₂ emissions	3	5	15	Low
Air Quality	Silo dust control (85-90% efficiency)	2	3	6	Low
Water Resources	ZLD system (closed-loop reuse)	2	2	4	Low
Water Resources	Chemical handling (bunds, SOPs)	3	2	6	Low
Soil / Land	Boiler ash disposal (controlled reuse/disposal)	3	3	9	Low
Soil / Land	ZLD sludge handling (managed disposal)	3	3	9	Low
Noise Environment	Boiler, turbines, compressors	3	4	12	Low
Noise Environment	Transport & logistics	3	4	12	Low
Solid Waste	Ash, sludge, packaging waste (managed system)	3	4	12	Low
Energy / Resources	Upto 6 MW vinasse	-8	9	-72	Strong

	energy recovery system				Positive Impact
Energy / Resources	4.3 MW internal consumption efficiency	-7	9	-63	Positive Impact
Occupational Health & Safety	Confined space entry (PTW, gas monitoring)	4	2	8	Low
Occupational Health & Safety	Chemical handling (PPE, SOPs, automation)	4	3	12	Low
Occupational Health & Safety	Working at height (fall protection systems)	4	3	12	Low
Occupational Health & Safety	Electrical maintenance (LOTO system)	3	3	9	Low

Energy Recovery System

- Upto 6 MW total vinasse-based renewable power
- 4.3 MW internal use (self-sufficiency)

Environmental Controls

- Zero Liquid Discharge (ZLD)
- Dust control efficiency 85-90%
- Controlled chemical handling
- Managed solid waste system

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Table 21: HIRA Matrix with Risk Classification (Distillery Project)

Activity	Hazard Type	Hazard Description	Initial Risk (1–10)	Risk Level	Existing Controls	Residual Risk (1–10)	Responsible Person	Additional Controls Required
Boiler Operation (Vinasse Boiler – 6 MW)	Physical / Thermal / Pressure	Explosion risk, steam burns, high temperature flue gas exposure	9	High	Safety valves, trained operators, instrumentation & alarms, PPE	4	Boiler Engineer / HSE Officer	Periodic boiler inspection, emergency shutdown drills, stack emission monitoring
Chemical Handling (Acids / Caustic for CIP & ZLD)	Chemical	Skin burns, inhalation exposure, accidental spills	8	High	MSDS available, PPE (gloves, goggles), chemical storage tanks, dosing pumps	3	Chemical Engineer / HSE Supervisor	Eyewash & safety showers, secondary containment bunds, automated dosing system
Fermentation Process	Biological / Physical	CO ₂ accumulation causing asphyxiation in enclosed areas	7	High	Ventilation system, gas monitoring, PPE, controlled	3	Fermentation Supervisor	Continuous CO ₂ monitoring alarms,

					access			entry restriction signage
Confined Space Entry (Tanks, pits, reactors)	Asphyxiation / Physical	Oxygen deficiency, toxic gas exposure, entrapment	10	Extreme	Permit-to-work system, gas testing, standby rescue team, ventilation	3	HSE Manager	Rescue tripod, continuous gas monitoring, confined space certification training
Working at Height (Silos, stacks, platforms)	Physical	Fall from height during inspection/maintenance	9	High	Safety harness, guard rails, scaffolding inspection, PPE	4	Maintenance Supervisor	Fall arrest systems, ladder safety audits, toolbox talks
Electrical Maintenance	Physical / Arc flash	Electric shock, arc flash, equipment failure	9	High	LOTO system, insulated tools, trained electricians, PPE	3	Electrical Engineer	Arc flash study, periodic insulation testing, emergency response drills

Risk Score Category

1-3	Low
4-6	Medium
7-8	High
9-10	Extreme



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8.3 Identification of Monitoring Requirements

The last step in the assessment process is the identification of minimum monitoring requirements. The scope and frequency of monitoring depend on the residual impacts. The purpose of monitoring is to confirm that the impact is within the prescribed limits and to provide timely information if acceptable limits are being breached.

8.4 Methodology for Impact Evaluation

Refers to the systematic approach used to identify, predict, and assess the significance of environmental impacts of a project using tools like checklists, matrices, and scoring systems (e.g., Leopold Matrix with severity $\times$ probability).

a. Impact Screening Checklist

The impact screening checklist is developed to screen out potentially insignificant environmental and social impacts from potentially significant adverse environmental and social impacts during planning & designing, demolition, construction and operational phases of the project. The objective of impact screening process is to assess the significance of issues related to the air, water, noise, soil, transportation, civil work, communication, the hazards and external constraints. The beneficial and adverse impacts of project during planning & designing, construction and operational phases are identified based on their duration, location, frequency, extent, significance and reversibility. The impact of each activity on various environmental parameters is given below:

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Table 22: Impact Checklist

Environmental Aspect	Phase	Impact Present (✓/✗/Δ)	Key Remarks / Control Measures
Air emissions (boiler, CO₂ from fermentation, silo dust)	Operation	✓	Controlled via APC systems, dust control efficiency 85-90%, stack monitoring
Air emissions (construction dust & machinery)	Construction	✓	Temporary dust controlled through water sprinkling and covered transport
Water consumption	Operation	✓	High demand, minimized through ZLD recycling and condensate reuse
Wastewater generation	Operation	✓	No discharge due to ZLD system (closed-loop reuse)
Surface runoff / drainage changes	Construction	✓	Managed through proper stormwater drainage design
Soil contamination risk	Operation	✓	Controlled chemical storage, bunding, sludge management
Noise pollution	Construction / Operation	✓	Controlled through equipment maintenance and acoustic enclosures
Vegetation loss / land use change (454 Kanals 18 Marlas)	Construction	✓	SEZ-based planned development, compensated through greenbelt
Habitat disturbance	Construction	✓	Localized impact, non-sensitive ecological area
Greenbelt development	Operation	✓	Positive impact, improves air quality and buffer zones
Solid waste (ash, sludge, packaging waste)	Operation	✓	Reuse in brick/cement industry or authorized disposal
Hazardous waste (chemicals, oil, filters)	Operation	✓	Stored safely and disposed via licensed handlers
Construction debris	Construction	✓	Reused or disposed through approved waste management
Energy consumption	Operation	✓	Offset by vinasse-based energy recovery system
Renewable energy generation (6 MW system)	Operation	✓	4 MW internal use + 2 MW surplus export (positive impact)
Raw material usage (molasses/feedstock)	Operation	✓	Efficient utilization under controlled supply chain
Employment generation	Construction / Operation	✓	Positive socio-economic impact
Local economic development	Operation	✓	SEZ industrial growth and value addition
Traffic increase	Construction / Operation	✓	Managed through logistics planning and routing

Occupational health & safety risks	All phases	✓	Controlled via PPE, SOPs, PTW system, training
Confined space / chemical / boiler hazards	Operation	✓	High-risk areas managed through engineered safety systems

Overall Screening Conclusion:

- ✓ The project shows multiple environmental aspects with potential impacts
- ✓ However, all impacts are technically manageable through design and mitigation
- ✓ No unmitigated critical or irreversible environmental impacts identified
- ✓ Strong positive impacts due to ZLD system and 6 MW vinasse-based energy recovery
- ✓ Project is environmentally acceptable under EMP implementation



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9 SCREENING OF POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

9.1 General

This Chapter identifies the potential impacts (positive and adverse) on the physical, biological and socio-economic environment of project area due to JK Sugar Mills (Private) Limited-Distillery. It also identifies measures that will help to mitigate the adverse environmental and social impacts as well as it will enhance positive impacts of aforesaid project. Impacts are assessed by analyzing their magnitude and sensitivity, which is a legal requirement as discussed in previous Chapter.

9.2 Impact and Mitigation Management

Purpose of mitigation is to evade, reduce or balance the expected antagonistic effects in suitable way and to integrate these for devising environmental management strategy or plan. At every stage of project, mitigation plan for all the adverse impacts should be predicted to find out the best alternative. The objectives of mitigation are to:

- Invent of best substitution, better alternatives and ways to reduce the adverse environmental and social impacts in immediate surroundings.
- To improve the environmental and societal payback of project.
- To prevaricate, remedy/reduce and pro-vocative impacts.
- To certify that remaining negative influences are kept within permissible limits.

In this part of the EIA Report, a number of complications including; cleanliness, environmental health and safety, societal and environmental managing and inspection, industrial vulnerability, tools and apparatuses and during operational activities, influx of workers and procurement of land have been deeply elaborated.

9.3 Approaches for Mitigation Measures

Following approaches may be used to mitigate the impacts of the project:

Table 23: Approaches for Mitigation Measures

Avoid: Change of route or site details, to avoid damage important ecological or archaeological features.

Replace: Regenerate similar habitat of equivalent ecological value in different location.

Reduce: Noise barriers, dust, enclosures, visual screening, wildlife and changed time of activities to reduce the impact.

Restore: Site restoration at the end of the operational activities.

Compensate: Relocation of displaced communities, facilities for the affected community financial compensation for the affected individuals, etc.

9.4 Expected Positive Impacts

Following is the expected outcome for construction of above stated project:

a) Socio-Economic Development

The project will create substantial employment opportunities during both construction and operational phases. Direct employment will be generated for skilled, semi-skilled, and unskilled labor, while indirect employment will arise in transportation, logistics, maintenance, and allied services. The establishment of the distillery within privately purpose build industrial estate will also stimulate local business growth, service industries, and ancillary industrial development, thereby strengthening the regional economy. Additionally, improved industrial activity will enhance income levels and contribute to overall socio-economic uplift of the surrounding communities.

9.5 Renewable Energy Generation and Energy Efficiency

A key positive impact of the project is the generation of upto **6 MW of renewable energy from vinasse combustion**, a by-product of the distillation process. Out of this, around **4.3 MW will be utilized for internal plant operations**, ensuring a high level of energy self-sufficiency. This significantly reduces dependence on fossil fuels and grid electricity, contributing to **clean energy production and reduced carbon footprint**.

9.6 Resource Recovery and Circular Economy

The project promotes a **circular economy approach** by converting vinasse, a high-strength waste stream, into a valuable energy resource. This not only minimizes waste generation but also enhances overall resource efficiency. The reuse of process water through the **ZLD system** further ensures conservation of freshwater resources and reduces environmental burden. Such integration of waste-to-energy and water recycling systems represents a major advancement in sustainable industrial design

9.7 Environmental Protection and Pollution Reduction

The implementation of a **Zero Liquid Discharge (ZLD) system** ensures that no untreated wastewater is released into the environment, thereby protecting surface water and groundwater resources. In addition, installation of **high-efficiency dust control systems (85–90% removal efficiency)** and air pollution control equipment on the vinasse boiler will significantly reduce particulate emissions. These measures collectively contribute to improved **ambient air quality, water conservation, and soil protection** in and around the project area.

9.8 Industrial Growth and SEZ Development

The establishment of the distillery within privately purpose build industrial estate will strengthen the industrial base. The generation of energy upto 4.3MW can support future power requirement.

9.9 Infrastructure and Technological Advancement

The project introduces modern distillation technology, vinasse-based energy recovery systems, and advanced effluent treatment systems, promoting technological advancement in the industrial sector. It will also contribute to improved infrastructure development, including roads, utilities, and supporting services within the privately purpose build industrial estate.

b) Adverse Impacts and Mitigation Measures

This section identifies the potentially significant and in-significant adverse environmental and social impacts anticipated during the operation phase of said unit. Appropriate mitigation and management measures, where applicable, have also been suggested to reduce the severity of anticipated impact up to the extent possible.

9.10 Impacts and Mitigations due to Project Location

During planning and designing phase most of the associated impacts will be associated with the selection of appropriate location and design that would have minimal impact on the environment and society. It will include:

i. Impacts of Location

The project is privately purpose build industrial estate which will involve conversion of existing land into a planned industrial estate, resulting in permanent land use change. As the area will be systematically zoned for industrial purposes, potential impacts on sensitive ecological or residential receptors will be minimized through structured land-use planning. The availability of planned internal infrastructure will support efficient provision of roads, utilities, and services, thereby reducing unplanned environmental stress. Overall, the selected location facilitates organized industrial development with controllable and site-specific environmental impacts.

ii. Nature of Impact

The nature of proposed impact will be direct, low, short-term and hence in-significant.

iii. Mitigation Measures

Following mitigation measures has been adopted to reduce the impact of said project location on sensitive receptors:

- The selected site located at adequate distance from the various sensitive receptors.
- The selected site is located Chak No. 36-B/NP, Mahi Chowk Road (10 KM off KLP Road), Sadiqabad, District Rahim Yar Khan, Punjab and due to establishment of aforesaid project no change in the land use of area is being envisaged.
- The site is owned by the proponent and no dispute is associated.
- Proper site grading and leveling will be carried out to minimize soil erosion and land degradation during construction.
- Topsoil will be conserved separately and reused for greenbelt development and landscaping within the project area.
- Movement of heavy machinery will be restricted to designated routes to prevent unnecessary compaction and disturbance of soil.

- A comprehensive solid waste management plan will be implemented to ensure safe disposal and prevent land contamination.

9.11 Impacts and Mitigations due to Design

The design phase of the proposed **Distillery (230 KLPD) incorporating vinasse boiler technology and Zero Liquid Discharge (ZLD) system** has been optimized using **best available technologies (BAT)** to prevent or minimize potential environmental impacts while ensuring efficient operational and environmental performance. During the pre-construction and design stage, an integrated environmental management approach has been incorporated to reduce impacts at source through engineering controls and system design improvements. The project design complies with all applicable technical standards, environmental regulations, and legal requirements to safeguard socio-environmental conditions and human health. Efficient and well-planned infrastructure will be developed within privately purpose build industrial estate and procurement of construction materials will be ensured from approved and certified suppliers. The proposed distillery will utilize **state-of-the-art closed-loop process technology**, ensuring minimal emissions and maximum resource recovery. This technology has been selected due to its ability to support **ZLD operation, vinasse-based energy recovery, high process efficiency, and reduced environmental footprint**, thereby making the project environmentally sustainable and compliant with modern industrial standards.

- The process will be carried out ensuring minimal to no process emissions from the proposed distillery plant.
- The emergency response system will be semi-automated and integrated with computerized controls, linked with smoke and safety alarm systems for rapid detection and response.
- The selected technology will ensure high-quality product output through efficient and controlled process operations.
- Domestic wastewater will be treated through an appropriate Wastewater Treatment

System prior to disposal and may be reused for irrigation of nearby green areas where feasible.

- The proponent aims to minimize environmental and social impacts to the maximum practicable extent by implementing Standard Operating Procedures (SOPs), Emergency Response Plan (ERP), and Firefighting Plan throughout all project phases.

9.12 Impacts and Mitigation during Construction Phase

Project construction phase will be 02 year whose activities will affect land environment, water, air, noise level, soil quality, socio-economic trend of area, etc. These impacts had been controlled effectively by adopting best management practices.

By the implementation of said project, a positive impact on the socio-economic culture for the people has been observed. The chance for local employment, fabrication, brick masonry, painting and machinery erection works had been increased.

The construction phase of aforesaid project will include activities associated with the site leveling, construction of civil structures, architectural works and building services. The construction phase would bring in immediate but short-term changes on various components of environment near the project site. This section explains how aforesaid project will affect different environmental aspects and its mitigation measures to manage the impact. The impacts during construction phase will be temporary and localized. Even though, the measures proposed to minimize such impacts.

i. Impacts of Dust and Exhaust Emissions

Air quality is expected to deteriorate locally mainly due to fugitive dust emission and exhaust gaseous emission from vehicular movement. This will cause short-term but moderate impacts on local environment. Soil erosion may occur in small area and they will be prone to wind erosion. Air pollutants such as; NO_x, SO_x and CO emissions may be generated from the working of construction machinery on-site which includes; hauling vehicles, loaders, trucks, mixers, etc. This machinery will generate smoke and other potential pollutants in air. This impact is considered to be negative of minor magnitude. The effect due to construction is however, of temporary nature and will have no permanent impact on environment.

ii. Nature of Impact

The nature of proposed impact will be direct, medium, short-term and hence significant.

iii. Mitigation

- Dust control measures are need to be taken to control the same; as the area is located in semi- arid zone having dry soil conditions and it is vulnerable to spread during high winds. Following mitigation measures will be adopted to mitigate the anticipated impact:
- Ensure that trucks carrying the raw-material should be covered by tarpaulin to reduce fugitive dust emissions.
- Water spraying/sprinkling should be done on regular basis.
- Ensure that all equipment and vehicles, used during the construction phase, are properly tuned and maintained in good working condition, in order to minimize the exhaust emissions and it will be regulated by concerned authority.
- Ensure that high quality fuel having low sulfur contents will be used in the vehicles engaged in the construction activity.
- Ensure that dust emission generated due to vehicular movement is minimized by restricted speed limit and vehicular movement impacts which will be minimized through good traffic management at site.
- Ensure that dust emission during the construction phase will be minimized by implementing best management practices.

9.13 Soil Erosion and Contamination

During constructional activities the chances of soil erosion and contamination may be increased. Soil erosion from construction activities will deteriorate the soil quality. There are low chances of land contamination due to release/spill of lubricants, oil and other materials during the construction period. Erosion may also result from movement of heavy vehicle such as; bulldozers, excavators, trucks and pick-ups. The impact will be short term, localized and can be controlled through immediate appropriate management and mitigation measures. This impact is considered negative of minor magnitude. Hence, the impact is in-significant.

i. Nature of Impact

The nature of proposed impact will be direct, medium, short-term and hence significant.

ii. Mitigation

Following mitigation measures will be adopted to protect the soil from erosion and contamination:

- iii. During construction phase no tree removal is involved however, tree plantation will be done after completion of construction at designated green areas.
- iv. Native and fast-growing trees will be planted in the designated green areas.
- v. Spill prevention and response plan for storage, usage and transfer of fuel should be prepared (if used on site) and implemented.
- vi. Workers should be trained on spill prevention and response plan.
- vii. Maintenance and washing of vehicles as well as equipment will be carried out at designated areas within the facility.
- viii. Any hard surface or tarpaulin should be spread on area to prevent soil contamination.
- ix. Regular inspections should be carried out to detect leakages in construction vehicles and equipment.
- x. Machinery involved should be maintained properly to avoid leakages.

9.14 Socioeconomic Impacts

In project area, no significant changes are envisaged in traditional life style and occupation of local people residing in the nearby communities. The local people are rather benefited due to the provision of job opportunities. No impact is envisaged due to influx of workers as local will be preferred and hired for working. Moreover, health and safety related issues may arise during the construction activities. These impacts are in-significant can be further reduced significantly by adopting best management practices.

i. Nature of Impact

The nature of proposed impact will be direct, low, short-term and hence in-significant.

ii. Mitigation Measures

Following mitigation measures will be adopted to reduce the socio-economic impact on the community:

- Good relations with local communities will be promoted by encouraging Contractor to provide opportunities for skilled and un-skilled employment to the locals as well as on-job training.
- The contractor should prefer hiring local labor from adjacent community
- The contractor will keep the copy of National Identity Card (CNIC) of his employees and will warn the workers not to involve in any anti-social activities
- At the time of hiring the Contractor has to ensure that workers should be of good repute.
- First aid kits will be available at site.
- Training of workers should be carried out for operating various constructional machinery, safety procedures should be adopted, environmental awareness should be carried out, equip all workers with safety boots, helmets, gloves, protective masks and monitoring of their proper and sustained usage will be carried out. In case of accidents, contractor will provide free medical treatment to the community.
- The Contractor will be responsible for sensitivity towards the local customs and traditions.

9.15 Impacts & Mitigation during Operational Phase

This section delineates the potential impacts during operation phase of the project and the mitigation measures to counteract these impacts. The summary of the impacts and possible mitigation measures are as follows:

i. Impact on Ecology

The site will be used for industrial activities. After the completion of said project different native and ornamental plants species will be planted at designated green spaces and along boundary of project site. The overall aesthetic beauty of the area has been enhanced and it will have a significant impact on the overall ecology, aesthetic and landscape of the area.

ii. Nature of Impact

The nature of proposed impact will be direct, low, short-term and hence in-significant.

iii. Mitigation Measures

This impact is considered to be positive, long-term and significant. Hence, it doesn't require any mitigation measure.

9.16 Impact on Air Environment

The proposed distillery project may result in impacts on air quality due to emissions from the vinasse-fired boiler, CO₂ release during fermentation, and fugitive dust generated from raw material handling and silo operations. However, these impacts will be effectively controlled through a closed process system, installation of high-efficiency air pollution control silos achieving 85-90% removal efficiency. Regular monitoring of stack emissions and ambient air quality will be carried out to ensure compliance with applicable environmental standards. Overall, the impact on the air environment is expected to remain localized and within permissible limits.

i. Nature of Impact

The nature of proposed impact will be direct, low, short-term and hence in-significant.

ii. Mitigation Measures

Following mitigation measures will be adopted:

- iii. Water sprinkling and dust suppression systems will be implemented at raw material handling areas to control fugitive dust emissions.
- iv. All vehicles used for transportation of raw materials, ethanol product, and utilities will be regularly inspected, maintained, and serviced to minimize exhaust emissions.
- v. The vinasse-fired boiler (6 MW power generation system) will be provided with suitable air pollution control arrangements to control particulate emissions in compliance with applicable environmental standards.
- vi. The diesel generator set (backup power) will be installed in an acoustically treated enclosed room to minimize air and noise impacts.
- vii. A greenbelt will be developed using native species along the project boundary, with compensatory plantation at a ratio of 1:10 for any tree cutting, to serve as a natural buffer for air quality improvement and natural carbon sequestration.

9.17 Noise Environment

Noise, an unwanted sound, affects human being. Excessive exposure to noise produces varying degree of damage to hearing system. It leads to headache, fatigue, etc. Continuous exposure

of increased level of noise will have an adverse impact on the health of workers as well as the people residing in surrounding area.

i. Nature of Impact

The nature of proposed impact will be direct, low, short-term and hence in-significant.

ii. Mitigation Measures

In general the following methods will be adopted to control the noise pollution from the above-said unit;

- iii. Residential area is located at safe distance from project site.
- iv. Proper encasement of noise generating sources will be done to control the noise levels within prescribe PEQS limits.
- v. Greenbelt will be developed all around the plant which will be acting as noise barrier.
- vi. The use of concrete and masonry walls & barriers keeping in view the benefits of stiffness weight & cavity construction & the need to provide well sealed sound attenuating doors & windows.
- vii. The use of complete or partial enclosures, as and if required.
- viii. Attenuation by use of sound absorbents on walls and fixed or suspended ceilings.
- ix. The use of mufflers, sound attenuation and acoustic louvers in air flow paths, taking particular care to direct inlet and discharge an opening away from critical areas wherever possible, so as to take advantage of direct effects.
- x. All the workers will be provided with ear plugs/ear muffs, masks, gloves and safety shoes as per job requirement.
- xi. All the transporters will be advised to carry out regular maintenance of their vehicles

9.18 Solid Waste Management

The solid waste generated from the process will mainly be Granular potash which will be used as biofertilizer in agriculture.

i. Nature of Impact

The nature of impact will be direct, low, long-term and significant.

ii. Mitigation

Following mitigations should be adopted to manage generated solid waste:

- iii. Generated Granular potash during combustion in boiler will be used as biofertilizer in agriculture.
- iv. The recyclable waste including plastic, packaging material sold out to contractor.
- v. Waste bins will be placed in the facility at the strategic position for the collection of solid waste.
- vi. The installed bins will be covered in order to reduce the chances of the disease vector production.
- vii. Regular training will be given to the workers dealing with the waste management it will include; identification, segregation and management of waste.

9.19 Water consumption and wastewater production

Water requirement will be fulfilled by taking water from Rain Harvesting, Sugar Mill & Canal (if needed).

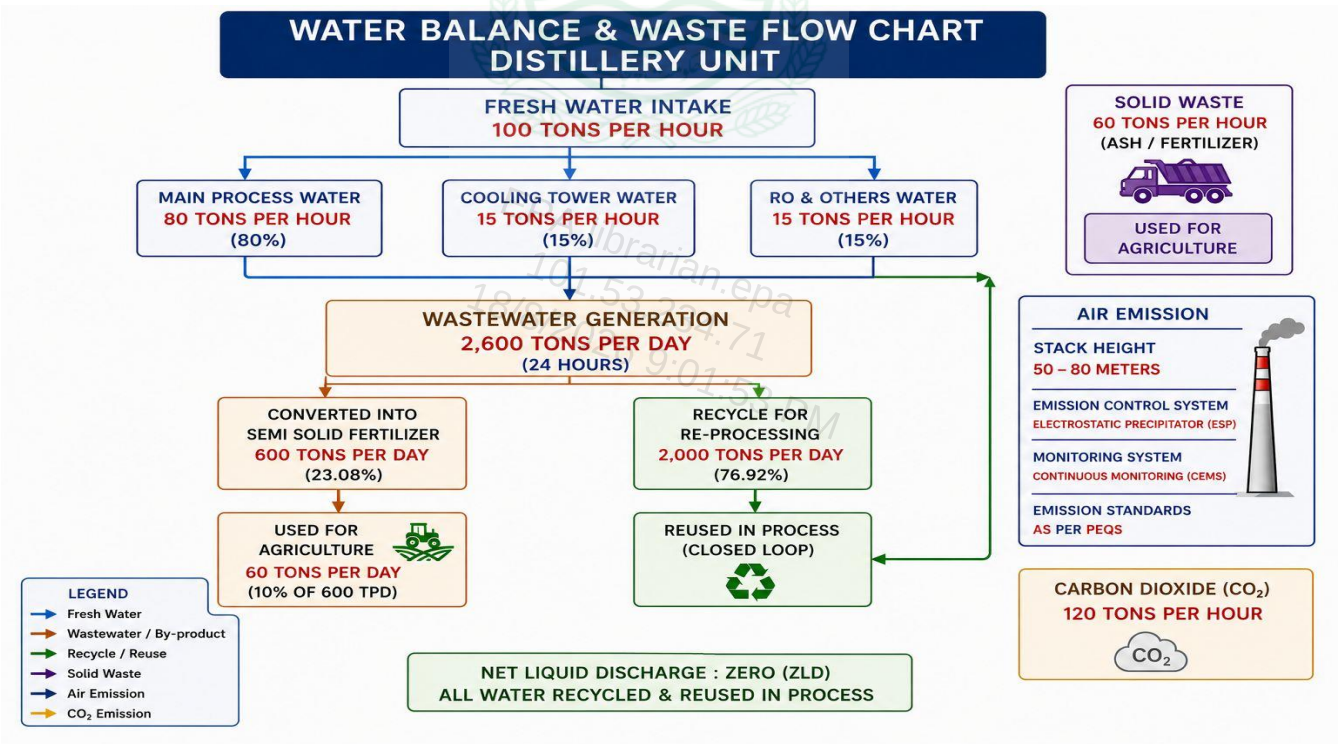


Figure 17: Water Balance

i. Nature of Impact

The nature of impact will be direct, low, long-term and significant.

ii. Mitigation

Following mitigations should be adopted to manage generated wastewater:

- iii. Water conservation activities will be adopted for the preservation of water.
- iv. Water conserving methods will be applied by placing taps and toilets.
- v. All faults will be monitored and fixed.
- vi. Freshwater conservation techniques should be adopted to ensure sustainable development
- vii. Monitoring of effluents shall be carried out as per requirement of Self-Monitoring and Reporting Tools (SMART) to ensure compliance with the PEQS.
- viii. It will be ensured that no solid waste will be entered in the wastewater.

9.20 Occupational Health and Safety

Following health and safety impacts arise during the operational phase of the above-said project:

- ix. Fermentation
- x. Slips, trips and falls on ground
- xi. Unguarded machinery
- xii. Hazards associated with the fire and explosion
- xiii. Noise and vibration
- xiv. Electrical burns and electric shock

i. Nature of Impact

The nature of proposed impact will be direct, low, long-term and hence significant.

ii. Mitigation

The following mitigation measures are suggested that could be applied to reduce the risk of health and safety:

- Spillage prevention plan should be adopted and it should be implemented effectively.
- Workers are properly trained handling machines and equipment.
- Floor surfaces shall be maintained and cleaned on regular basis.

- Floor should be kept clean and free of oil spills, other slippery fluids or materials and obstructions.
- The effective use of hearing-protection devices shall be ensured.
- Protective measures and emergency rescue procedures should be followed strictly.
- Only authorized persons shall be allowed in the processing and industrial premises.
- Unloading of raw-material and loads of final products should be controlled, supervised, slow and smooth.

9.21 Security Risks

A large number of workers will be hired including; Managers, Engineers, skilled and un-skilled laborers. The increase in number of individuals residing in area, may lead to an increase in crime and violence in surrounding areas. The nature of impact is considered to be low as the locals will be preferred for hiring.

i. Nature of Impact

The nature of proposed impact will be direct, low, long-term and hence significant.

ii. Mitigation Measures

Following mitigation measures will be adopted:

- Proper security will be provided to the workers working in the premises of proposed project.
- CNIC of all the workers will be kept by the proponent.
- Security to the workers at site should be provided.

9.22 Emergency Response

Emergency response preparedness committee will be formulated consisted of heads of all the departments. Emergency Response Leader will be the head of the team assisted by safety team and safety supervisors. Emergency Response Leader along with his team will ensure that in the case of emergency, team is prepared for fire-fighting and the first aid kits will be provided which may include; blankets, hot water bottles, stretchers, benches, sterilized dressing, snake bite kit, cotton and iodine (2% alcohol). Incidents and accidents may take place unexpectedly during project operations no matter how effective, strong and efficient the mitigation measures for all adverse impacts; especially the safety issues may be adopted. These may include; accident and natural disasters.

i. Nature of Impact

The nature of the proposed impact will be direct, low, long-term and hence significant.

ii. Mitigation

Following mitigation measure will be adopted:

- a. Site in-charge should be responsible to ensure that fire-fighting plan has been implemented with true spirit.
- b. Safety team will be responsible to monitor the activities and to act on approved firefighting plan in the case of fire.
- c. Workers should be given adequate training of handling machinery.
- d. Emergency call service must be made available.
- e. The drills to check the response of the workers against any emergency situation will be carried out on the regular basis.
- f. Safety and hazards signs will be displayed with the facility to avoid any unfortunate incident.
- g. Only authorized persons will be allowed in factory premises.

9.23 Socioeconomic Impact

It is envisaged that adverse impacts associated with the said project includes; local community will be disturbed due to increase in the traffic load (i.e., vehicles carrying raw material and final products), wastewater management, soil pollution, etc. The intensity of impacts occurred due to the establishment of aforesaid project will be quite low. The commencement of aforesaid project will have a beneficial impact on the surrounding community such as; increase in employment opportunity, increase in wages of the local area employees, increase in revenue generation, provision of social welfare funds of employees and appreciation of land value.

i. Nature of Impact

The aforesaid impact is considered to be positive and will have a direct, medium, long term and significant impact.

ii. Mitigation Measure

No mitigation measures will be required.

9.24 Health & Safety of Workers

Improper handling of machinery and unskilled labor may cause various health issues such as; work place incident and physical hazards, etc. To ensure the safety of workers these impacts need to be managed effectively.

i. Nature of Impact

The nature of impact will be direct, low, long-term and significant.

ii. Mitigation

Following mitigations should be adopted to improve the health and safety:

- a. Regular inspection and maintenance of the plant will be carried out to eliminate the risk and associated hazards of any unfortunate incident.
- b. Workers will be trained on the regular basis regarding personal safety, disaster management physical and chemical hazards.
- c. Operators operating the plant should be fully trained and equipped.
- d. Training regarding HSE should be given on the regular basis.
- e. Workers will be given PPEs such as; helmets, mask, ear-plugs/muffs, safety boots, etc.
- f. It should be strictly enforced to wear PPEs while working.
- g. Incidents should be reported directly to the concerned authority.
- h. Floor surfaces shall be maintained and cleaned on regular basis.
- i. Floor should be kept clean and free of oil spills, other slippery fluids or materials and obstructions.
- j. The effective use of hearing-protection devices shall be ensured.
- k. Protective measures and emergency rescue procedures should be followed strictly.
- l. Only authorized persons shall be allowed in the processing and industrial premises.
- m. Unloading of the raw-material and loads of the final products should be controlled, supervised, slow and smooth.

9.25 Potential Environmental Enhancement Measures

The said project will result in following benefits:

- Direct and indirect employment opportunities,
- Gains in the local and national economy,
- Industrial development in region
- Tree plantation

Tree plantation along boundary of project will act as environmental enhancement measure.

Indigenous and ornamental tree species will be grown on all open spaces and along boundary of project.

The environmental budget allocated for tree plantation, management & disposal of solid waste and wastewater and Environmental monitoring is approximately **PKR 2million** approx.



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10 ENVIRONMENTAL MANAGEMENT AND MONITORING PROGRAM

10.1 General

This EIA Report provides the Environmental Management and Monitoring Plan (EMMP) for implementation of aforesaid project in order to keep anticipated environmental and social impacts in check by adopting suggested mitigation measures and monitoring of the certain parameters moreover, to ensure the compliance of EMMP. As per the environmental legislation in Pakistan, the EMMP for the operations phase, along with other documents, is to be submitted in EPA, Punjab to obtain confirmation for compliance and Environmental Approval/NOC for project execution. Even after implementation of the suggested mitigation measures, the impact may remain significant and require regular environmental monitoring. This section also underlines the monitoring framework for operation phase to check compliance of EMMP and to take timely actions for correction in case any negligence & accident of significant criteria, requirements or goals is found.

10.2 Objectives of Environmental Management Program

The primary objectives of the EMP are to:

- Facilitate the implementation of the mitigation measures identified in this EIA Study.
- Define the responsibilities of the project proponent and contractor and provide a means of effective communication of environmental issues between them.
- Identify monitoring parameters in order to ensure the effectiveness of the mitigation measures.
- Provide a mechanism for taking timely action in the face of unanticipated environmental situations.
- Identify training requirements at various levels.

10.3 Components of EMMP

Components of EMP are as follows

- Management plan
- Monitoring Plan
- Communication and documentation
- Institutional capacity
- Environmental training

10.4 Proposed Mitigation actions

It lists all the mitigation measures identified in the EIA and the associated environmental or social aspect in line during construction and operational phase with the administrative framework involving all the responsible implementing authorities who are required to take the planned actions/measures and monitor it accordingly. It enhances project benefits by reducing its impacts and making it environment friendly.

Table 24: Environmental Management Plan

Project Activities	Type of Impact	Potential Imp On Environment	Mitigation Measure	Institutional Responsibility	
				Implementing Body	Supervision
CONSTRUCTION PHASE/Operational Phase					
Civil works	Physical, Social, Biological Aesthetical	Soil Erosion, Emissions, Water Contamination, Noise & Vibration, Wildlife affected, Employment, Health & Safety o Workers	- Record keeping and timely transfer of SW from bins to the disposal site for ultimate management and disposal - Dust emission from soil piles and aggregate storage stockpiles will be reduced by keeping the material moist by sprinkling of water at appropriate frequency - Covering the pile, for example with tarpaulin or thick plastic sheets, to prevent emission. - Noise control measures will be implemented - Paved roads are already there that will be used for transportation of raw material. - Camping site will be established during construction	Contractor	Proponent

Movement fueling vehicles	Physical Aesthetical	Soil &W Contamination to Fuel Leake &Spillage, Emissions, N &Vibration	- Periodic maintenance and inspection vehicles will be done - Vehicles with leaks will be operated after maintenance. - Vehicles should not be washed or serviced in the field.	Contractor	Proponent
Transportation of construct material	Bio-physical	Dust and Particular Emissions, Noise Generation Safety and Health Effects	- Excessive use of horns will be avoided - PPE's will be provided to workers - Covering of trucks carrying transport material - Night time driving of project vehicles will be limited where possible - Low speed limit will be maintained on the section of the access road that is adjacent to the community and site. - The fence surrounding the site will be put in on during the construction to - prevent access to the construction site	Contractor	Proponent
Ecological Resource	Physical, aesthetical biological	Flora & Fauna	More tree plantation will be done at designated green areas.	Project Manager	Project Manager
Wastewater management	Physical/ social	Degradation of water quality	- The project will operate on a Zero Liquid Discharge (ZLD) system, ensuring that no untreated wastewater is discharged into the surrounding environment. - Wastewater generated from process and utilities will be fully treated, recycled, and reused within the plant, significantly reducing freshwater demand. - The closed-loop water management system will promote water conservation and improved	Environmental Officer	Project Manager

			operational efficiency through maximum reuse of treated streams. +Implementation of advanced wastewater treatment will help in protecting soil and groundwater quality , ensuring compliance with environmental standards and sustainable water management		
Noise generation	Physical, soc biological	Psychological hearing problems	- There will be ban on the use of horn in the area. - Proponent has planned a proper plantation plan which will also act as barrier for noise.	Environment officer	Proponent
Solid Waste Generation	Physical, Biological, Social	Soil Contamination effecting GW Quality, vectors production odor, Health, Welfare	- Generated granular potash will be used as biofertilizer in agriculture - The solid waste from the project should not be allowed to pile up. - Solid waste should be disposed off properly as per local practice - Recyclable waste should be dispose of through certified contractor	Environmental Officer	Proponent
Health and Safety	Biological	Injury may happen while handling machine	- Personal Protective equipment's (PPE i.e. surgical masks, gloves and sanitize will be provided to the workers - Warning signs will be placed in local language. - Fire drills training has been carried to avoid hazards - Proper maintenance of machines has been carried out - First aid kits and other necessary equipment will be kept available at site - Dange larvae eradication will be done - COVID-19 SOP's must be implementation	Environmental Officer	Proponent

10.5 Schedule for Implementation of Environmental Budget

The allocated environmental budget is **PKR 2 million approx.** The allocated environmental budget will be spent on landscape/green zone management, Environmental Monitoring, solid waste management and wastewater management (Domestic). The proponent will plant indigenous and ornamental plants to increase the aesthetic value of the area. Thus, the project is also a source of employment for locals and would help in economic development activities of the area.



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10.6 Environmental Management Team along with their roles and responsibilities

The primary responsibility for implementing different aspects of the EMP within the company lies with the concerned departments of JK Sugar Mills (Private) Limited.

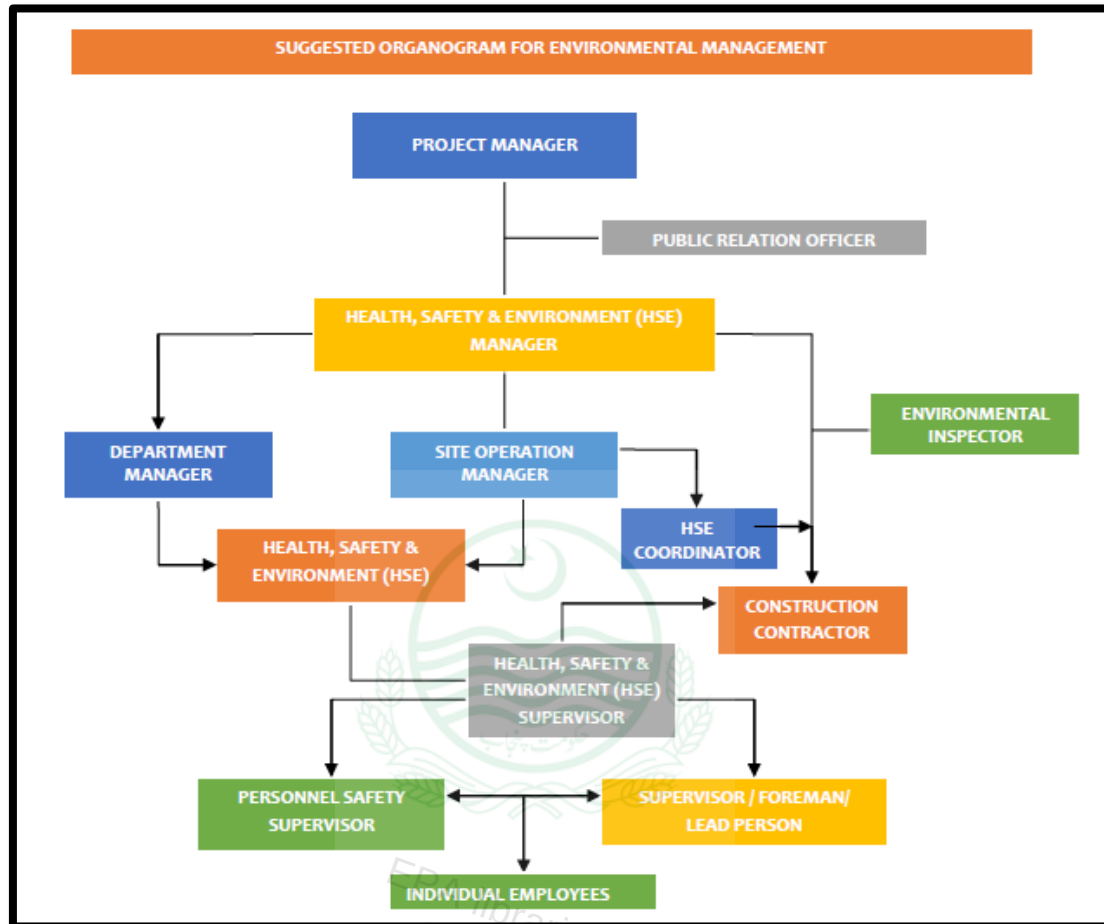


Figure 18: Proposed Hierarchy of Monitoring team

10.7 Proposed Monitoring program

Environmental monitoring is a vital component of the Environmental Management Plan. It is the mechanism through which the effectiveness of the EMP in protecting the environment is measured. The feedback provided by the environmental monitoring is instrumental in identifying any problem or lapse in the system under implementation and planning corrective actions. For domestic activities already constructed facilities will be used. Solid waste disposal will be according to standard practices of area. It should be noted that it is difficult to outline a formal monitoring protocol for specific.

environmental parameters and key impacts until detailed project design have been completed.

The main objectives of the environmental monitoring are:

- To provide a mechanism to determine whether the project construction contractors are carrying out the project in conformity with the EMP.
- To identify areas where the impacts of the project are exceeding the criteria of significance and, therefore, require corrective actions.
- To document the actual project impacts on physical, biological, and socio-economic receptors, quantitatively where possible, in order to design better and more effective mitigation measures.

Following environmental record should be maintained:

- Periodic inspection reports of the site
- Incident record of all moderate and major incidents and accidents. The record will include:
 - ✓ Location or limit of the accident
 - ✓ Estimated quantity or the amount of injury
 - ✓ Nature of injury or loss (temporary or permanent)
 - ✓ Restoration measures
 - ✓ Photographs
- Description of any damage to vegetation, water resource, or community asset.
- Corrective measures taken, if any
- Waste Tracking Register that will hold records of waste generated during the construction period. This will include quantities of waste disposed, recycled, or reused.
- Records of water consumption with use wise breakdown
- Survey reports, in particular, the following:
 - ✓ Vehicle and equipment noise.
 - ✓ Ambient noise survey reports.
 - ✓ Ambient level of PM

- ✓ Vendor data—all vendors disturbed by the project and compensation paid
- Public infrastructure: Record of all damages and repair work undertaken.
- ✓ Employment
- ✓ Total number of unskilled, semi-skilled, and skilled jobs offered during Construction.
- ✓ Name and domicile of the employed staff.
- ✓ Project and Community Interface
- ✓ Record of community complains and the measures taken to address them.
- ✓ Number of meetings held in various communities and data of persons who attended.

10.8 Proposed EMP reporting and reviewing procedures

During construction, EMP reporting and reviewing will be done by the contractor/HSE department. Following steps will be taken during reporting and reviewing of EMP.

- ✓ **Data recording and maintenance:** All forms that will be used for monitoring will be numbered and a tracking system will be developed for each. In this manner, it will be ensured that all forms are returned to the office, be filled, unused or discarded.
- ✓ **Storage of information:** A database will be prepared for collecting the information during the project. The database may include information on training programs, non-compliance, corrective actions and results of monitoring. It will also contain photographic records of project site.
- ✓ **Site Monitoring:** Quarterly Monitoring will be done by monitoring team as per SMART Rules and will be reviewed by concerned. The parameters that will be measured are given below.

Table 25: Monitoring Parameters

Sampling	Parameters
Ambient Air Quality	SO ₂ , NO, O ₃ , NO ₂ , CO, PM _{2.5} , PM ₁₀
Drinking Water	TDS, pH, Color, Taste, Odor, Tota Hardness as CaCO ₃ , Turbidity.
Noise Level	Area Mid-Point

Afterward, monitoring reports will be submitted in EPA as per condition of Environmental Approval of construction phase. Furthermore, recorded data will be reviewed by supervisory so that it can be further improved if required.

10.9 Environmental Training

Training is an integral part of a preventive strategy. Environmental and disaster management training will be required to ensure proper implementation of effective environmental management and monitoring plan; and disaster management plan. However, training could be organized by proponent involving relevant staff. As a trainer, competent Consultant can be outsourced. Important training under the spectrum needs to include:

- Training on firefighting and safety management;
- Training on environmental safeguards and compliance;
- Staff training on environmental monitoring and reporting;
- Training on occupational health and safety measure.

Table 26: Training Schedule

Target Audience	Trainers	Contents	Schedule
Selected Management Staff	Subject Expert	Key finding of mitigation measure	After every five months
All Personnel	HSE Officer	Mitigation measures especially firefighting, safety, health and environment (emissions & discharges) etc.	Monthly
Technical Staff	HSE Officer	Waste disposal, vehicle movement restriction and other mitigation measures	After every three months
Other Staff	HSE officer	Waste disposal, resource conservation and other mitigation workers	Monthly

11 PUBLIC CONSULTATION AND PUBLIC DISCLOSURE

11.1 General

Public consultation refers to the process by which the concerns of various stakeholders and local community who have a plausible stake in the environmental management & associated impacts of the project or activity are ascertained with a view to taking into account all the material concerns in the project or activity design as appropriate. According to the Review of IEE and EIA Review Regulations, 2022 public consultation is mandatory for any socio-environmental study for the commencement of any project.

Impact assessment survey and public consultation sessions held with different stakeholder groups that may be impacted by this project commencement were carried out. The consultation process was carried out in accordance with the guidelines laid by EPA, Punjab. The objectives of this process were to:

- Share information with stakeholders on proposed project establishment.
- Access the impacts on the physical, biological and socio-economic environment.
- Understand stakeholder concerns regarding various aspects of the project commencement.
- Note valuable suggestions of local stakeholders to improve the proposed project design.
- Understand the perceptions, assessment of social impacts and concerns of the affected people/communities of the project area.
- Find out the awareness level and situation of acceptability to identify any issues for the implementation of the proposed project.
- Invite people to express their views about the positive/negative impacts on their lifestyles and environment.
- Disclose information about contact offices/officers for any complaints/queries.

It is envisaged; there will be no social impact being foreseen due to the commencement of aforesaid project at aforesaid location. This EIA Report includes all the comments, which were taken into account during the social survey and preparing the definitive development concept for the installation and operation of proposed project. Public consultation questionnaires and consultation with Govt official are attached as **Annex-VI** of this EIA Report.

11.2 Consultation with Government officials

Consultation regarding JK Sugar Mills (Private) Limited-Distillery was carried out with different departments, Concerns of locals, Environmental Practitioners & experts and Government EPA departments were discussed and asked to consider them while construction of above-said project. Locals will be preferred for employment after providing proper training. Mitigations measures mentioned in EMP will be truly implemented.

11.3 The responsible authority

Overall responsibility for implementation of EMP will be of project proponent. He will appoint a HSE/Project Manager of relevant qualification. HSE/Project Manager will act as Environmental Manager and will manage the all HSE conditions.

11.4 Consultation with affected and wider community

In addition, to the use of direct methods to evince the response of the various stakeholders in targeted population residing in study area was ascertained by conducting a sample survey, through specially formatted questionnaires (attached in the **Annex-VI** of this EIA Report). Questions posed to the public were related to creation of possible impacts, adverse impacts and beneficial impacts, including; employment opportunities, income generation activities, change in living standards and provision of the basic amenity.

Personal views of the respondents on the establishment of above-mentioned unit by JK Sugar Mills (Private) Limited, possible disturbance to the residents near the AOI and infringement of their privacy were also recorded. The various rounds of public meetings and consultations were arranged in project and study area. The objectives of consultation with the affected persons are given in the table below:

- Disclose the proponent plan for the construction/operation of said facility.
- To share information on the design and specifications of project works.
- To analyze the expected impact on the socio-economic environment.
- To understand their concerns regarding various aspects of project commencement.

11.5 Views, Concerns and Suggestions of Various Stakeholders

The major socio-economic concerns and problems of the affected persons of various communities have been given in tabulated form below along with their main concerns and remarks. Community showed a lot of concerns; a few are being mentioned here:

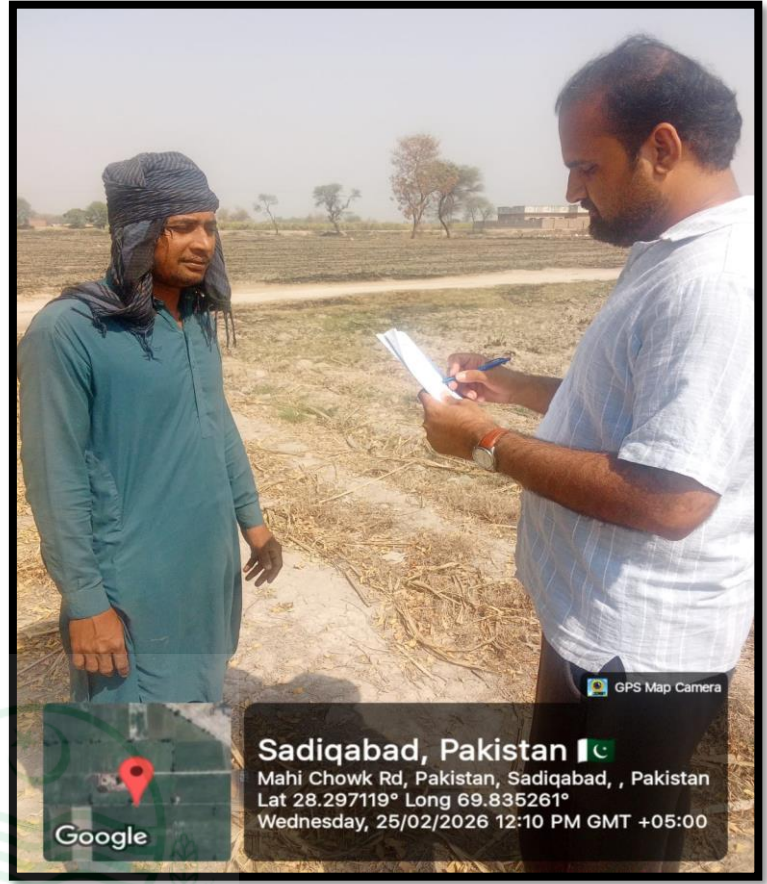
- Removal of shrubs and trees should be avoided to the extent possible in the case of clearance green zones should be established within the facility.
- Indigenous trees around the facility should be planted to control air pollution and as the compensation of removed trees.
- The project will become the source of income for local to earn their livelihood easily and honorably, so locals should be preferred.
- The area will inhabit and will be used for the beneficial purposes.
- For the solid waste management and waste disposal, proper disposal techniques should be adopted.
- Water spraying/sprinkling should be done on the regular basis for dust suppression.
- Employment opportunities will be generated and locals should be hired on the priority basis.
- The air pollution is one of the major impacts from which Punjab is being affected at the large scale. So, ambient air quality should be monitored regularly and air pollution expected to generate from the operation should be mitigated beforehand.
- Good relations with the local communities will be promoted by encouraging Contractor to provide opportunities for skilled and unskilled employment to the locals as well as on-job training.
- Noise generated activities should be carried out during day hours.

The views and the concerns of the local communities, direct and indirect stakeholders has been complied and are presented in the tabular form below:

Table 27: Views and Concerns of Stakeholders

Sr.	Respondents	CNIC/Contact No.	Concerns
i.	M. Jameel	0304-5489560	During the survey in the study area following concerns of the local community were noted: Locals should be preferred for the job opportunities. Wastewater should be treated prior to final disposal. Noisy activities should be confined. Solid waste should be managed effectively b adopting the standard practices of the area. Cleanliness of the area should be ensured. An effective EMMP should be designed and enforced with true spirit. Health of the workers should be ensured. Plantation should be carried out at extensive scale. Workers should be hired from local community Indigenous tress around the ☐ facility should be planted to control air pollution During the survey in the study area following concerns of the local community
ii.	Abdul Razzaq	0304-6867747	
iii	Jama Khan	0315-1676276	
iv.	Naveed Ahmed	0301-6581191	
v.	Abdul Hameed	0304-1823211	
vi.	M. Farooq	0305-6826774	
vii	M. Aslam	0303-7664283	
vii	Khursheed Ahmed	0305-6798792	
ix.	M. Nawab	0325-3128515	
x.	Rafaqat Irshad	31304-7978874-5	
xi.	Jamil Ahmed	31304-2061233-5	

			were noted:
	Haji Hazoor Uddin	31304-5883166-7	☐ Locals should be preferred for the job opportunities. ☐ Noisy activities should be confined. ☐ Solid waste should be managed effectively b adopting the standard practices of the area. ☐ Cleanliness of the area should be ensured. ☐ An effective EMMP should be designed and enforced with true spirit. ☐ Health of the workers should be ensured. ☐ Plantation should be carried out at extensive scale. Workers should be hired from local community Indigenous tress around the facility should be planted to control air pollution.
xii	Riaz Ahmed	31304-1398841-1	
xiv	Ejaz Ali	45404-0380414-5	
xv	Khawand Bakht	31304-8653311-1	
xvi	Syed Esan Shab	31304-5940961-7	
xvi	M. Amjad	31304-8715233-1	
xvii	Sadam Hussain	31304-8205906-7	
xix	Nazir Ahmed	31304-1822488-1	
xx	M. Amir	31304-1899421-7	





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CONCLUSION AND RECOMMENDATIONS

The proposed project comprising a modern distillery based on vinasse incineration and Zero Liquid Discharge (ZLD) technology, represents a significant step towards sustainable industrial development in Pakistan. The project has been designed to integrate renewable energy generation, efficient resource utilization, and advanced environmental management practices, ensuring that industrial production is achieved with minimal environmental impact.

The adoption of vinasse incineration technology enables the recovery of thermal energy from process by-products while eliminating the discharge of spent wash through a comprehensive ZLD system. Water conservation measures, wastewater recycling, air emission control systems, and beneficial utilization of ash further demonstrate the project's commitment to pollution prevention and circular economy principles.

The Environmental Impact Assessment indicates that the potential environmental impacts associated with the construction and operational phases are site-specific, manageable, and can be effectively mitigated through the implementation of the proposed Environmental Management Plan (EMP), environmental monitoring program, and compliance with the Punjab Environmental Quality Standards (PEQS) and other applicable regulatory requirements.

In addition to its environmental benefits, the project is expected to contribute to industrial growth, renewable energy utilization, employment generation, technology transfer, and regional economic development. By integrating modern process technologies with sustainable environmental practices, the proposed project establishes a model for environmentally responsible industrial development, supporting Pakistan's objectives for resource efficiency, industrial innovation, and long-term sustainable economic growth.

Based on the findings of this Environmental Impact Assessment, the proposed project is considered environmentally acceptable, subject to the effective implementation of the recommended mitigation measures, environmental monitoring program, and all applicable statutory and regulatory requirements.



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