ENVIRONMENTAL IMPACT ASSESMENT

REPORT OF

M/S ETISTAR BIOENERGY (Pvt.) LTD.

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PREPARED BY:

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LIST OF ABBREVIATIONS

AA	Anhydrous Alcohol
AAQ	Ambient Air Quality
ACF	Activated Carbon Filter
BOD	Biological Oxygen Demand
CIP	Clean in Process
CPU	Condensate Polishing Unit
COD	Chemical Oxygen Demand
CMD	Cubic Metric Per Day
CREP	Corporate Responsibility for Environmental Protection
CSR	Corporate Social Responsibility
DG	Diesel Generator
DO	Dissolved Oxygen
DM	Demineralized water
EC	Environmental Clearance
EIA	Environmental Impact Assessment
ENA	Extra Neutral Alcohol
EPA	Environmental Protection Act
ETP	Effluent Treatment Plant
FO	Fossil Oil
FBC	Fluidized Bed Combustion
GI	Galvanized Sheets

GLC	Ground Level Concentration
HSE	Health, Safety and Environmental
HSD	High Speed Diesel
HWMH	Hazardous Waste (Management & Handling) Rules
PMD	Pakistan Meteorological Department
KLPD	Kilo Liters Per Day
KL	Kilo lifers
kVA	kilo-volt-ampere
kWh	kilowatt hour
MSDS	Material Safety Data Sheet
MTD	Metric Tons per day
MW	Mega Watt
NFPA	National Fire Protection Association
OSHA	Occupational Safety and Health Administration
PCC	Power Control System
PEL	Permissible Exposure Limit
PFR	Prefeasibility Report
PPE	Personal Protective Equipment's
RS	Rectified Spirit

RSPM	Respirable Suspended Particulate Matter
SPM	Suspended Particulate Matter
SS	Suspended Solids
STG	Steam Turbine Generator
STP	Sewage treatment plan
TA	Total Alcohol
TDS	Total dissolved solid
TSS	Total Suspended solids
TCD	Ton Crush Per Day
TLV	Threshold Limit Value
TPD	Ton Per Day
TPA	Tons Per Annum
TPH	Tons Per Hour
TORs	Terms of References
WTP	Water treatment plant

Compliance of TOR for new 125 KLPD Molasses Based Distillery

A. Specific TOR

Sr. No.	Awarded TOR's	Compliance
1.	Number of working days of the distillery unit.	The distillery will operate for 330 days/ Annum.
2.	Details of raw materials such as molasses, their source with availability.	Please refer Chapter II
3.	Details of the use of steam from the boiler.	Please refer Chapter II Biogas shall be generated from Digesters. This Biogas will be fired with bagasse in boilers
5.	Proposed effluent treatment system for molasses distillery as well as domestic sewage and scheme	Please refer Chapter XII

6.	Details about capacity of Holding tank, material used, design consideration.	Capacity will be installed in an area of 7700 sq.meter One or two piezometers will be installed around the lagoon.
7.	Action plan to control ground water Pollution.	There will be no ground water pollution Due to proposed project as the factory refer Chapter XII Wet Land Technology
8.	Details of solid waste management Including management of ash and yeast etc.	Please refer Chapter X
9.	Details of bio-composting yard (ifApplicable).	Not Applicable as there will be no bio-Composting.
10.	Action plan to control odor pollution.	Please refer Chapter X

Compliance of TOR for new 125 KLPD Molasses Based Distillery

B. Additional TOR

Sr. No.	Awarded ToR's	Compliance
I.	Public hearing to be conducted and issues raised and commitments made by the project proponent on the same should beincluded in EIA/ Report in the form of tabular chart with financial budget for complying with the commitments made.	Public Hearing will be conducted after Submission of draft EIA report. All the issues addressed during the Public Hearing and their compliance along with the financial budgeting will be incorporated in the Final EIA report after the completion of the Public Hearing.
II.	To draw proper green belt plan and EIA should include photographs of plant grown with number	Complied Please refer Chapter X

C. Generic TOR

Sr.	Awarded ToR's	Compliance
1.	**Executive Summary**	It is attached as a separate chapter no II to the EIA report
2.	**Introduction**	
	i. Introduction of EIA consultant	IES Environmental Solutions Pvt Ltd
	ii. Information about the project proponent	Please refer Chapter I
	iii. Importance and benefits of the project	Please refer Chapter I
3.	**Project Description**	
	Project Proponent	Noman Ali Awan S/O Niaz Ali, R/O Post Office Lidher Rorahan Wala, Tehsil Lahore
	i. Cost of project and time of completion.	Please refer Chapter II of the EIA report.
	ii. Products with capacities for the proposed project.	Please refer Chapter II of the EIA report.

	iii. If expansion project, details of existing products with capacities and whether adequate land is available for	Not Applicable as it is a new project.
	iv. List of raw materials required and source along with mode of transportation.	Please refer Chapter II
	v. Other chemicals and materials required with quantities and storage capacities	Please refer Chapter II
	vi. Details of Emission, effluents, hazardous waste generation and management.	Details of emission of effluent, hazardous waste information and management is briefly summarized in Chapter II
	vii. Requirement of water, power	All this information is summarized in chapter II

	viii. Process description along with major equipment's and machineries,	Process description and quantities of raw water and products are given in Chapter II,

ix. Hazard identification and details of proposed safety systems.	Hazardous identification and the proposed safety system are thoroughly Described in Chapter VII .
Expansion/modernization proposals:	
a. Copy of all the Environmental Clearance(s) including Amendments thereto obtained for the project from EPA Punjab shall be attached. A certified copy of the latest Monitoring Report of the Regional Office of the Ministry of Environment on the status of compliance of conditions stipulated in all the existing environmental clearances including Amendments shall be provided. In addition, status of compliance of Consent to Operate for the ongoing /existing operation of the project	Not Applicable as it is a new project.

from SPCB shall be attached with the EIA- report.	

	b. In case the existing project has not obtained environmental clearance, reasons for not taking EC under the provisions of the EIA Notification 1994 and/or EIA Notification 2006 shall be provided. Copies of Consent toEstablish/ No Objection Certificate and Consent to Operate (in case of units operating prior to EIA Notification) obtained from the EPA Punjab shall be submitted. Further, compliance report to the conditions of consents from the EPA Punjab shall be submitted.	Not Applicable as it is a new project.
4.	**Site Details**	
	i. Location of the project site covering village, Taluka/ Tehsil, District and State, Justification for selecting the site, whether other sites were considered.	The location of the project and site selection criterion is described in Chapter V, of the EIA report.No alternative site has considered as proposed project site is appropriate for establishment of distillery.

ii.	A top sheet of the study area of radius of 10 km and site location on 1:50,000/1:25,000 scale on an A3/A2 sheet. (Including all eco-sensitive areas and environmentally sensitive places)	Map of study area of 10 km radius marked on Top sheet is given in chapter III.
iii.	Details w.r.t. option analysis for selection of site	Analysis for selection of site information is given in Chapter V,
iv.	Co-ordinates (lat-long) of all four corners of the site.	Please refer Chapter II of the EIA report.
v.	Google map-Earth downloaded of theproject site.	Please refer Chapter II of the EIA/ report.
vi.	Layout maps indicating existing unit as well as proposed unit indicating storage area, plant area, greenbelt area, utilities etc. If located within an Industrial area/Estate/Complex, layout of Industrial Area indicating location of unit within the Industrial area/Estate.	Please refer Chapter II

vii. Photographs of the proposed and Existing (if applicable) plant site. If existing, show photographs of plantation/greenbelt, in particular.	Please refer Chapter II
viii. Land use break-up of total land of the project site (identified and acquired), government/ private - agricultural, forest, wasteland, water bodies,settlements, etc. shall be included.	Please refer Chapter II of the EIA reports.
ix. A list of major industries with name and type within study area (10 km radius) shall be incorporated. Land use details of the study area	No major industries occurred in 10 km study radius
x. Geological features and Geo-Hydrological status of the study	Geological features and Geo-Hydrological status of th project is described in Chapter III

xi.	Details of Drainage of the project up to5km radius of study area. If the site is within 1 km radius of any major river, peak and lean season river discharge as well as flood occurrence frequency based on peak rainfall data of the past	Details of Drainage of the project is described in Chapter III
xii.	Status of acquisition of land. If acquisition is not complete, stage of the acquisition process and expected timeof complete possession of the land.	The land is the property of owner and acquisition of land has been completed
xiii.	R&R details in respect of land in line with state Government policy	The site is situated on a barren land Without having human settlements. Therefore, no R & R study is required.
5.	**Forest and wildlife related issues (if applicable)**	
i.	Permission and approval for the use of forest land (forestry clearance), if any, and recommendations of the State Forest Department. (if applicable)	Not Applicable as no forest land is Involved within 10 km radius of the project site.

ii. Land use map based on High resolution satellite imagery (GPS) of the proposed site delineating the forestland (in case of projects involving forest land more than 40 ha)	No forest land is involved. Please refer Chapter III
iii. Status of Application submitted for obtaining the stage I forestry clearance along with latest status will be submitted	Not Applicable

6.	**Environmental Status**	
	i. Determination of atmospheric inversion level at the project site and site-specific micrometeorological data using temperature, relative humidity, hourly wind speed and direction and rainfall.	Chapter III of the EIA/ report for site-specific data.
	ii. AAQ data (except monsoon) at 8 locations for PM10, PM2.5, SO2, NOX, CO and other parameters relevant to the project shall be collected. The monitoring stations shall be based CPCB guidelines and take into account the pre-dominant wind direction, population zone and sensitive receptors including reserved forests	Details of AAQ monitoring are given in Chapter III
	iii. Raw data of all AAQ measurement for 12 weeks of all stations as per frequency given in the NAQQM Notification of Nov. 2009 along with - min., max., average and 98% values for each of the AAQ parameters from data of all AAQ stations should be provided	AAQ monitoring are given in Chapter III

	iv. The projects to be located within 10 km of the National Parks, Sanctuaries, Biosphere Reserves, Migratory Corridors of Wild Animals, the project proponent shall submit the map duly authenticated by Chief Wildlife Warden showing these features vis-à-vis the project location and the recommendations or comments of the Chief Wildlife Officer	Not Applicable. No National Parks, Sanctuaries, Biosphere Reserves, Migratory Corridors of Wild Animals located within 10 km radius of the project site.
	Wildlife Conservation Plan duly authenticated by the Chief Wildlife Warden of the State Government for conservation of Schedule I fauna, if any exists in the study area	Not Applicable
	vi. Copy of application submitted for clearance under the Wildlife (Protection) Act, 1972, to the Standing Committee of the National Board for Wildlife	Not Applicable

	iv. Surface water quality of nearby River (100m upstream and downstream of discharge point) and other surface drains at eight locations as per EPA Punjab guidelines.	Chapter III of the EIA report.
	v. Whether the site falls near to polluted stretch of river identified by the EPA Punjab, if yes give details.	No. The site does not fall near to polluted stretch of river identified by the EPA Punjab
	vi. Ground water monitoring at minimum at 8 locations shall be included	Total 10 ground water monitoring locations were selected and results for the same are given in Chapter III
	vii. Noise levels monitoring at 8 locations within the study area	Chapter III of the EIA report.
	viii. Soil Characteristic as per CPCB guidelines	Soil characteristics are given in Chapter III of the EIA report.
	ix. Traffic study of the area, type of vehicles, frequency of vehicles for transportation of materials, additional traffic due to proposed project, parking	Details of traffic study are given in Chapter IV,

	arrangement etc.	
	x. Detailed description of flora and fauna (terrestrial and aquatic) existing in the study area shall be given with special reference to rare, endemic and endangered species. If Schedule-I fauna are found within the study area, aWildlife Conservation Plan shall be prepared and furnished.	Details of Flora and Fauna are given in Chapter III

	xi. Socio-economic status of the studyarea.	Details of Socio-economic are given in Chapter III of the EIA report
7.	**Impact and Environment Management Plan**	
	i. Assessment of ground level concentration of pollutants from the stack emission based on site-specific meteorological features. In case the project is located on a hilly terrain, the AQIP Modeling shall be done	Cumulative impact of all sources of emissions (including transportation) on the AAQ of the area have been assessed and described in Chapter IV

	using inputs of the specific terrain characteristics for determining the potential impacts of the project on the AAQ. Cumulative impact of all sources of emissions (including transportation) on the AAQ of the area shall be assessed. Details of the model used and the input data used for modeling shall also be provided. The air quality contours shall be plotted on a location map showing the location of project site, habitation nearby, sensitive receptors, if any.	
	ii. Water Quality modeling - in case of	Not Applicable
	iii. Impact of the transport of the raw materials and end products on the surrounding environment shall be assessed and provided. In this regard, options for transport of raw materials and finished products and wastes (large quantities) by rail or rail-cum road transport or convey or cum- rail transport shall be	There will be no negative impact of the transport of the raw materials and end products on the surrounding environment. All product and raw material transportation will be done by adjacent state highways. No village road will be involved. Transportation of Products and Raw material will be done by Trucks.

	examined.	
	iv. A note on treatment of wastewater from different plant operations, extent recycled and reused for different purposes shall be included. Complete scheme of effluent treatment. Characteristics of untreated and treated effluent to meet the prescribed standards of discharge under EPA Rules.	Process condensate around 791 CMD will be generated during evaporation, and this will be recycled in the process. Moreover, cooling tower make up water. After recycling the generated wastewater in the process, daily fresh water requirement is for Production. Complete scheme of effluent generation and its disposal is given in Chapter IV

	v. Details of stack emission and action plan for control of emissions to meet	Details of stack emissions and control measures are given in Chapter X,

	standard	
	vi. Measures for fugitive emission	Chapter IV
	vii. Details of hazardous waste generation and their storage, utilization and management. Copies of MOU regarding utilization of solid and hazardous waste in cement plant shall also be included. shall include the concept of waste- minimization, recycle/reuse/recover techniques, Energy conservation, and natural resource conservation.	Solid waste will be mainly yeast sludge, ETP sludge, ash and, discardedcontainer etc. Ash will be sold to the brick-manufacturing units.. The yeast sludge and sludge from ETP can be used as manure.
	viii. Proper utilization of fly ash shall be ensured as per Fly Ash Notification, 2009. A detailed plan of action shall be provided.	Chapter X ofthe EIA report.

	ix. Action plan for the green belt development plan in 33 % area i.e. land with not less than 1,500 trees per ha. Giving details of species, width of plantation, planning schedule etc. shall be included. The green belt shall be around the project boundary and a scheme for greening of the roads used for the project shall also be incorporated.	Detail action plan for green belt development is given in Chapter X,
	x. Action plan for rainwater harvesting measures at plant site shall be submitted to harvest rainwater from the roof tops and storm water drains to recharge the ground water and also to use for the variousactivities at the project site to conserve fresh water and reduce the water requirement from other sources.	Chapter X ofthe EIA report.

	xi. Total capital cost and recurring cost/annum for environmental pollution control measures shall be included	Estimated cost of is Rs. 223 lakhs per annum for environmental pollution control measures.

	xii. Action plan for post-project environmental monitoring shall be submitted.	Action plan for post-project environmental monitoring is given in detail in chapter VI,
	xiii. Onsite and Offsite Disaster (natural and Man-made) Preparedness and Emergency Management Plan including Risk Assessment and damage control. Disaster management plan should be linked with District Disaster Management Plan.	Details of onsite and offsite Disaster (natural and Man-made) preparedness and Emergency Management Plan including Risk Assessment and damage control is given in Chapter VII,
8.	**Occupational health**	
	i. Plan and fund allocation to ensure the occupational health & safety of all contract and casual workers	Chapter X of the EIA report. Initial fund allocation to ensure the occupational health & safety of all contract and casual workers is Rs. 10 lakhs.

	ii. Details of exposure specific health status evaluation of worker. If the workers' health is being evaluated by pre designed format, chest x rays, Audiometry, Spirometry, Vision testing (Far & Near vision, color vision and any other ocular defect) ECG, during pre-placement and periodical examinations give the details of the same. Detailsregarding last month analyzed data of above mentioned parameters as per age, sex, duration of exposure and department wise.	Details regarding Occupational & Safety Hazards including replacement andperiodical examinations etc. have been incorporated in this EIA/ Report. Please referChapter X.

	iii. Details of existing Occupational & Safety Hazards. What are the exposure levels of hazards and whether they are within Permissible Exposure level (PEL)? If these are not within PEL, what measures the company has adopted to keep them within PEL so that health of the workers can be preserved,	It is not applicable (NA) since, proposed project is new project.

	iv. Annual report of health status of workers with special workers with special reference to Occupational Health and Safety	Annual report of health status of workers will be submitted in six monthly compliances report after the accord of EC as it is a newproject.
9.	**Corporate Environment Policy**	
	i. Does the company have a well laid down Environment Policy approved by its Board of Directors? If so, it may be detailed in the EIA report.	No, at the movement factory does not have approved Environment Policy; however, factory shall develop an appropriate policy for the project

	ii. Does the Environment Policy prescribe for standard operating process / procedures to bring into focus any infringement / deviation / violation of the Punjab environmental quality standereds (PEQS)	Factory shall develop an environmental policy and ensures that the environment policy prescribe for standard operating process / procedures to bring into focus any infringement / deviation / violation of the Punjab environmental quality standereds (PEQS)
	iii. What is the hierarchical system or Administrative order of the company to deal with theenvironmental issues and for ensuring compliance with the environmental clearance conditions? Details of this system may be given.	Hierarchical system of the company deal with the environmental issues is given in Chapter X,
	iv. Does the company have system of reporting of non-compliances / violations of environmental norms to the Board of Directors of the company and / or shareholders orstakeholders at large? This reporting mechanism shall be detailed in the EIA report	The EMC will monitor non-compliances /violations of environmental norms. The cell will also be responsible for maintaining the records of data, documents and information in line with the legislative requirement and will regularly furnish the same to the concerned statutory authorities.

10.	Details regarding infrastructure facilities such as sanitation, fuel, restroom etc. to be provided to the labor force during construction as well as to the casual workers including truck drivers during operation phase.	Facilities during construction and operation such as clean water for washing the hands, sanitation facility and cleanup after work, Clean area for eating and taking rest shall be provided.
11.	**Enterprise Social Commitment (ESC)**	
	Adequate funds (at least 2.5 % of the project cost) shall be earmarked towards the Enterprise Social Commitment based on Public Hearing issues and item-wise details along with time bound action plan shall be included.	The Etistar Bioenergy (Pvt) Ltd.planned to invest 100Million (2.5 % of the project cost) on the CSR activities. Details of CSR activities are given in ChapterX,

12.	Any litigation pending against the project and/or any direction/order passed by any Court of Law against the project, if so, details thereof shall also be included. Has the unit received any notice under the Section 5 of Environment (Protection) Act? 1986 or relevant Sections of Air and Water Acts? If so, details thereof and compliance/ATR to the notice(s) and	No

13.	'A tabular chart with index for point wise compliance of above TOR.	Point-wise compliance of the TOR's has been given in the tabular form.
14.	The prescribed shall be valid for a period of three years for submission of the	Noted

D. General Points

Sr. No.	General points	Compliance
I.	All documents shall be properly indexed, page numbered.	Noted and complied
II.	Period/date of data collection shall be clearly indicated.	Noted and complied
III.	Authenticated translation of all English languages shall be material in regional provided	Noted and complied
IV.	The letter/application for environmental clearance shall quote the MOEF file No. and also attach a copy of the letter.	Noted and complied
V.	The copy of the letter received from the Ministry shall be also attached as an annexure to the final	Noted and complied
VI.	The index of the final EIA- report must indicate the specific chapter and page no. of the EIA/ Report	Noted and complied

VII.	While preparing the EIA report, the instructions for the proponents and instructions for the consultants issued by EPA Punjab, which are available on the website of this Ministry shall also be followed.	Noted and complied
III.	The consultants involved in the preparation of EIA- report after accreditation with EPA Punjab references	EIA report to be submitted EPA Punjab.

EXECUTIVE SUMMERY

Introduction

The purpose of this Environmental impact Assessment (EIA) guideline is to provide clear and concise information to all stakeholders (Proponents, Consultants, Government Ministries, Departments and Agencies, Members of the Public, Expert in relevant disciplines and interested groups, the organized private sector, non-governmental organizations, professional bodies, host and project affected communities) to improve and streamline the EIA study for the M/S Etistar Bioenergy (Pvt.) Ltd, Rahim Yar Khan Situated at Chak No. 106/1-L, Tehsil Khanpur District Rahim yar khan. Environmental Impact Assessment (EIA) report of the project has been conducted in accordance with the Punjab Environmental Protection (Amendment) Act 2012 and IEE/EIA Regulations 2000. The process for conducting environmental assessment and the results of EIA is described in this document.

Salient Features of Project

	CONSTITUENT	**DESCRIPTION**
	Name of Project	M/S Etistar Bioenergy (Pvt.) Ltd, Rahim Yar Khan Situated at Chak No. 106/1-L, Tehsil Khanpur District Rahim yar khan.
	Project Location:	Situated at Chak No. 106/1-L, Tehsil Khanpur District Rahim yar khan.
	Project Proponent & Contact Person	Mr. Nouman Ali Awan S/O Niaz Ali R/O Dak Khana Lidher Roas Anwala Cantt Tehsil and District Lahore

	Total Area:	25 Acre
	Project Cost	4000 million Pkr.

Project Outline

This report is related to M/S Etistar Bioenergy (Pvt.) Ltd, Rahim Yar Khan Situated at Chak No. 106/1-L, Tehsil Khanpur District Rahim yar khan. The proposed project is falls under category B(4) (Food processing industries including sugar mills, beverages, milk and dairy products, with total cost of Rs. 100 million and above) requiring Environmental Impact Assessment (EIA) according to IEE/EIA Regulation

Major Impacts and Recommended Mitigation Measures:

Anticipated impacts associated with the construction phase include noise, air emissions, wastewater from industry and soil contamination during process, water used and safety of the workers and employment conflicts as the major adverse environmental impacts. Mitigation measures recommended to be incorporated into the project include running the machines and vehicles on good quality (low-sulfur, unleaded fuels) in good working order ensuring regular maintenance, tuning and servicing, and providing them with emission control devices. Water suppression and covered transportation and storage of the construction materials and slow driving on unpaved roads will control dust emission. Solid waste of construction and demolition activities will be used for flooring, while the remaining solid waste will be managed as per area practices in the area. For safety, irrelevant persons will not be allowed inside and boundary of the site will be fenced. Safety of the workers will be ensured by developing SOPs for all jobs, training the workers to follow SOPs, discouraging any careless attitude of workers and providing the workers with, and

encouraging them to use PPEs.

Key impacts related to the operation phase include:

- Wastewater
- Solid Waste
- Safety, Public Health & Nuisances

Proposed Monitoring

During construction and operational phase, ambient air quality for dust level in particular, vehicle and equipment exhaust, noise level (tests), solid waste management and soil contamination, and workers' safety (visual) need to be monitored.

EIA REPORT

M/S ETISTAR BIOENERGY ((Pvt.) LTD, SITUATED AT CHAK NO. 106/1-L, TEHSIL KHANPUR DISTRICT RAHIM YAR KHAN

CHAPTER I

INTRODUCTION

CHAPTER I
INTRODUCTION

1.1 Purpose of report

Environmental Impact Assessment (EIA) report is being submitted to the Environmental Protection Agency (EPA), Government of the Punjab, Lahore in compliance with the legal requirement for Punjab Environment Protection Act-1997 (Amended 2012), Section 12- for obtaining No Objection Certificate (NOC) before starting and construction activity at the project site. The other relevant regulations and guidelines considered while preparing this EIA report include:

- Policy and procedures for filing, review and approval of environmental assessments.
- Guidelines for the preparation and review of environmental reports.
- Guidelines for public participation.
- Guidelines for sensitive and critical areas.
- Detailed sectorial guidelines

Various aspects like environmental, social, physical and other aspects of the project both during construction and its regular occupancy are highlighted in this EIA report. Measures necessary to be adopted to mitigate any environmental impacts on any part of the environment around are also described. All the important information is also provided as described under the format used to help decision makers, EPA Punjab in the present case, before issuing the desired Environmental Approval

Overview of project

Sugar factories cannot survive in a healthy condition on a single product i.e., sugar. Manufacturing of sugar is a seasonal phenomenon with a short crushing season varying normally from 3 to 5 months in a year, thus creating financial problems for the industry as a whole. Hence,

it is necessary for the factory to establish distillery unit which provides stability to sugar unit in the financial crises. Molasses is a very important by- product of the sugar industry. The profits earned by the conversion of molasses to alcohol will be much higher than that the value realized by sale of molasses.

As per EPA The Punjab Environmental (Protection) Act, 1997 (Amended 2012-2017) regarding the Punjab Environmental, the quality standard to be maintained.

1.2 Identification of project & project proponent

M/S Etistar Bioenergy (Pvt.) Ltd Situated at Chak No. 106/1-L Tehsil Khanpur District Rahim yar khan

Proponent: Mr. Nouman Ali Awan S/O Niaz Ali R/O Dak Khana Lidher Roas Anwala Cantt Tehsil and District Lahore

1.3 EIA Consultant

The services of environmental consultant IES Environmental Solutions (Pvt) Ltd have been taken by the proponent for the formulation of Report. It is an environmental consultancy firm that has an unrivalled reputation for providing high quality tailored services. IES Environmental Solutions (Pvt.) Ltd is a dynamic, responsive and innovative in providing this cost-effective solution. IES Environmental Solutions (Pvt.) Ltd comprising of Environmental Engineers & Consultants, and rendering their services to clients in both industrial and the government sectors.

With the visionary leadership of its veteran management and enthusiasm of its team, it is committed to come up with innovative ways of maintaining and enriching the Environmental Profiles / Portfolios of its prestigious clients with activities having a strong and lasting impact to their corporate image. It has attracted and retained staff with an unrivalled depth and breadth of expertise and experience that they have from working, not just in consultancy but also in commercial, industrial and regulatory environments. With its pool of Environmental Consultants,

Environmental Scientists and Environmental Engineers, company offers one stop solutions tailored to its client's needs.

CONTACT DETAILS:

Qualified professionals with relevant experiences of conducting environmental assessment have contributed to the preparation of Environmental Impact Assessment (EIA) Report. The team has been shown in Table below:

Table 1.1: List of Team Members

Sr. #	Name	Highest Qualification
	Mr. Waqas Ahmad Khan	PhD in Environmental Sciences
Members		
	Mahwish	PhD Environmental sciences, GIS Expert
	Mr. Abdul Rehman	M.phill Environmental Sciences (UOL)
	Bilawal Zafar	BS(Hons) Environmental Sciences (UOL)
	Fajar Waheed	BS(Hons) Environmental Sciences (UOL)
	M. Faheem	Environmental Expert

1.4 Nature and size of the project

M/S Etistar Bioenergy (Pvt.) Ltd is proposing a 125 KLPD molasses-based distillery. Molasses is one of byproducts of sugar industry which is used to produce rectified spirit/alcohol for making spirit and fuel. The main raw material for distillery is molasses. Other raw materials will be some chemicals and Yeast which help in fermentation. The total area of the project is 25 Acre and total cost of the project is 4000 million

M/S Etistar Bioenergy (Pvt.) Ltd is proposing a 125 KLPD molasses-based distillery. Molasses

is one of byproducts of sugar industry which is used to produce rectified spirit/alcohol for making spirit and fuel. The main raw material for distillery is molasses. Other raw materials will be some chemicals and Yeast which are help in fermentation.

1.5 Location of the project

Proposed project will be located at Chak No. 106/1-L, Tehsil Khanpur, District Rahim yar khan. The land requirement for the proposed industry unit is already in possession and it is not prime agricultural land. There are no Tropical Forest, Biosphere Reserve, National Park, Wild Life Sanctuary and Coral Formation Reserves within 10 km Influence Zone.

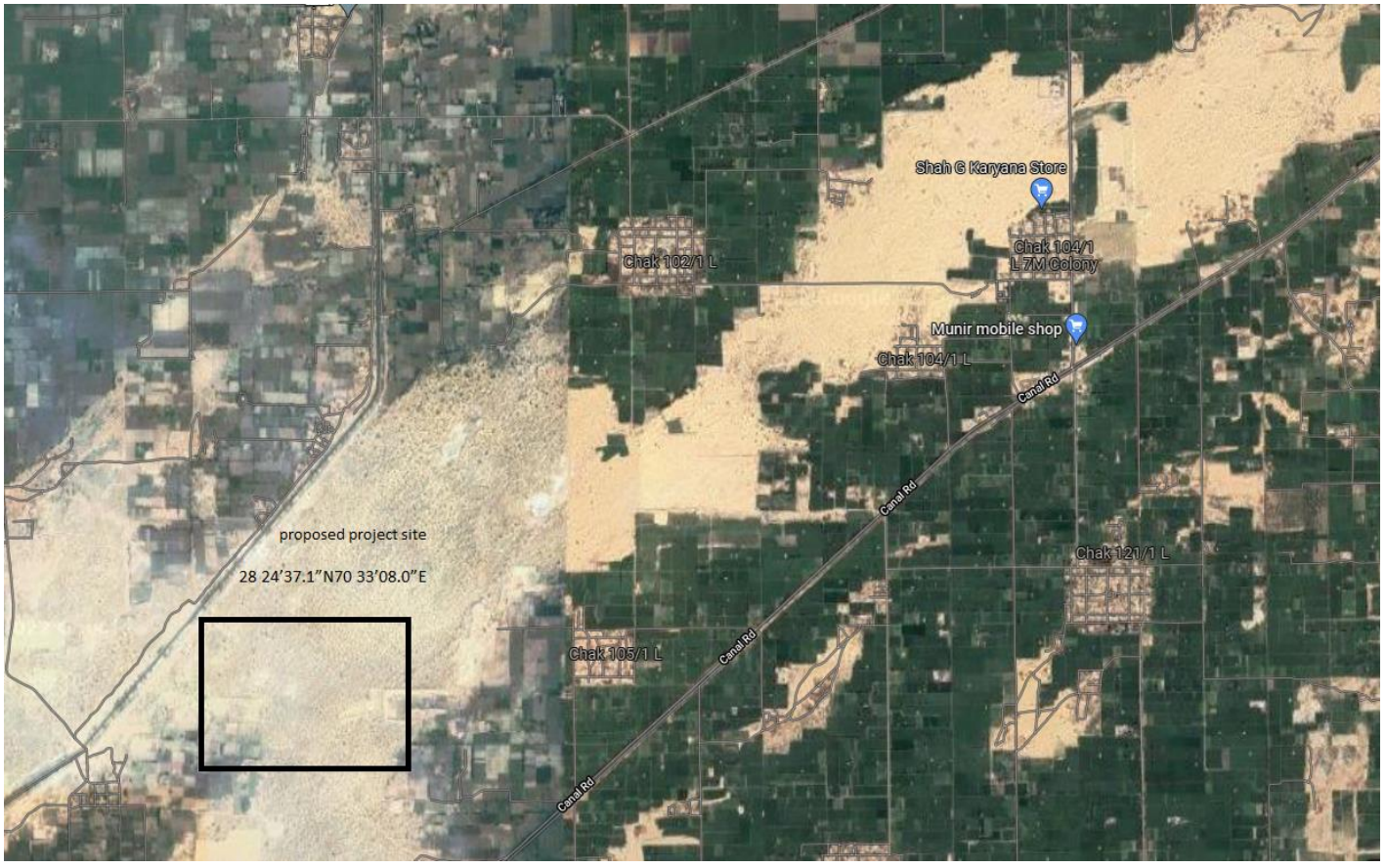


Figure 1 PROJECT LOCATION

1.6 Scoping

The proposed project is falls under category B(4) (Food processing industries including sugar mills, beverages, milk and dairy products, with total cost of Rs. 100 million and above) requiring Environmental Impact Assessment (EIA) according to IEE/EIA Regulation

1.7 Spatial and Temporal Boundaries of the Assessment

Temporal and spatial boundaries for the effects assessment are defined by the characteristics of the project and the VECC being assessed. These boundaries encompass time periods and areas during and within which the VECCs are likely to interact with or be influenced by the project. Spatial boundaries vary according to the nature of the VECC but generally are defined in terms of:

The definition of the RSA may take into consideration factors such as:

- Habitat for sensitive life stages;
- Wildlife migration routes and ranges;
- Areas of potential effects from dispersed or intermittent project activities, such as, air transport, and road haul; and
- Areas within which there is potential for cumulative effects with other projects.

Temporal boundaries for project-related effects are defined in terms of the project phases:

Baseline – covers ecological, physical and human-related characteristics of the environment, as characterized in 2006, 2007 and 2008, prior to the initiation of the construction phase;

Construction – includes all activities associated with project construction and before commencement of ore processing (mill start-up) such as:

- transportation corridors construction;



- mobilization of equipment and supplies to the site by road and air;
- construction of site facilities, including camp, infrastructure, ore stockpile, mill, waste rock storage dump, TWRMF, water management facilities (diversions, settling ponds, seepage collectors etc.)
- camp operations and personnel transport during construction;

Decommissioning – includes all activities to decommission site facilities and remove equipment and materials from the site, recontour the site and restore drainage patterns to stable long-term conditions, stabilize the wastes (TWRMF and waste rock) for safe long-term maintenance, and implement the final site reclamation procedures to prevent erosion and restore vegetation cover where feasible;

Closure – refers to conditions that will exist on the site after the site is abandoned and revegetation is complete.

Temporal boundaries are also defined for the cumulative effects assessment, spanning baseline to a point in the future, within which project effects on VECCs are predicted to overlap with effects of other projects or activities. Spatial and temporal boundaries for each VECC are detailed in respective report sections.

1.8 IMPORTANT ISSUES AND CONCERNS RAISED DURING CONSULTATION

Issue	Aspect/Concern raised by Stakeholders	Project Proponent Commitments
Employment Opportunities	Expectations of employment are very high. Job opportunities are less for herders as they generally have less skills and training.	Employment is the main priority of the industry. Mostly locally skill and unskilled labor will be prioritized Around 100-150 people will be employed by

		the industry.
Training Opportunities	People are keen to consult with subject industry if the Project offers training and upgrading opportunities to enhance their trade or professional skills.	Development of the Training Strategy, including commitment of allocation of budget investment for training infrastructure, delivery and design. Installation of training facilities in for worker of the company and students will also be accommodating. The internship program will offer to the students to develop professional skills.
Health & safety	Truck traffic is a main concern because the road used by the Project passes through a number of small communities and different industries and there will be a high volume of trucks transporting concentrate.	Development of Transport Management Plan including traffic safety training. Traffic advisory signs will be installed along project site and all nearby specific areas.
Local economy and business development	Local service providers are keen to participate in providing services to provide raw material and expect to receive in order to adjust their businesses to meet specific needs. Local/regional companies and	Proponent has main focus that they will all the material regarding construction and plant operation to buy from the local market. This will help the local and small business and to people who are keen interested to become suppliers.

	entrepreneurs have limited understanding about meeting the high volumes required by the Project and the quality standard, but are keen to know these requirements so they can become suppliers.	
Environmental Issues	Dust and noise impacts, particularly from the construction activities and in operation of mechanically unfit machines, are of concern to herders and other residents. Environmental degradation during road construction and use. Loss and change of vegetation due to soil degradation.	Implementation of controls under the Environmental Management Plans, including on and off-site dust and noise monitoring. A Participatory Environmental Monitoring Program will be launched to spread awareness.
Water quantity and quality	Water quality and quantity, and impacts from the wastewater disposal are all key concerns for nearby herders.	Implementation of consultation in relation to water use and development of the Participatory Environmental Monitoring Program. Water treatment will be done by the proponent that will help to safe disposal of the water.

1.9 Significance Impact

The construction of the project can create some adverse impact on the existing environment. The acoustic impacts, dust emission, traffic congestion, safety and sanitation during the construction period would be limited to construction of building and site preparation. Since the new building would be set

up in existing warehouse premises, the resettlement won't be an issue here. During construction, the contractor will adopt all necessary measures to reduce the probable environmental impacts from different aspects. There are minimal impacts during operation period and Construction will be responsible to take necessary steps during operation. The significant impacts in different phases i.e. (i) due to project location and preparation, (ii) construction phase and (ii) operation phase have been identified using the checklist process. From this process, the main potential environmental impacts, which may arise due to construction, can be grouped as follows: (i) Atmospheric emissions and Air quality, (ii) Noise generation, (iii) Water pollution and waste water disposal, and (iv) Health and safety However, the magnitude of these impact shall be very low and insignificant

1.10 Consideration of Alternatives

Alternatives sites were identified initially for the proposed project. These sites were also located in district Rahim Yar Khan . The present site has been selected after consideration of the other two alternative sites. These sites and their reasons of rejection are summarized below:



1.11 Reasons of Rejection

- The reasons of rejection of this site are:
- Wastewater disposal drain was not exist
- Land was deep and water logged
- Under ground water was deep and not easy to extract. Ground water quality was not good.
- Security threat was present
- Distance from the main city was greater
- Land ownership conflict due to the land cost

Selected Site:

- ❖ The reasons of selection of this site are:
- ❖ Availability of access roads
- ❖ Communication facilities
- ❖ Availability of electricity
- ❖ Basic infrastructure
- ❖ Sewerage system
- ❖ Approved drainage system
- ❖ Less/few vegetation/plantation
- ❖ Less fauna species at site
- ❖ Convenient plot layout
- ❖ Subject selected site surrounded by industrial area except one site which is open land

Obviously, environmentally sound, neat and clean environment are the other considerations for site

selection. The project will also facilitate the people of the area with increasing the opportunity of employment and others related facilities. Keeping these requirements and their feasibility and other basic infrastructural requirements at the site, the selected site is ideally suited for construction of Distillery Unit.

1.12 Importance to country region

Pakistan is the 10th largest producer of alcohol in the world and there has been a steady increase in its production over the last 15 years.. In Pakistan alcohol is largely produced in the form of,

i) Rectified Spirit (RS) (95 to 96 % v/v ethanol) which is mainly used for industrial applicationsin the form of Ordinary Denatured Spirit (ODS) or Special Denatured Spirit (SDS)

ii) Extra Neutral Alcohol (ENA) (96 % v/v ethanol) mainly used for manufacture of potable liquors

iii) Fuel Ethanol or Absolute Alcohol (AA) (99.8 % v/v) mainly used for blending with petrol.

1.13 Use of Alcohol

Industrial Use

Ethyl alcohol is an important feedstock for the manufacture of various chemicals like acetic acid, butanol, butadiene, acetic anhydride and PVC etc. Although, ethylene and ethylene oxide are also produced from a petrochemical route, yet this requires plants of huge scales and thus requiring substantially high investments. The drug industry also uses alcohol as a raw material for production of insulin, antibiotics, tonics and several other essential bulk drugs & formulations. The following are the major uses of alcohol- based chemical industriesin the country,

- Synthetic fibers and synthetic yarn
- Drugs and pharmaceuticals
- Agrochemicals
- Personal care products
- Dyestuffs, pigments, flavors and fragrances
- Textile processing
- Toiletries and perfumeries
- Paints and surface coatings
- Electroplating
- Synthetic adhesives
- Plastics and polymers
- Solvents for inks and lacquer finishes
- Food preservatives
- Oilfield chemicals
- Leather chemicals

Beverages

Alcohol is also used in Pakistan for manufacture of Country liquor by Murree Brewery. In Pakistan the pattern of alcohol consumption is quite different from the world pattern, and is generally equally utilized for Industrial Alcohol and exported Alcohol.

Fermentation alcohol has great demand in countries like Japan, United States of America, Canada, Europe, UAE, Africa etc.

Cane Molasses is the single largest raw material. Pakistan produces almost 10% of the world's molasses production.

1.14 Benefits of the project

- Ethanol as a fuel
- Rectified Spirit / ENA Grade for industrial use
- Industrial /B Grade for Paint and Polish Industry
- Help to generate foreign currency as export.
- Direct and indirect employment to the local people
- Development of region

1.15 Applicable Environmental Acts & Rules

As per the notification, proposed project falls under Activity 5 (g) Cat. A (All molasses-based distilleries). The following are some other acts and rules related to environment which will be applicable for the proposed project

1. The Punjab Environmental (Protection) Act, 1997 (Amended 2012-2017)
2. The Environmental Samples Rules,2001
3. Environmental Tribunal Rules, 2012
4. Punjab Environmental Quality Standard for Ambient Air
5. Punjab Environmental Quality Standard for Noise
6. The Punjab Environmental Quality Standard for Industrial Gases

Chapter

I	Introduction
II	Project Description
III	Description of the Environment
IV	Anticipated Environmental Impact & Mitigation Measures
V	Analysis of Alternatives (Technology & Site)
VI	Environmental Monitoring Program
VII	Additional Studies
VIII	Project Benefits
IX	Environmental Cost – Benefit Analysis
X	Environmental Management Plan
XI	Summary & Conclusion

Project Description

- Products with capacities
- Land requirement and details
- List of raw materials, their source along with mode of transportation.

- Chemicals and other materials required with quantities and storage capacities.

- Details of emission, effluents, hazardous waste generation and their management.

- Requirement of water, power, with source of supply, status of approval and water balance details

- Man-power requirement (regular and contract)

- Process description along with major equipment and machineries, process flow sheet

(Quantities) from raw material to products are provided

- Hazard identification and details of proposed safety systems

- Cost of project and time of completion

1. **Site Details**

- Location of the project site covering village, Taluka/Tehsil, District and State, justification for selecting the site

- A toposheet of the study area of radius of 10 km and site location on 1:50,000/ 1:25,000scale on an A3/ A2 sheet. Including eco-sensitive & environmentally sensitive areas - Details for selection of site, co-ordinates (Lat-Long) of all four corners of the site andGoogle map

- Layout maps indicating storage area, plant area, greenbelt area, utilities etc.

- Photographs of the proposed plant site. If existing, show photographs of plantation/greenbelt, in particular.
- Land use break-up of total land of the project site (identified and acquired), government/ private - agricultural, forest, wasteland, water bodies, settlements, etc. will be included. (Not required for industrial area)
- A list of major industries with name and type within study area (10 km radius) will be incorporated.
- Land use details of the study area, geological features and geo-hydrological status of the study area will be included.
- Details of drainage of the project up to 5 km radius of study area. If the site is within 1 km radius of any major river, peak and lean season river discharge as well as flood occurrence frequency based on peak rainfall data of the past 30 years. Details of Flood

  Level of the project site and maximum Flood Level of the river will also be provided.

4. Forest and wildlife related issues

i. Location of the project site covering village, Taluka/Tehsil, District and State, justification for selecting the site

ii. A top sheet of the study area of radius of 10 km and site location on 1:50,000/ 1:25,000 scale on an A3/ A2 sheet. Including eco-sensitive & environmentally sensitive areas

iii. Details for selection of site, co-ordinates (Lat-Long) of all four corners of the site and

Google map

iv. Layout maps indicating existing unit as well as proposed unit indicating storage area, plant area, greenbelt area, utilities etc. If located within an Industrial area/ Estate/ Complex, layout of Industrial area indicating location of unit within the Industrial area/ Estate.

v. Photographs of the proposed plant site. If existing, show photographs of plantation/ greenbelt, in particular.

vi. Land use break-up of total land of the project site (identified and acquired), government/ private - agricultural, forest, wasteland, water bodies, settlements, etc. will be included. (not required for industrial area)

vii. A list of major industries with name and type within study area (10 km radius) will be incorporated.

viii. Land use details of the study area, geological features and geo-hydrological status of the study area will be included.

ix. Details of drainage of the project up to 5 km radius of study area. If the site is within 1 km radius of any major river, peak and lean season river discharge as well as flood occurrence frequency based on peak rainfall data of the past 30 years. Details of FloodLevel of the project site and maximum Flood Level of the river will also be provided.

5. Environmental Status

i. Determination of atmospheric inversion level at the project site and site-specific micrometeorological data using temperature, relative humidity, hourly wind speed and direction and rainfall.

ii. Ambient Air quality data (except monsoon) at 8 locations for PM_{10}, $PM_{2.5}$, SO_2,NO_X and other Parameters relevant to the project will be collected. The monitoring stations will be based E P A Punjab guideline and take into account the pre-dominant winddirection, population zone and sensitive receptors including reserved forests.

iii. Surface water quality of nearby River (100 m upstream and downstream of discharge point)

iv. Ground water monitoring at minimum at 8 locations will be included.

v. Noise levels monitoring at 8 locations within the study area.

vi. Soil characteristic as per Pakistan Soil standard guidelines.

vii. Traffic study of the area, type of vehicles, frequency of vehicles for transportation of materials, additional traffic due to proposed project, parking arrangement etc.

viii. Detailed description of flora and fauna existing in the study area will be given with special reference to rare, endemic and endangered species. If Schedule-I fauna are found within the study area, a Wildlife Conservation Plan will be prepared and furnished.

ix. Socio-economic status of the study area.

6. Impact and Environment Management Plan

i. Assessment of ground level concentration of pollutants from the stack emission based on site-specific meteorological features. In case the project is located on a hilly terrain, the AQIP Modeling will be done using inputs of the specific terrain characteristics for

determining the potential impacts of the project on the AAQ. Cumulative impact of all sources of emissions (including transportation) on the AAQ of the area will be assessed. Details of the model used and the input data used for modeling will also be provided. The air quality contours will be plotted on a location map showing the location of project site, habitation nearby, sensitive receptors, if any.

ii. Water quality modeling - in case of discharge in water body

iii. Impact of the transport of the raw materials and products on the surrounding environment will be assessed and provided. In this regard, options for transport of raw materials and finished products and wastes (large quantities) by rail or rail-cum road transport or conveyer cum-rail transport will be examined.

iv. A note on treatment of wastewater from different plant operations, extent recycled and

reused for different purposes will be included. Complete scheme of effluent treatment. Characteristics of untreated and treated effluent to meet the prescribed standards of discharge under EPA Rules.

v. Details of stack emission and action plan for control of emissions to meet standards.

vi. Measures for fugitive emission control

vii. Details of hazardous waste generation and their storage, utilization and management.

Copies of MoU regarding utilization of solid and hazardous waste in cement plant will also be included. EMP will include the concept of waste-minimization, recycle/ reuse/

recover techniques, energy conservation and natural resource conservation.

viii. Proper utilization of fly ash will be ensured as per Fly Ash Notification, 2009. A detailed Plan of action will be provided.

ix. Action plan for the green belt development plan in 33 % area i.e. land with not less than

1,500 trees per ha. Giving details of species, width of plantation, planning schedule etc. will be included. The green belt will be around the project boundary and a scheme for greening of the roads used for the project will be incorporated.

x. Action plan for rainwater harvesting measures at plant site will be submitted to harvest

rainwater from the rooftops and storm water drains to recharge the ground water and also to use for the various activities at the project site to conserve fresh water

xi. Total capital cost and recurring cost/ annum for environmental pollution control measures will be included.

xii. Action plan for post-project environmental monitoring will be submitted.

xiii. Onsite and Offsite Disaster (natural and manufactured) Preparedness and Emergency Management Plan including Risk Assessment and damage control. Disaster Management Plan should be linked with District Disaster Management Plan.

7. Occupational health

i. Plan and fund allocation to ensure the occupational health & safety of all contract and casual workers.

ii. Details of exposure specific health status evaluation of worker. During pre-placement and periodical examinations and the details of the same. Details regarding last month analyzed data of above-mentioned parameters as per age, sex, duration of exposure and department wise.

iii. Details of existing Occupational & Safety Hazards. What are the exposure levels of hazards?

and whether they are within Permissible Exposure level (PEL). If these are not within PEL, what measures the company has adopted to keep them within PEL so that health of the workers can be preserved, annual report of health status of workers with special reference to Occupational Health and Safety.

8. Corporate Environment Policy

Detailed in Environment Policy of the Factory

i. Hierarchical system or administrative order of the company to deal with the environmental issues and for ensuring compliance with the environmental clearanceconditions? Details of this system may be given.

ii. Reporting of non-compliances / violations of environmental norms to the Board of Directors of the company and/or shareholders or stakeholders at large and this reporting mechanism will be detailed in the EIA report.

9. Infrastructure facilities

Details such as sanitation, fuel, restroom etc. to be provided to labor force duringconstruction as well as to the casual workers including truck drivers during operation phase.

10. Specific Terms of Reference for EIA Studies for Distilleries

i. List of existing distillery units in the study area along with their capacity and sourcing of raw material.

ii. Number of working days of the distillery unit.

iii. Details of raw materials with their source & availability.

iv. Details of the use of steam from the boiler.

v. Surface and Ground water quality around proposed ETP.

vi. Proposed effluent treatment system (condensate and utilities) as well as domestic sewage

vii. Proposed action to restrict fresh water consumption.

viii. Details about capacity of storage tank, material used, design consideration.

ix. Action plan to control ground water pollution.

x. Details of solid waste management including management of ash, yeast, etc.

xi. Details of ash generation and its disposal, if used.

xii. Action plan to control odor pollution.

EIA REPORT

M/S ETISTAR BIOENERGY (PVT.) LTD, SITUATED AT CHAK NO. 106/1-L, TEHSIL KHANPUR DISTRICT RAHIM YAR KHAN

CHAPTER II

PROJECT DESCRIPTION

CHAPTER II

PROJECT DESCRIPTION

2.1 INTRODUCTION

This chapter furnishes detail information on project type, its need, location, size/magnitude, technology and process. It also gives details on complete of the project its description, operating conditions and implementation schedule.

2.2 TYPE OF PROJECT

The Manufacturing of Rectified Spirit/ Extra Neutral Alcohol/ alcohol for making liquor/ fuel will be done by adopting Batch fermentation method. The fermented wash will be distilled in a pressure & vacuum distillation to obtain rectified spirit or Extra Neutral Alcoholat 96.0% of total volume and 4.0% of B-Grade or Industries grade ethanol to be obtained. The impurities in Rectified Spirit will be reduced by diluting and redistilling the spirit. The impurities like aldehydes, ketones, acids, esters, higher alcohols are minimized by controlled condition.

2.3 OBJECTIVE OF THE PROJECT

Utilization of molasses for the production of ethanol in Pakistan will not only provide value addition to the by-product, it also ensures better price stability and price realization of molasses for the sugar mills. This will improve the viability of the sugar mills, which will in turn benefit to Chak No. 106/1-L, Tehsil Khanpur District Rahim yar khan. In addition to the objective, creation of new job opportunities. meanwhile providing better job opportunities to the local community.

2.4 INDUSTRY OVERVIEW

Molasses is one of major byproducts of sugar industry which is used to produce rectified spirit/alcohol for mainly for export and fuel. Traditionally, molasses has been used in Pakistan to produce rectified spirit and alcohol of higher than 95% purity for export purpose and for producing various chemicals. However, with technological developments in the recent past, molasses has been effectively used to produce bioethanol for blending with petrol as a fuel.

2.5 GLOBAL SENARIO

Brazil is the second largest producer of ethanol globally after U.S. While U.S. produces ethanol from corn, Brazil manufactures ethanol from sugarcane. Brazil has mandatory blending ratio of ethanol in gasoline ranging from 18% to 25%. The blend rate was as high as 25% before September 2011 and was reduced to 20% due to drop in cane output hence affecting the ethanol production. Currently, flex-fuel cars, which can use either ethanol or blended gasoline, in Brazil account for about 53% of the total car fleet and around 90% of the new vehicles sales. The proportion of the flex-fuel cars are expected to cross 80% by 2020. Currently, the Brazilian light vehicle fleet has been increasing by 6.7% y-o-y since 2003 with currently 90% ofthe new vehicles being flex-fuel cars. Thus, there exists an increasing demand in Brazil for ethanol which is encouraging for the sugarcane industry.

2.6 PAKISTAN SCENARIO

Pakistan has about 25 distilleries, which produce over 700 million liters of rectified spirit (alcohol) a year. Beyond total distilleries, about all distilleries have the capacity to distillate 700 million liters for export purpose and local purpose.

2.7 GOVERNMENT POLICY

In 2008, GOP mandated 10% ethanol blending with petrol, EBP programmed to directly benefit the sugarcane farmers by assuring the sugar industry a stable and reasonable return for the molasses and then passing a significant part of the same to the farmers. Pakistan government supporting export-based industries by provide ERF (Export Refinancing) for export at very nominal markup of 5%, market for ethanol producers - mostly sugar companies. This shall result in an increased demand for ethanol for export.

2.8 DEMAND & SUPPLY GAP

The gap between the availability of alcohol and the requirement by the industry has been widening. The existing requirement of alcohol by the industries is around 700 million liters 70 crore liters annually for export and even more alcohol produced will be exported.

2.9 LOCATION AND SITE DETAILS

The proposed project will be located at Chak No. 106/1-L, Tehsil Khanpur District Rahim yar khan. The proposed site is in the have nearby sugar factory; so that there is less transportation of molasses and the maximum resources likewater, power and road connectivity are available. The land requirement for proposed industry unit is already in possession and it is not prime agricultural land. Road is adjacentto proposed site. District headquarter Rahim yar Khan is (47.2 km) km away from the project site. The nearest habitation is village at Chak No. 106/1-L, km away from the project site.

There are no Tropical Forest, Biosphere Reserve, National Park, Wild Life Sanctuary and Coral Formation Reserves within 10 km Influence Zone.

The topography of the proposed project site is nearly flat with some undulating patches. The existing land is used for industrial purpose and comes under khanpur. Rainy Canal is flowing at a distance of 30 km in west and SCARP drain in north at 5 km from the project site.

The general location map is given in Figure 2 and Figure 3 showing project site boundary on Google map. Plant Layout of proposed project is given in Figure 4.

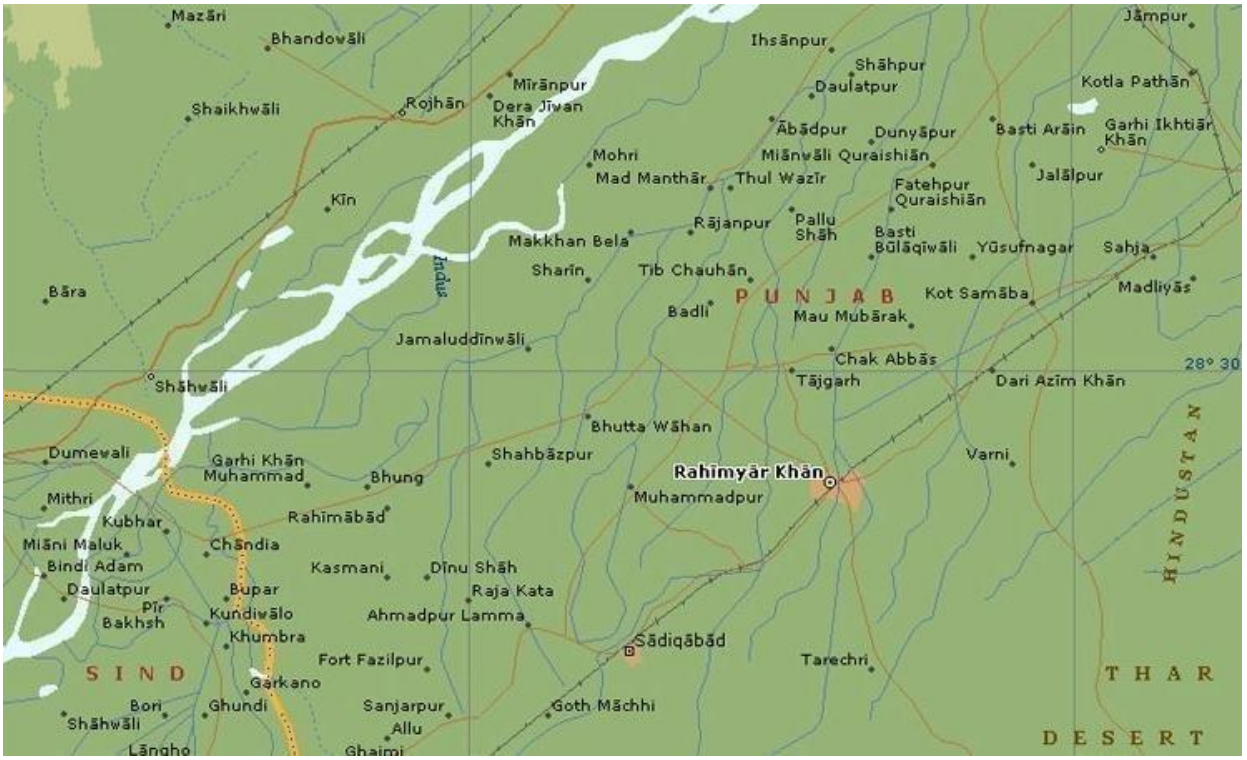


FIGURE 2 GENERAL LOCATION MAP OF SITE

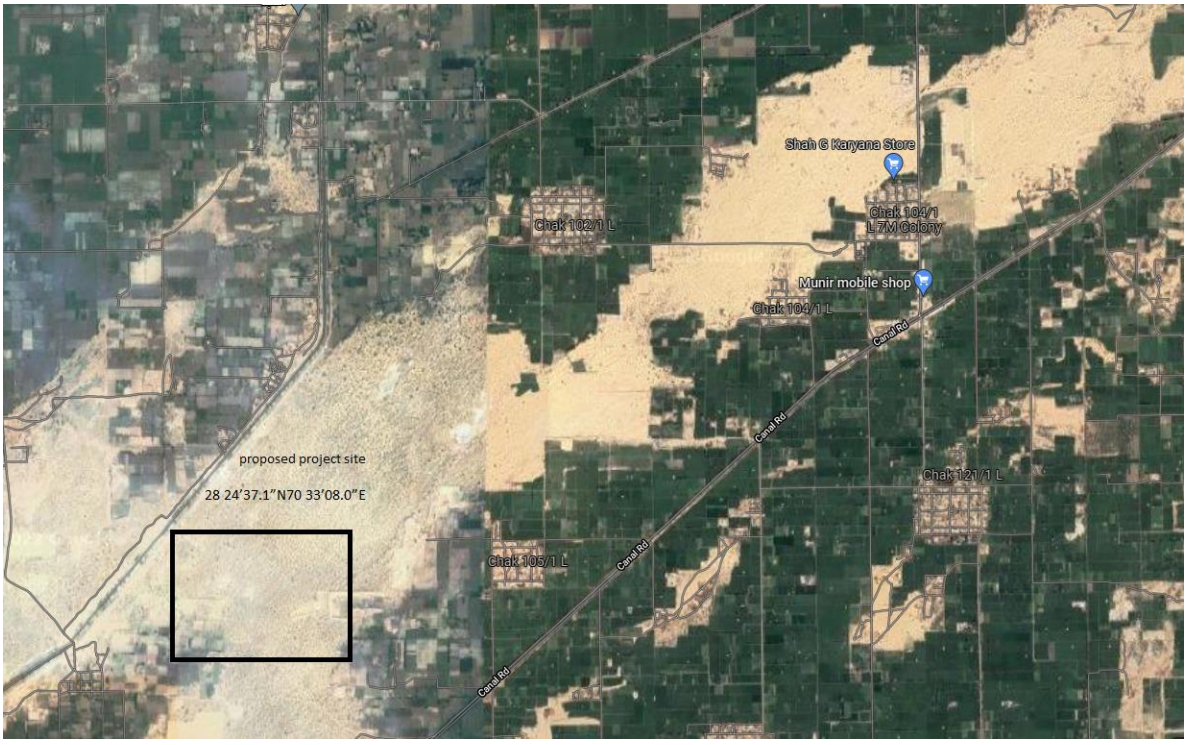


Figure 3 PROPOSED DISTILLERY LOCATION

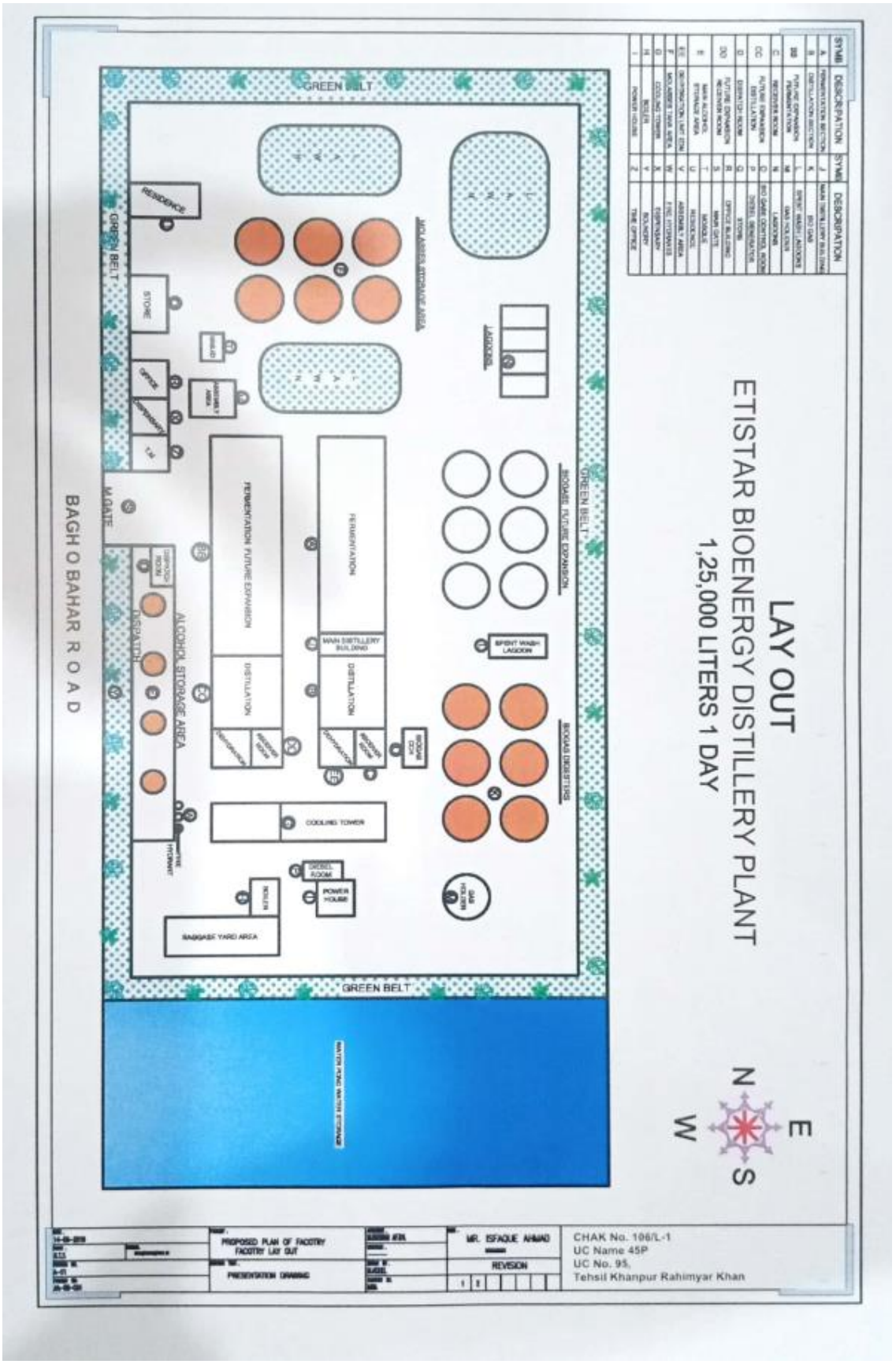


FIGURE 4 PROJECT LAYOUT PLAN

CHAK NO. 106/1-L, TEHSIL KHANPUR DISTRICT RAHIM YAR KHAN

2.10 Road Access

The subject project situated in the area of District Rahim Yar Khan with main access roads named Khan Bela to Liaquatpur Road linked to the other main roads.

2.11 Vegetation features of the project

The project site has few and scattered amount of vegetation, only five trees will be cut during construction. Project site is open land that will help to avoid land clearing, mainly shrubs, weeds and grasses are present over there in scattered quantity.

2.12 Schedule of implementation

The proponent is waiting for the environmental approval from environmental protection department. No Construction work has been initiated so far as the company is waiting for the Environmental Approval from the Department. After the approval, the project construction work would be carried out within 6-8 months.

Sr. #	Activities	2.5 Months			2.5 Months			2.5 Months			2.5 Months		
		4W	4W	2W	4W	4W	2W	4W	4W	2W	4W	4W	2W
1	Detailed Designing	■	■										
2	Mobilization of Contractors			■									
3	Lean Development Period				■	■	■						
4	Peak installation Period							■	■	■	■	■	
5	Plantation at Site												■
6	Commissioning												*
W=Weeks													

2.13 Magnitude of the operation including capital cost, and associated activities

M/S Etistar Bioenergy (Pvt.) Ltd is proposing a 125 KLPD molasses-based distillery. Molasses is one of byproducts of sugar industry which is used to produce rectified spirit/alcohol for making spirit and fuel. The main raw material for distillery is molasses. Other raw materials will be some chemicals and Yeast which help in fermentation. The total area of the proposed project is 25 Acre and total cost of the project is 4000 million

2.14 Restoration / Rehabilitation Plan

All possible precaution will be taken to prevent an untoward incident in terms of life and property losses. The demolition materials will possibly be reused and recycled. All excavated surfaces will be termite proofed.

One completion of the project, the debris will be removed from the site in order to maintain aesthetics of the project. All measures will be undertaken for ensuring occupational safety, security and clean environment in the project area. Ornamental trees and flower plants will be planted on inside peripheral of the unit premises to restore the land.

TABLE 2.1: LAND BIFURCATION

No.	Units	Area (sq. m.)
1.	Molasses Storage Tanks	8100
2.	Fermentation Section	4500
3.	Distillation Section	1500
4.	Control Building Section	450
5.	Receiver Room and Pumps	1000
6.	Main Alcohol Storage and Dyke wall and Pump	8000
7.	Cooling Tower for Fermentation	200
8.	Cooling Tower for Distillation	400
9.	Power House & Turbine	1000
10.	Residence	200
11.	storage pit	120

12.	Weigh Bridge	75
13.	Administration Office	225
14.	Excise Office & Residence	100
15.	Biogas Plant	36000
16.	Time Office	20
17.	Digester House	2100
18.	Bagasse Yard	4500
19.	Lagoon & Settling Pit	7700
20.	Fire Water Pump House	110
21.	Total area	76300
22	Acres	19.075

The land requirement for different applications for the proposed industry consisting of sugar, power and distillery units are given in Table 2.2.

TABLE 2.2: LAND UTILIZATION

Sr. No.	Land utilization	Area in acres
1.	Distillery Plant Area including Biogas	19.075
2.	Green Area	6.4
3.	Future Expansion	14.60
4.	Green area further	6.4
5.	Vacant land	3.525

6.	Wet Land Area	200
7.	Total area	250

2.15 SALIENT FEATURES OF THE PROJECT

Brief information of the project is given in Table 2.3 and design parameter for distillery is given in Table 2.4.

TABLE 2.3: PROJECT INFORMATION IN BRIEF

Sr. No.	Particulate	Description
1.	Name of the proponent	M/S Etistar Bioenergy Pvt Ltd,
2.	Project capacity	125 KLPD Molasses Based Distillery
3.	Location of the project	Situated at Chak No. 106/1-LTehsil Khanpur District Rahim yar khan
4.	Geographic Location	28 24’37.1”N 70 33’08.0”E.
5.	Land requirement	50 Acre for Plant and Green Belt and 200 Acre for WetLand System

6.	Product	**Products** • Rectified spirit (RS) :125 KLPD **Or** • Extra Neutral Alcohol (ENA): 125 KLPD **Or** • Anhydrous Alcohol (only Fuelgrade):125.00 KLPD
7.	Operation days	330 days
8.	Molasses required	Molasses 490-500 TPD (Fermentable sugar 45 **%** w/w)
9.	Total water	2100 CMD
10.	Source of water	Ground Water
11.	Electricity	Operational: 1500 kWh Connected load: 2500 kWh
12.	Turbine generator	2.5 MW

13.	Steam	20.0 TPH

14.	Fuel	Bagasse or Rice Husk: 65 TPD Biogas: 56000 Cm/DAY
15.	Source	Nearby Sugar Mills or Rice Plants
16.	Boiler	20 TPH
17.	DG	Two DG sets of capacity 500 kVA
18.	Effluent treatment system	Effluent Treatment Plant where its COD and BOD are decreased up to 80% then sent to aeration lagoons and then wet land system nearby
19.	Man-power	150 skilled and unskilled
20.	Total project cost	4000 million PKR

TABLE 2.4: DESIGN PARAMETER FOR DISTILLERY OPERATION

Sr. No.	**Description**	**Quantity**
1.	Sugar factory crushing capacity (TCD) (Two Units)	18000
2.	No. of hrs. per day	24
3.	No. of season days, sugar factory	100
4.	Cane crushing (MT) @ 18000 day	1800000
5.	Molasses % cane	4.50
6.	Molasses available	72000

7.	Molasses available per day @100 days (MTD)	720
8.	Distillery capacity (KLPD)	125
9.	No. of days of operation of distillery	330
10.	Molasses required for distillery MT per annum	165000
11.	Molasses required for distillery MT per day	500 TPD
12.	Own molasses available MT per annum	81000
13.	Procured molasses MT per annum	84000
	Ethanol recovery for one liters / MT of molasses containing 45% w/w fermentable sugars @95 %v/v	250

2.16 Resource requirement

The detail raw material required for distillery operation listed below in Table 2.5.

TABLE 2.5: RAW MATERIAL REQUIREMENT

Sr. No.	Name of raw material	Quantity	Storage	Transportation
	Distillery			
1.	Molasses	490-500 TPD	3 X 15000 MT	Tanker
2.	Bagasse	65.00 TPD	-	Trucks/Trollers

3.	Sulfuric Acid	10 kg /kl	-	Tanker
4.	Urea	5 kg/kl	-	Trucks
5.	Di ammonium Phosphate	4 kg /kl	-	Trucks
6.	Anti-foam reagent	2.5 kg/kl	-	Trucks

Molasses

Molasses is a by–product from sugar industry left behind after the extraction of crystalline sugar from the evaporated sugar can juice. Molasses fermentation process utilizes yeast enzymes to convert the sugar into alcohol. Molasses is a viscous byproduct of the refining of sugarcane or sugar beets into sugar. Molasses contains 50 to 55% dissolved sugar, of which is 35 to 40% is in the form of sucrose and 15 to 20% in the form of inverted sugar. An output of 250 liters of alcohol can be secured out of every ton of molasses, allowing for wastage and use of molasses for various other purposes. Proposed distillery of 125 KLPD required 500 TPD molasses. Molasses will be procured from nearby sugar factories. The factory has received letter of intent from five nearby sugar factories regarding the supply of molasses. General specification of molasses is given in Table 2.6. List of sugar factories providing molasses is given in Table 2.7.

TABLE 2.6: MOLASSES SPECIFICATION

No.	Specification		
1.	Molasses requirement	500	TPD
2.	Total Solids	80	%W/W
3.	Color in terms of optical density (OD) at 375 nm with 0.1 % w/v molasses dilution	<0.35	OD
4.	pH at 40° Brix	4.5 -5.0	
5.	Total Inorganics	< 12	%W/W
6.	Fermentable Sugar (FS)	45	%W/W
7.	F/N Ratio	0.9	
8.	Total Dry Sludge at pH 4.5	< 2.5	%W/W
9.	Titratable Volatile Acids	< 5000	Ppm
10.	Yeast Free Assimilable Nitrogen Content (FAN)	1500	Ppm
11.	Butyric Acid Content	<100	Ppm
12.	Total Bacterial Count	<1000	Cfu/gm
13.	Sulphated Ash	12	

TABLE 2.7: SUGAR FACTORY LIST

Sr. No.	**Name of factory/ supplier**	**Capacity TCD**	**Molasses quantity**	**Distance from factory**
1.	United Sugar (JDW-2) Sugar Mill Goth Machi	16000	65000-	~35-40 km
	Sadiqabad		72000 MT	
2.	JDW-1 Sugar Mill Jamaluddin wali RoadRahimyar Khan	24000	105000- 110000 MT	~55-60 km
3.	JK 2 Sugar Mill Murid Shakh Ghotki	18000	75000- 81000 MT	~40-45 km
4.	Etihad Sugar Mill Iqbalabad Rahimyar Khan	18000	75000- 81000 MT	~55-60 km
5.	Hamza Sugar Mill Khanpur Rahimyar Khan	28000	120000- 130000 MT	~80-90 km
6.	Ghotki (JDW-3) Sugar Mill	18000	75000- 81000 MT	~80-90 km

7.	Dahrki Sugar Mill Ghotki	16000	65000- 72000 MT	~40-45 km
8..	SGM Sugar Mill Khan Garh Ghotki	8000	32000-36000 T	~120-125 km

2.17 Water requirement

The total fresh water requirement at the startup will be around 2100 m^3/day, Source of water will be Lakhi Minor coming from Sadiq canal/Gulan Canal from Head Punjnad. Water storage facility will be managed for at least 30 days with storage ponds. Detail water breakup is given in Table 2.8.

TABLE 2.8: WATER AND WASTEWATER BALANCE FOR DISTILLERY

Sr. No.	Water inputs	CMD
1.	Process water for fermentation section and CO_2 scrubber	1400-1800
2.	DM water for RS dilution	1260-1620
3.	Water for vacuum pump, pump sealing, air blower & others	30
4.	Soft water makeup for cooling towers	500
5.	Other domestic usage, laboratory uses, cleaning	10
6.	Boiler	480
7.	Total water input at start-up	For winter 2100 & for summers 2500

	Water out Put	
1.	DIGESTOR	240
2.	Process condensate	480
3.	CT Evaporation & Drift Losses	545
4.	Water losses from vacuum pump, pump sealing, Air blower	1.0
5.	Cooling tower and boiler blow down	13 4
6.	**Total Water Output**	1400
	Recycled water 480 from Boiler Condensate	
1.	RO rejection	240
2.	Process condensate fermentation	400
3.	Process condensate to cooling tower, CIP, Fermentation	180
4.	Pumps Sealing Water Recycle cooling tower	9
5.	CO_2 scrubber beer well to process water for fermentation	1
6.	Total Recycling water per day	830
7	Daily Fresh Water Input	1400

2.18 Electricity requirement

The estimated power requirement will be 1340 kWh. The power required will be met from power generation 2.5 MW. Total power requirement forfermentation, distillation, ENA section, cooling tower, storage and plant yard lightning. Backup power arrangement is done with DG sets of capacity 500 kVA. Electricity consumption breakup is given in Table 2.9

TABLE 2.9: ELECTRICITY CONSUMPTION BIFURCATION

Sr. No.	Section	Operating load (kWh)	Connected load (kWh)
1.	Fermentation	280	400
2.	Distillation	150	300
3.	Dispatch	30	50
4.	Instrument Air compressor	30	50
5	Cooling Towers	400	800
6	Boiler	150	300
7	RO Plant	100	200
8	Biogas	200	400
9	Total	1340	2500

2.19 STEAM REQUIREMENT

The estimated total steam requirement of the proposed distillery will be 16.0 TPH.

TABLE 2.10: STEAM BIFURCATION

Sr. No.	Section	Quantity (TPH)
1.	Steam for Distillation (Wash to ENA mode).	15.0
2.	Steam for Fermentation Section	1.0
3.	**Total**	**16.00**

Major utilities details

TABLE 2.11: BOILER DETAILS WITH STACK DETAILS

Sr. No.	Boiler	Unit	Design Capacity
1.	New 20 TPH biogass/biomass fired boiler	TPH	20
2.	Fuel (Bagasse)	TPD	65
3.	Flow rate of Bio gases, $Nm^3/hr.$	$Nm^3/hr.$	2500
4.	Flue gas temperature at stack, C^0	^0C	180
5.	Flue gas velocity through stack/s	m/s	18
6.	Emission rate of PM10	mg/Nm3	50
7.	Emission rate of NOx	ppm v on 7% O_2DRY	300
8.	Emission rate of SO_2	Ppm v on 7% O_2 dry	1100+/- 25
9.	Stack height, m	m	30
10.	APC device	-	Electrostatic precipitator
11.	Ash	TP/Day	2.0

TABLE 2.12: COOLING TOWER DETAILS

Sr. No	Particular	Quantity
1.	Distillation	1200 CMD
2.	Fermentation	700 CMD

2.20 Fuel Requirement

HSD diesel will beused in D.G sets in case of power shut down or emergency. Fuel consumption details are given in below in Table 2.13

TABLE 2.13: FUEL CONSUMPTION

Sr. No	Fuel	Quantity
1.	Biogas From ETP	55000 CMD
2.	Bagasse	65 TPD

2.21 Manpower requirement

During construction phase 225-250 skilled and un-skilled labors will be required. Local labors will be engaged during construction phase. During operation phase skilled labor like distillery Manager, Process Engineers, Supervisor and Operators will be required. Total initial manpower requirement during operation phase is given below in Table 2.14. The required skilled manpower shall be made available from the local area and appropriate training will be imparted to get required skill for the operation of the plant.

TABLE 2.14: TOTAL MANPOWER REQUIREMENT

Sr. No	Staff	Nos.
1.	Distillery manager	1
2.	Production manager	1
3.	ETP in-charge	1
4.	Lab chemist	3
5.	Operators	6
6.	Project Engineer / Shift Engineer	4
7.	Electrician	9
8.	Mechanical fitters	9
9.	Office Peon/Helper/Technical Helper	88
10.	Office assistant	2
11.	Excise officer	3
12.	Waterman/ Pump man	3
13.	Other Contractual staff	90
14.	Security	30
15	Total	250

2.22 PROCESS DESCRIPTION

Alcohol/Ethanol will be manufactured by Batch fermentation process. The main steps in this operation are as follow:

- Dilution of Molasses with water and acid addition
- Dilution: Preparation of molasses for fermentation by appropriate dilution with water
- Fermentation: Production of alcohol from fermentable sugars in molasses solution with the help of yeast
- Distillation: Product recovery through distillation processes

FEED PREPARATION AND WEIGHING

Molasses stored in a Daily storage tank apply Numeric cater so that accurate quantity can be fed to the fermentation section. The weighed molasses then transferred from tank to the dilutor in fermentation section where it is diluted with water and fed to the Fermenter.

DILUTION

The molasses contains about 45-50% sugar. The main dilution operation occurs in a diluter where the solid concentration is brought down to 30-35° Brix. The bulk of this diluted molasses is fed to the fermentation Tank while a small quantity is further diluted to 10-15°Brix and used for preparation of the final yeast inoculum. Additives like urea and de-foaming oil are also introduced in the fermenter as required. Propagation of yeast for the final inoculation is done in successive stages in volumes of 10, 100, 1000 and 10,000 liters where, in each stage, 10 parts of diluted molasses is inoculated with 1 part of yeast culture.

FERMENTATION

Fermentation process in the fermentation tank continues for about 30 to 45 hours after the final inoculum of yeast addition. *Saccharomyces cerevisiae* metabolize sugar in the presence of oxygen, they produce ethanol and CO_2.

The fermentation process is exothermic in reaction. Every kilogram of alcohol generates about 290 kilocalories of heat. This excess heat is removed by continuous circulation of fermented wash through an external plate heat exchanger called the fermenter cooler. The fermenter temperature is always maintained between 32-34^{0}C, the optimum range for efficient fermentation.

YEAST PROPAGATION

- Culture yeast is grown in laboratory during plant startup. Yeast propagation section comprises molasses diluter and hygienically engineered yeast vessels equipped with heating, cooling and air sparging facility.
- Dilute molasses media is prepared in yeast vessel. Laboratory propagated cell mass is scaled up in series of yeast vessels. Sterile air is sparged in pasteurized and cooled dilute molasses medium for optimum growth of yeast. Temperature is maintained by recirculation of cooling water through jacket of yeast vessels. Cell mass from Yeast vesselis transferred to yeast activation vessel to buildup cell mass required for Fermentation by cell mass transfer pump.

PRE-FERMENTATION

In Pre-Fermenter vessel, molasses, process water, nutrients and additive are added for activation/growth of cell mass. Filtered air is sparged as required for repairing of cell

membranes and other cell components. Activated cell mass is transferred to fermenter to maintain desired cell mass concentration in fermenter.

Fermentation

The Fermentation process is engineered to operate in batch mode. The purpose of Fermentation is to convert the fermentable sugars into alcohol. During Fermentation, sugars are broken down into alcohol and carbon dioxide and significant heat is released. The fermenter temperature is maintained at around 30 -32^{0}C by forced recirculation flow through plate heat exchangers.

MULTI PRESSURE DISTILLATION/ VACUUM DISTILLATION

Multi-pressure/ vacuum distillation scheme has distillation columns operating under different pressures/ vacuum. Heat energy from columns operating under high pressure is recycled back to columns operating under low pressure to conserve energy. The plant can be operated under two different modes to produce Rectified Spirit (RS) or Extra Neutral Alcohol (ENA) as desired.

Following columns will be under operation

i. Distillation / Degassing Column
ii. Hydro Selection Column
iii. Rectification Column
iv. Refining Column
v. Low Impurities Column
vi. Very Low impurities column

PROCESS

- Pre-heated Fermented wash will be fed to Distillation and Degasifying Column.

- Fermented wash is stripped off alcohol by ascending vapors in Analyzer Column.

- Vapors of Degasifying Column are condensed and fed to Hydro selection column.

- Condensed Analyzer vapors are taken to ED Feed Tank.

- The condensate from ED feed tank is fed to Purifier column in 1:3 dilutions and diluted alcohol stream from the Purifier column bottom is fed to Rectifier Column, which operates under pressure.
- Rectifier column concentrates the diluted alcohol to 95% v/v concentration.

- A suitable Impure Spirit cut is taken out from this Column.

- Rectified Spirit draw of 95% v/v is taken out from the upper trays of Rectifier Column and taken to storage after passing it through a cooler.
- Fossil oil draw from Rectifier column is fed to Fossil oil column and concentrated impurities are separated from top of column. Concentrated fossil oil draw is taken from appropriate trays and fed to Fossil oil decanter for separation of Fossil oil.

DISTILLATION – WASH TO ENA MODE

Following Columns will be under operation

i. Distillation Column

ii. Degasifying Column

iii. Pre-Rectifier Column

iv. Extractive Distillation Column

v. Rectifier cum Exhaust Column

vi. Recovery Column

vii. Simmering Column

- Pre-heated Fermented wash will be fed to Degasifying Column.

- Fermented wash is stripped off alcohol by ascending vapors in Analyzer Column.

  Rectifier vapors provide energy to Analyzer Column.

- Vapors of Degasifying Column are condensed and taken to Recovery Feed Tank.

- Analyzer vapors are condensed in Falling Film Evaporator and are taken to Pre-Rectifier Feed Tank.
- Analyzer Condensate is concentrated in Pre-Rectifier Column, which operates under pressure. Condensing steam provides energy to Pre-Rectifier.
- A Technical Alcohol cut of Total Spirit is taken from the Pre-Rectifier column.

- Concentrated alcohol draw from Pre-Rectifier Column is fed to Extractive Distillation Column for purification. Dilution water is added in this column for concentratinghigher alcohol at the top. Top of this Column is condensed in its condensers and fed toRecovery Feed Tank while bottoms are fed to Rectifier cum Exhaust Column for concentration.
- Rectifier Column operates under Pressure and condensing steam provides energy to this column. Technical Alcohol cut is taken out from the top of this Column while ENA draw is taken out from appropriate upper trays and fed to Simmering Column after partial cooling.
- Fossil Oil build up is avoided by taking fossil oil draws from appropriate trays.

- These fusil oils along with the condensate of Degasifying & Extractive Distillation columns are fed to Recovery Column for concentration. A Technical Alcohol cut is taken out from the top of this column. Simmering Column is operated under high

Reflux for better separation of methanol and di-acetyls. Final ENA product draw is taken from the bottom of this column.

BENEFITS OF MULTI PRESSURE DISTILLATION

- Multi Pressure Distillation system has lower steam consumption as it is designed for maximum heat integration to conserve energy.
- Energy efficient Multi-Pressure Distillation system with a Steam Consumption kg/lit of Total Spirit (depending on mode of operation).
- Vacuum operation nearly eliminates scaling problem in Analyzer Column and ensures better separation of impurities, which results into better quality product.
- Well-engineered Plants with high efficiency trays to ensure elaborate separation and removal of impurities ensuring superior quality of Extra Neutral Alcohol.
- Analyzer Column with Hyper-stat Rh-Grid trays ensure high turbulence on tray, this minimizes chances of scaling. Also, this special construction of trays and access to each tray helps in easier cleaning column internals.
- Condensers are designed with multiple passes to ensure high velocity and to minimize scaling inside tubes.

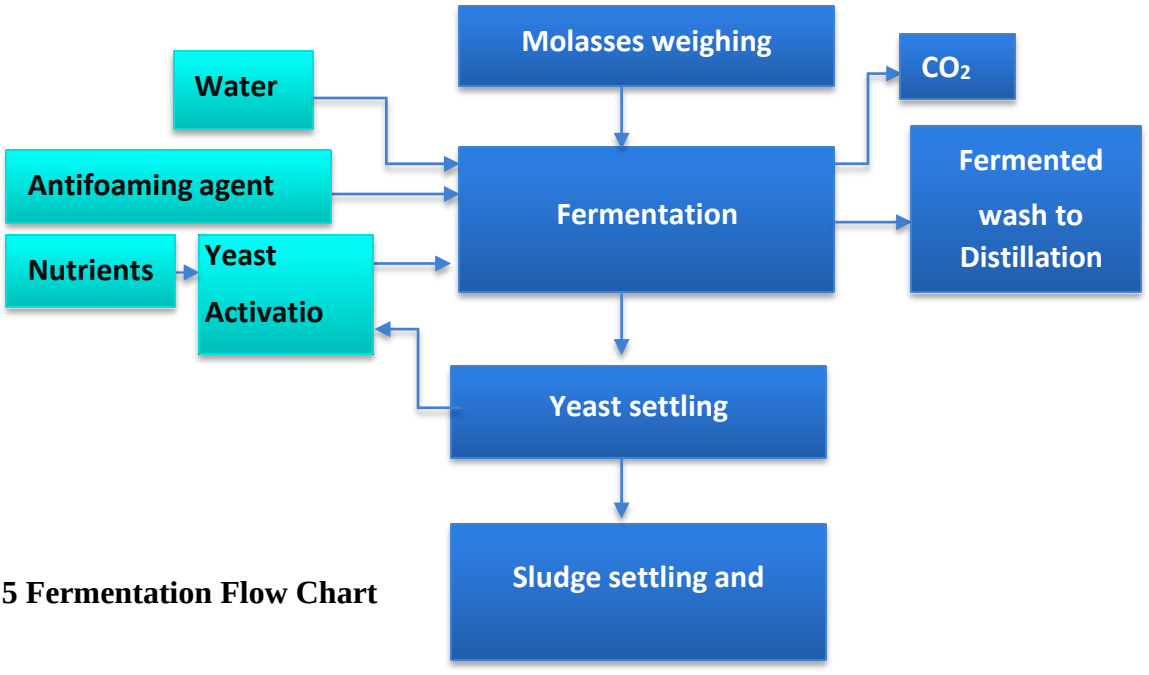


Figure 5 Fermentation Flow Chart

EQUIPMENT LIST

TABLE 2.15: LIST OF EQUIPMENT'S REQUIRED FOR DISTILLERY

Sr. No	EQUIPMENTS	SPECIFICATIONS	QUANTITY
1	Molasses Day Tank	Type: Cylindrical Vertical with Conical Top and Flat Sloping Bottom, Gross Cap:625 MT (300 m3 MOC: Mild Steel	2
2	Molasses Dilution tank	Type: Cylindrical Vertical With open Top and conical Bottom, Cap – 50.0 m3	1
3	Molasses Filter	Basket Strainer MOC: Mild Steel	2
4	Automatic Weighing system	100 Ton	1
5	Fermentation Preferments Tanks with air sparger	SS Tank with Cone Capacity 125 Tons Each	3
6	Dilute Acid Dosing Tank	Type: Cylindrical, Vertical, With Flat Top and Sloping Bottom, Capacity Gross :2 m3 MOC: MS	1
7	Antifoam Agent Tank	Type: Cylindrical, Vertical, With Flat Top and Sloping Bottom, Capacity Gross: 1 m3 MOC: MS	1
8	Nutrient Dosing Tank	Type: Cylindrical, Vertical, With Dished Topand Dished Bottom, Capacity	1

		Gross :1 m3 MOC: AISI 304	
9	Blower Water Collection Tank	Type: Cylindrical, Vertical, With Open Topand Flat Sloping Bottom, Capacity Gross :0.5 m3 MOC: MS	1
10	CO2 Scrubber	Standard MOC: AISI 304	1
11	Molasses Both Mixer for Fermenters	Static Mixer MOC: AISI 304	1
12	Sealing Water Tank pump	Type: Cylindrical, Vertical, With Open Top and Flat Sloping Bottom Capacity Gross :0.5m3	1

		MOC: AISI 304	
13	Fermenter with Side Agitator	Type: Cylindrical, Vertical, With Conical Topand Flat Sloping Bottom, Capacity Gross: 450 m3 MOC: SS304	8
14	Beer well with Side Agitator	Type: Cylindrical, Vertical, With Conical Topand Flat Sloping Bottom Capacity Gross: 450 m3 MOC: MS Epoxy	1
15	Weighed Molasses Tank	Type: Cylindrical, Vertical, With Conical Topand Flat Sloping Bottom, Capacity Gross: 30 m3	1

		MOC: Mild Steel	
16	Pre-Fermenter with Air Sparger	Type: Cylindrical, Vertical, With Conical Topand Flat Sloping Bottom, Capacity Gross: 150 m3 MOC: SS304	3
17	CIP Tank	Type: Cylindrical, Vertical, With Conical Top and Sloping Bottom, Capacity Gross: 50 m3MOC: MS	1
18	Wash Settling Tank	Type: Cylindrical, Vertical, With ConicalBottom, Capacity Gross: 175 m3 MOC: MS Epoxy	1
19	Sludge settling tank	Type: Cylindrical, Vertical, With ConicalBottom, Capacity Gross: 40 m3 MOC: MS Epoxy	1
20	Dilute Acid Dosing Pump	Type: Centrifugal Type MOC: Alloy 20	1
21	Nutrient Dosing Pump	Type: Centrifugal Type MOC: CF8	1
22	Fermenter - Fermented Wash Recirculation Pumps	Type: Centrifugal Type MOC: CF8	8

23	Motor for Fermenter Recirculation Pumps	Type: Non flame proof MOC: Standard	8
24	Motor for Pre fermenter	Type: Non flame proof	2
25	Transfer Pump	MOC: Standard	

26	Day Molasses Transfer Pump	Type: Screw/Gear Type MOC: BodyCI, Wetted Parts - CF8	2
27	Blower Water Recycle Pump	Type: Centrifugal Type Capacity: 2m3/ hr, 25 m MOC: Wetted Parts - CF8	2
28	Motor for Blower Water Recycle Pump	Type: Non flame proof MOC: Standard	2
29	Air Blower	Type: Water Ring Air Blower MOC: CI	2
30	Motor for Air Blower	Type: Non flame proof MOC: Standard	2
31	Air Filter for Blower	HEPA MOC: MS Frame	2
32	Fermented Wash Coolers	Type: Plate Heat Exchanger MOC: Frame: MS, Plates: SS316	8
33	Pre-Fermenter Cooler	Type: Plate Heat Exchanger	2

		MOC: Frame: MS, Plates: SS316	
34	Blower Water Cooler	Type: Plate Heat Exchanger MOC: Frame: MS, Plates: SS316	2
35	Safety System for Fermenters	Type: Breather Valve MOC: AISI 304	2
36	Cleaning Nozzle for Fermenters	Type: Breather Valve MOC: AISI 304	2
37	Decanter	Type – centrifuge MOC: Std.	2
38	DISTILLATION SECTION:		
39	Analyzer Column Día Type of tray No. of trays	2180 mm dia. Rh Grid, 18+1Nos.750 mm, MOC: Shell: SS304, Trays : SS304	1

	Trays Spacing		
40	Degasifying Column Día, Type of tray No. oftrays Trays Spacing	1200 mm dia. Sieve / Grid tray,5 trays, 750 mm,	1

41	Pre-Rectifier ColumnDía, Type of tray No. of trays Trays Spacing	1550 mm dia. Combination of Sieve tray & Bubble Cap, 56 trays, 250mm	1
42	Rectifier cum exhaust Column Dia Type of tray No.of trays	2050 mm dia. Combination of Sieve tray & Bubble Cap 68 trays 250 mm MOC: Shell – AISI 304, Trays - T1- T38	1
43	Spacing	AISI 304, & Shell & Trays - T39-T68 Dow Cu	
44	Fossil Oil Column diaType of tray No. of trays Tray Spacing	720 mm dia. Sieve 50 trays 250 mm MOC: Shell:SS304, Trays : SS304	1
45	Simmering ColumnDia Type of tray No. of trays, Trays Spacing	1200 mm dia. Sieve 50 trays 250 mm Shell: DowCu Trays: Dow Cu	1
46	Alcohol Scrubber	Sieve Tray MOC: Shell: SS304, Trays: SS304	1
47	Re-boilers		

48	Reboiler for Analyzer Column Vertical Thermosyphon	25.4 mm OD, tubes, MOC: AISI 304	3
49	Reboiler for Pre - Rectifier Column Vertical	25.4 mm OD tubes, MOC: AISI 304	1
	Thermo syphon		
50	Reboiler for Rectifier cum Exhaust Column VerticalThermo syphon	25.4 mm OD tubes, MOC: AISI 304	1
51	Reboiler for Extractive Distillation Column VerticalThermo syphon	25.4 mm OD tubes, MOC: AISI 304	1
52	Reboiler for SimmeringColumn Vertical Thermo syphon	25.4 mm OD tubes, MOC: AISI 304	1
53	Condensers and Coolers		
54	Analyzer Vent CondenserShell and tube heat exchanger	25.4 mm OD tubes MOC: AISI 304	1
55	Degasifying Condenser Shell	25.4 mm OD tubes,	1

	and tube heat exchanger	MOC: AISI 304	
56	Degasifying condenser 2 Shell and tube heat exchanger	25.4 mm OD tubes, MOC: AISI 304	1
57	Vent Condenser for Analyzer Reboiler Shell and tube heat exchanger	25.4 mm OD tubes, MOC: AISI 304	1
58	Rectifier PCV (Vent) Condenser Shell and tube heat exchanger	25.4 mm OD tubes, MOC: AISI 304	1
59	ED condenser I Shell andtube heat exchanger	25.4 mm OD tubes, MOC: AISI 304	1
60	ED condenser II Shell and tube heat exchanger,	25.4 mm OD tubes, MOC: AISI 304	1

61	FOC Condenser I Shell and tube heat exchanger	25.4 mm OD tubes, MOC: AISI 304	1
62	FOC Condenser II Shell and tube heat exchanger	25.4 mm OD tubes, MOC: AISI 304	1
63	Simmering Cond- I, Shell and tube heat exchanger	25.4 mm OD tubes MOC: AISI 304	1

64	Simmering Cond-II Shell and tube heat exchanger	25.4 mm OD tubes, MOC: AISI 304	1
65	Vent Condenser for Simmering Reboiler Shell and tube heat exchanger	25.4 mm OD tubes, MOC: AISI 304	1
66	Pre-Rectifier PCV condenser Shell and Tube heat exchanger	25.4 mm OD tubes, MOC: AISI 304	1
67	ED Feed Cooler Shell and tube heat exchanger	25.4 mm OD tubes, MOC: AISI 304	1
68	TA Cooler Shell and tube heat exchanger	25.4 mm OD tubes, MOC: AISI 304	1
69	Fossil Oil Cooler	Double pipe HE	2
70	Rectifier ENA Cooler Shell and tube heat exchanger	25.4 mm OD MOC: AISI 304	1
71	Pre-Rectifier FO CoolerShell and tube heat exchanger	25.4 mm OD MOC: AISI 304	1
72	Rectifier FO Cooler Shell	25.4 mm OD	1

	and tube heat exchanger	MOC: AISI 304	
73	Product cooler	25.4 mm OD	1
74	Fermented Wash	Plate heat exchanger	2

	preheater	MOC: Plates: SS 316 Frame: CS	
75	Pre-Rectifier Feed Preheater	Plate heat exchanger MOC: Plates: SS 316 Frame: CS	1
76	DM Water Preheater	Plate heat exchanger MOC: Plates: SS 316 Frame: CS	1
77	Cooler	Plate heat exchanger MOC: Plates: SS 316 Frame: CS	1
78	Sealing Water Cooler	Plate heat exchanger Plates: SS 316 Frame: CS	1
79	Analyzer Bottom Transfer Pump	Centrifugal Pump MOC Wetted parts: CF 8	2
80	Flash tank bottom transfer pump	Centrifugal Pump MOC: Wetted parts: CF 8	2
81	condensate transfer pump	Centrifugal Pump MOC: Wetted parts: CF 8	2
82	Rectifier reflux pump	Centrifugal Pump MOC: Wetted parts: CF 8	2

	FOC Feed Pump	Centrifugal Pump MOC: Wetted parts: CF 8	2
83	Rect. transfer pump	Centrifugal Pump MOC: Wetted parts: CF 8	2
84	FOC Reflux Pump	Centrifugal Pump MOC: Wetted parts: CF 8	2
85	ED bottom transfer pump	Centrifugal Pump MOC: Wetted parts: CF 8	2
86	FO Washing Pump	Centrifugal Pump MOC: Wetted parts: CF 8	2
87	Pre-Rectifier Reflux Pump	Centrifugal Pump MOC: Wetted parts: CF 8	2
88	ENA Transfer Pump	Centrifugal Pump	2

		MOC: Wetted parts: CF 8	
89	Simmering Reflux pump	Centrifugal Pump MOC: Wetted parts: CF 8	2
90	Vacuum pump	Centrifugal Pump MOC: CI	2
91	Sealing water pump for vacuum pump	Centrifugal Pump MOC: Wetted parts: CF 8	2

92	Steam condensate pump	Centrifugal Pump MOC: Wetted parts: CF 8	2
93	Sealing water transfer pump	Centrifugal Pump MOC: Wetted parts: CF 8	2
94	Tanks & Miscellaneous:		
95	Analyzer Flash tank	Cyl/ Vert shell Top & bottom Dished, Gross Cap – 5 m3 MOC: AISI 304	1
96	Rectifier Reflux Tank	Cyl/ Vert shell Top & bottom Dished, Gross Cap – 3.5 m3 MOC: AISI 304	1
97	Analyzer Condensate Tank	Cyl/ Hori shell Top & bottom Dished, Gross Cap – 3.5 m3 MOC: AISI 304	1
98	FO Washing tank	Cyl/ Vert shell Top & bottom Dished, Gross Cap – 1 m3 MOC: AISI 304	1
99	Recovery Feed tank	Cyl/ Vert shell Top & bottom Dished, Gross Cap – 0.5 m3 MOC: AISI 304	1

100	Recovery Reflux Tank	Cyl/ Vert shell Top & bottom Dished, Gross Cap – 0.5 m3 MOC: AISI	1
		304	
101	PR Reflux tank	Cyl/ Hori shell Top & bottom Dished, Gross Cap – 3 m3 MOC: AISI 304	1
102	Simmering Reflux tank	Cyl/ Vert shell Top & bottom Dished, Gross Cap – 1 m3 MOC: AISI304	1
103	Steam condensate tank	Cyl/ Hori shell Top & bottom Dished, Gross Cap – 2 m3 MOC:MS	1
104	tank	Cyl/ Vert shell Top & bottom Dished, Gross Cap – 1 m3 MOC: AISI 304	1
105	Sealing water Tank for vacuum pump	Cyl/ Vert shell Top & flat sloping Bottom MOC:MS	1
106	Fossil Oil Decanter prerectifier column	Dumbbell Shaped MOC: AISI 304	1
107	Fossil Oil Decanter recovery column	Dumbbell Shaped MOC: AISI 304	1

108	Gas Liquid Separator	Praj Standard MOC: AISI 304	1
109	TA Mixing Bottle	Cylindrical/ Vertical MOC: AISI 304	1
110	Manometer Bottle	Cylindrical/ Vertical MOC: AISI 304	2
111	ED Mixing Bottle	Cylindrical/ Vertical MOC: AISI 304	1
112	Vapour. Bottle	Cylindrical/ Vertical MOC: AISI 304	-
	MSDH Section		
	Columns		

113	Evaporator Column Dia Type of tray, No. of traysSpacing	850 mm dia. Sieve 23 trays 300 mm	1
114	Sieve Bed 1	Type: Cylindrical Shell with Topand Bottom Dished End MOC: AISI 304	1
115	Sieve Bed 2	Type: Cylindrical Shell with Topand Bottom Dished End MOC: AISI 304	1

116	Evaporation Column Shell & TubeType Vertical Thermo syphon	25.4 mm OD tubes MOC: AISI 304	1
	CONDENSERS AND COOLERS		
117	Super heater Shell and tube heat exchanger	25.4 mm OD tubes MOC: Shell: -AISI 304 Tubes:- AISI 304	1
118	Regeneration Condenser Shell and tube heat exchanger	25.4 mm OD tubes MOC: Shell:-AISI 304 Tubes:- AISI 304	1
119	Product Condenser Shell and tube heat Exchanger	25.4 mm OD MOC: Shell:- AISI 304 Tubes:- AISI 304	1
120	Feed Preheater Shell and tube heat exchanger	25.4 mm OD MOC: Shell:- AISI 304 Tubes:- AISI 304	1
121	Regeneration Preheater Shell and tube heat exchanger	25.4 mm OD MOC: Shell:- AISI 304 Tubes:- AISI 304	1
122	Feed Filter	Bag Filter MOC: CS	1
123	Regeneration Filter	Bag Filter MOC: CS	1

124	Product Filter	Bag Filter MOC: CS	1
	PUMPS & BOUGHT OUTS:		
125	Vacuum Educator	M.O.C: AISI 316	1
126	Regeneration Cooler	Plate heat exchanger MOC: Plates: SS 304, Frame: CS	1
127	Product Cooler	Plate heat exchanger MOC: Plates: SS 304, Frame: CS	1
128	Regeneration Pump	Centrifugal Pump MOC: Wetted parts' 8	2
129	Product Pump	Centrifugal Pump MOC: Wetted parts' 8	2
130	Molecular Sieve	Maguin Interis Standard	-
	Sieve Bed Internals (Inserts)	-	
	TANKS & MISCELLANEOUS:		
131	Regeneration Receiver	Cyl/ Vert shell Top & bottom Dished	1
132	Product Receiver	Cyl/ Vert shell Top & bottom Dished	1

133	Piping & Valves Instrumentation, Electrical	As specified in Respective annexure	-
	INTEGRATED STANDALONE EVAPORATION PLANT		
134	Biogas Digesters	Each Digesters having the capacity of 11000 CM for processing	6
135	Agitator /Mixers	Each Digesters have 2 individual agitator or mixer for the mixing of the during process	12

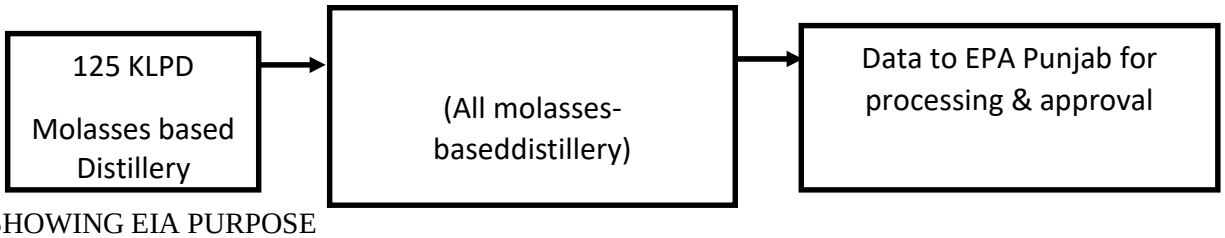
	Plate HE	Type Plate Type	
136		Plate Heat Exchanger is design for the heating in winter with steam and cooling the cooling water in summer	2
137	Biogas Blower	Blower used to send biogas	4
138	Gas Holder	To hold the gas for feeding to the digesters	1
139	feed Tank	Type: Cylindrical, vertical shell with dished top and bottom end; Gross Vol. – 10 M3 MOC: AISI 304	1
140	Process Condensate Tank	Type: Cylindrical, vertical shell with dishedtop and bottom end; Gross Vol – 2M3	1

		MOC: AISI 304	
141	Product Tank	Type: Cylindrical, vertical shell with dished top and bottom end; Gross Vol – 2M3 MOC: AISI 304	1
142	CIP tank	Type: Cylindrical, vertical shell with dishedtop and bottom end; Gross Vol – 15 M3 MOC: AISI 304	1
143	Sealing water Tank for vacuum pump	Cyl/ Vert shell Top & flat sloping bottom MOC: MS	1
144	Sealing water Tank for process pump	Cyl/ Vert shell Top & flat sloping bottom MOC: AISI 304	1
145	Vapor Bottles	Type: Cylindrical / Vertical Shell with DishedEnds MOC: AISI 304	10
	Bought out Equipment		-
146	Transferpump from lagoon	Type: Centrifugal Type MOC: Wetted Parts CF8	2
147	Motor	Type: Flame proof Type: Centrifugal Type;	2

	Transfer pump from		

	lagoon		
148	Feed Pump	Type: Centrifugal Type;	2
149	Motor for Feed Pump	Type: Flame proof	2
150	Recirculation cum Transfer Pump for FF	Type: Centrifugal Type; MOC: Wetted Parts CF8	12
151	Motor for Recirculation cum Transfer Pump for FF	Type: Flame proof	12

SCHEMATIC REPRESENTATION OF THE FEASIBILITY DRAWING



SHOWING EIA PURPOSE

2.23 ENVIRONMENT ASPECTS

Summary of major waste generation of the proposed distillery and its proposed disposal/treatment mechanism is given in Table 2.16

TABLE 2.16: WASTE GENERATION AND ITS TREATMENT MECHANISM

Sr. No.	Aspect	Pollutant Quantity	Treatment
1.	Wastewater	1600 KLD	Effluent Treatment Plantwhere it converted into Biogas and liquid goes to Wet Land
2.	Air Emission	SPM_{10}, $SPM_{2.5}$, Sox and NOx	Electro-Static Precipitator (ESP).
3.	Solid	• Yeast sludge	Sludge (Yeast and ETP) will be dried
4.		• Ash from Bagasse's	Ash will sell to brick manufacturer.

Air Pollution

- Air pollution during construction phase will be due to material handling, dust emission, vehicular movement and emission from machinery. Air emissions / pollution during operation phase will be mainly form flue gases, manufacturing process, material & Ash handling and from vehicular movement.

- Necessary preventive measures shall be taken during construction phase so that the ambient air quality will conform to National Ambient Air Quality standards.
- To avoid the generation of dust emission water sprinklers will be provided to suppress the dust.
- Distillery will be provided to the stack of 30-meter height to control the particulate matter emission into the air as main pollution control measures. Biogas shall be generated from Digesters. This Biogas will be fired with bagasse in boilers
- Water sprinkler will be provided at stack area to control fugitive emission
- Work zone area including internal roads in the plant will be asphalted or concreted.

Water spraying system will be installed for regular spraying of water on road and work zone to minimizing fugitive dust emission.

WASTE WATER

- Wastewater generated during the process of distillation will be treated in Effluent Treatment plant

SOLID WASTE/HAZARDOUS WASTE

- Ash generated will be given to brick manufacturers.

- Sludge from ETP will be used as manure.

2.24 PROJECT IMPLEMENTATION SCHEDULE

Project action will start after getting Environment Clearance from EPA Punjab and aftergetting the consent to establish from EPA Punjab and local NOC by district government. Estimated time

schedule of project implementation will be as mentioned in Table 2.1

TABLE 2.17: PROJECT IMPLEMENTATION

Sr. No	Activity	Period
1	Basic Engineering	4 weeks
2	Specification of Tender	2 weeks
3	Commercial Bidding	4 weeks
4	Bid Review & Finalization	4 weeks
5	Load Data	3 weeks
6	Civil	18 weeks
7	Structural work	18 weeks
8	Equipment manufacturing	18 weeks
9	Dispatch	2weeks
10	Installation	10 weeks
11	Local fabrications	10 weeks
12	Piping	15 weeks
13	Water Trials & commissioning	4 weeks

14	Commercial Production & handover	4 weeks
	Total	**116 weeks**

2.25 ENVIRONMENTAL CLEARANCE PROCESS CHRONOLOGY

- TOR Application: 2nd December 2021
- TOR Presentation: 11th December 2021
- TOR Approval: 28th December 2022
- Baseline data collection period: Jan to Feb 2022

2.26 PROJECT COST ESTIMATE

The total cost of the project is estimated about Rs. 4000 million PKR. The project cost estimates include land & land development, civil, building structure, plant & machinery band other expenses, contingencies @2% on building, plant & machinery, margin money of working capital. Environment management cost will be around Rs. 2.23 crores. The details of project cost are given in Table. 2.18 And EMP cost is mentioned in Table 2.19.

TABLE 2.18: TOTAL PROJECT COST

Sr. No	Description	Cost in (Rs. in PKR Million)
1.	Land and Land Development	1000
2.	Civil, Building / Structure	1000
3.	Plant & Machinery	1500
4.	Preliminary & Pre-operative and Other expenses	200
5.	Contingencies @ 2% on building, plant & machinery	200
6.	Margin money of working capital	100
8.	**Total**	**4000**

TABLE 2.19: ENVIRONMENT MANAGEMENT COST

Sr. No	Description	Capital Cost (Rs. in Million)	Recurring Cost (Rs. in Million)
1.	Air Pollution Control	10	1
2.	Water Pollution Control	7.5	1
3.	Solid waste Management	1.0	0.3
4.	Environmental Monitoring and Management	_	2
5.	Rainwater Harvesting	2.0	.5
6.	Occupational Health	1.0	.6
7.	Green belt development	1.0	.5
	Total	**22.5**	**5.9**

2.27 CONCLUSION

Chapter II describes the size, magnitude and basic requirements of the project. Environmental impacts due to proposed project activities have been identified. From the project description it is clear that major impacts are anticipated from wastewater, solid waste generation and air emissions. To predict the environmental impact of the project, baseline studies have been conducted in the month of January to February 2022. Baseline study reveals that the existing environmental condition in the proposed project area help to understand extent of existing pollution and thereafter the impact of the proposed activities from the prediction or through the

air modeling

EIA REPORT

M/S ETISTAR BIOENERGY (PVT. LTD) SITUATED AT CHAK NO. 106/1-L, KHANPUR DISTRICT RAHIM YAR KHAN

CHAPTER III

DESCRIPTION OF THE ENVIRONMENT

CHAPTER III
DESCRIPTION OF THE ENVIRONMENT

3.1 INTRODUCTION

The base line data of existing environmental condition is essential for Environmental Impact Assessment and prediction of impact of the proposed project activities. This chapter illustrates the description of existing environmental status of the study area with reference to the prominent environmental attributes. The data were collected from both primary and secondary sources. The primary data was collected through environmental monitoring in the study area. Primary survey involved meteorological study, hydro geological aspects, atmospheric conditions, water quality, soil quality, ecology & biodiversity, socio-economic profile and land use pattern of the study area. Secondary data were collected from various organizations to substantiate the primary data. The data thus collected were compared with the standards prescribed for the respective environmental parameters. Information on the existing environmental status is essential for assessing the likely environmental impacts of the proposed project. Sampling locations were selected based on following criteria:

1. Existing topography
2. Meteorological conditions of study area
3. Location of human habilitation
4. Sensitive areas present in the vicinity of the project site
1. Representative areas for baseline condition

3.2 Accessibility for sampling

Based on these criteria, various locations for baseline environmental monitoring were selected upwind and downwind of the project location. During selection of locations for other studies, topography and hydrogeology was considered.

3.3 STUDY PERIOD AND FREQUENCY OF SAMPLING

Baseline monitoring study was conducted in Post Monsoon Season i.e., . Details of frequency of environmental sampling considered for the study are illustrated in Table 3.1.

TABLE 3.1: SAMPLING LOCATIONS AND FREQUENCY OF SAMPLING

Environmen tAspect	**Numbe rof location s**	**Parameter**	**Frequency**	**Method**
Meteorology	_	Temperature, Relative Humidity, Precipitation Wind direction, Wind Speed	Primary data: • Hourly continuous • readings during the study period at plant site • Secondary data from meteorology	Monitoring for primary data of PMD 1980

			department	

Ambient Air Quality	10	PM_{10}, $PM_{2.5}$, SO_2 & NOx	9 Locations 24 hours, twice a week (as per EPA PunjabGuidelines)	PM_{10}, $PM_{2.5}$: Gravimetric method SO_2: Modified West
Water Quality	14	pH, EC, Total alkalinity, Chlorides, 18.59, Hardness, Ca,Mg, TDS, DO,COD, BOD, Sulphate, Phosphate,	Once in study period	ISO 14001-2015 method for sampling &Standard Methods

		Na ,K, Cu, Fe, Total coliform & *E.coli*		
Noise Quality	10	Noise levels indB(A)	Once in study period	PS: 14001-2015 as adopted
Soil Quality	10	Physical, Chemical Characteristics, Soil Texture	Once in study period	PS specifications
Ecology	Within 10 km	Existing Flora & Fauna for both terrestrial and aquatic Env.	Once in Study Period	Primary data by site visit and from literature, internet
Socioeconomic Data	Withi n10 km	Socio-economic characteristics of the affected area	Once in Study Period	Secondary data, based on Census data 2017

Land use pattern	10 km radius	Land use for different categories	Based on data published in Primary Census Abstract and satellite imagery LISS –III	Topo-sheets Satellite imageries
Geology and hydrogeology	10 km radius	Data collected during field survey and from secondary sources	Based on data collected from field survey once during the study period and from secondary sources.	Hydrogeological study conducted

3.4 DETAILS OF SITE AND SURROUNDING AREA

The district of Rahimyar Khan is located southern of the Punjab province. It is bordered by the state of Sindh on its southwest. The districts of Rahimyar Khan of Punjab Provinces lie towards its southern part; the districts of Ghotki are in the provinceof Sindh and it is west of the Rahimyar Khan District and east Bahawalpur district exist which is also division of the Rahimyar Khan

The proposed project will be located at Chak No. 106/1-L, Tehsil Khanpur District Rahim yar khan. The proposed site is in the nearby sugar factory premises. State highway - road is adjacent to proposed site. District headquarter Rahimyar Khan is 47.2 km away from the project site.

There are no Tropical Forest, Biosphere Reserve, National Park, Wild Life Sanctuary and

Coral Formation Reserves within 10 km Influence Zone. The site is geographically located at $28^0$24'37.6" N and 70^0 32' 52.7" E. The topography of the proposed project site is nearly flat with some undulating patches. The existing land is used for industrial purpose and comes under Punjab province. Rainy Canal is flowing at a distance of 35 km in west and Sadiq canal coming from Punjnad Canal 25 km in East.

Brief description of environmental setting around the factory is given in Table 3.2.

TABLE 3.2: ENVIRONMENTAL SETTING

Sr. No.	**Aspects**	**Description**
1.	Project Location	M/S Etistar Bioenergy Pvt Ltd, Situated at Chak No. 106/1-L, Tehsil Khanpur District Rahim yar khan.
2.	Geographical Coordinates	28024'37.6" N and 700 32' 52.7" E
3.	Nearest Town	Tehsil Sadiqabad 73.3 km District: Rahim yar khan: 47.2 km
4.	Nearest airport	Rahimyar Khan airport: 47.2 km
5.	No. of Villages in 10 km Study area	Around 03 no.
6.	Bio-geographical zone	Semi-Arid
7.	Precipitation	Maximum average perception of Tehsil Khanpur is 60 mm
8.	Temperature	12.5 ^{0}C to 47.0 ^{0}C

9.	Humidity	55%
10.	Wind Direction	North West

11.	Soil Type	Shallow to very deep black soils, red loamy soils, lateritic soils etc.
12.	Nearest Water body	Rainy Canal is flowing at a distance of 35 km in West and Sadiq Canal 25 km in East direction fromthe project site.
13.	Nearest Reservoir (Salt water)	SCARP drain at Gad Bair is Located at a distance of 50 kmfrom the plant
14.	Nearest Railway station	Railway station: 30.0 km Rahimyar Khan Railway Line is located at a distance of 60 kmsfrom the plant in Northern direction.
15.	Nearest Highway	Main KLP road located at a distance of 36 km from the plant in Eastern direction. Road is adjacent to site
16.	Nearest airport	Rahimyar Khan airport: 47.2 km
17.	Nearest Heritage site	Darawan Fort located is located at a distance of 100 km from the plant in Southern direction.
18.	State boundaries	Sindh at 15 KM
19.	Nearest densely	khanpur located at a distance of 30 km from the plant in

	populated place	South Eastern direction.

20.	Eco-sensitive area	There are no tropical forests, biosphere reserve, national park, wildlife sanctuary, coral formation, defense installations, recreational sites, holiday resorts, pilgrimage site, historically important structures, monuments, etc. within 10 km of the study area
21.	Nearest PMD station	At Khanpur 115 km (Station ID- 41718)

3.5 Land Environment

An area covering 10 km radius, with project site as center, is considered as the study area.

3.6 LAND USE PATTERN

Net sown area in the Rahimyar Khan district is 787,000 hectares, Major crops grown in the area are Sugar cane, Maize, Paddy, Wheat, Lemon orchards, cotton etc. Land utilization of khanpur is described below,

TABLE 3.3: LAND UTILIZATION OF RAHIMYAR KHAN DISTRICT

SR.NO	LAND DETAIL	AREA IN HECTARES
1	Total Irrigated Land	787,000
2	Forest	19,126
3	Land not available for cultivation	8,000
4	Land irrigated through Canal	385,000
5	Only Tube well cultivation	49,000

6	Canal & Tube well Irrigation	325,874

Land utilization pattern of the 10 km study area is described in below mentioned figur

TABLE 3.4: LAND USE/ LAND COVER STATISTICS OF 10 KM STUDY AREA

Sr. No.	Type	Color Code Bifurcation	Area in Sq. m.	Area in %
1.	Orchards		12.5	4.0
2.	Cotton/Wheat		4.8	1.5
3.	Sugar Cane		39.2	12.4
4.	Agriculture		181.5	57.6
5.	Barren Land		77.0	24.4
	Total area		**315.0**	**100.00**

3.7 Topography

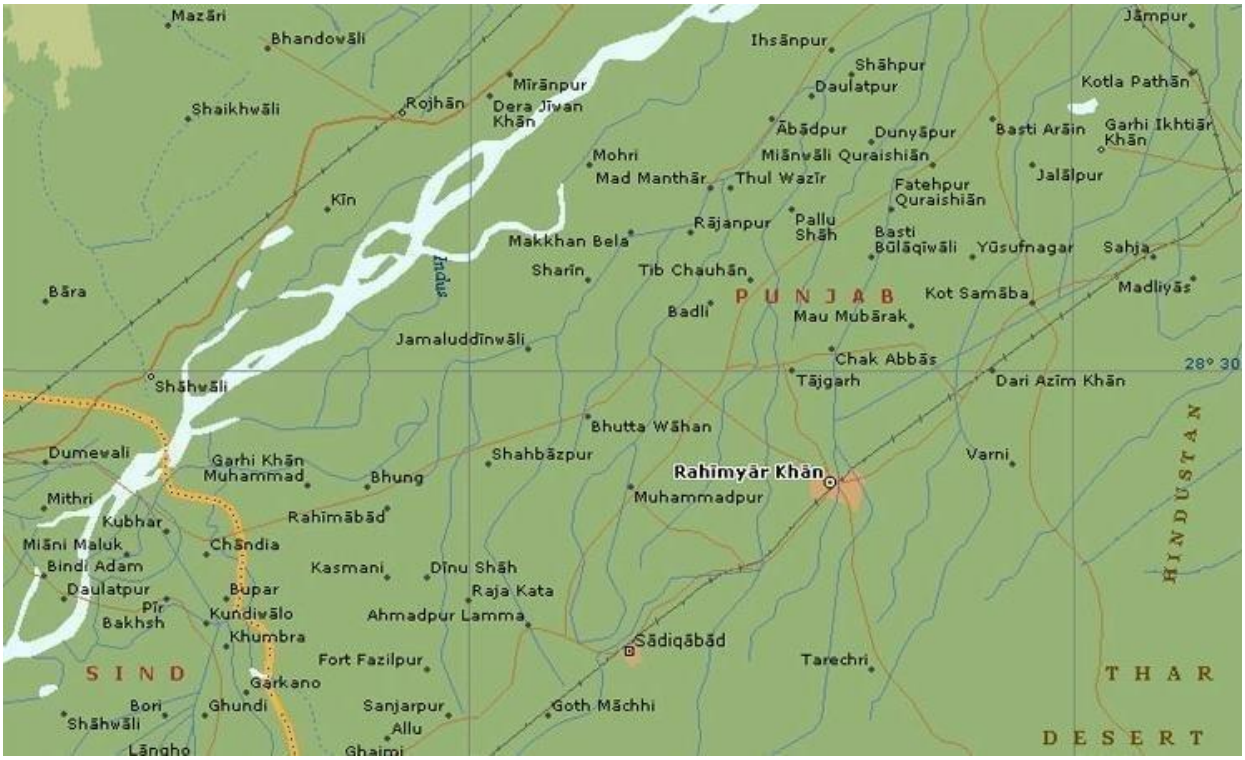
The topography of the project site and study area of 10 km radius zone is generally plan. Some hilly portion is present at south east site. The slope is towards North West site. The average elevation of the study area is about 580 m above mean sea level.

3.8 Geology & hydrology

The district is primarily located on the eastern side of the Western desert and its topography is predominantly undulating. A “rugged terrain” marks the western part of Khanapur and Rahimyar Khan. The elevation of these hills varies from 796 to 1025 m. Northern portion of the district is a plateau region formed by basaltic lava flows, which represents “Deccan Peneplain”. The central and southern parts exhibitmoderate to gently “undulating terrain” having sparsely distributed knolls and

tors. In some parts, especially in Sadiqabad and Taluka hills with elevations between 686 and 783 m are present.

The Western side is the main watershed of the Canal. In this region separating the short swift flowing West streams from the long winding courses of the eastward rivers.



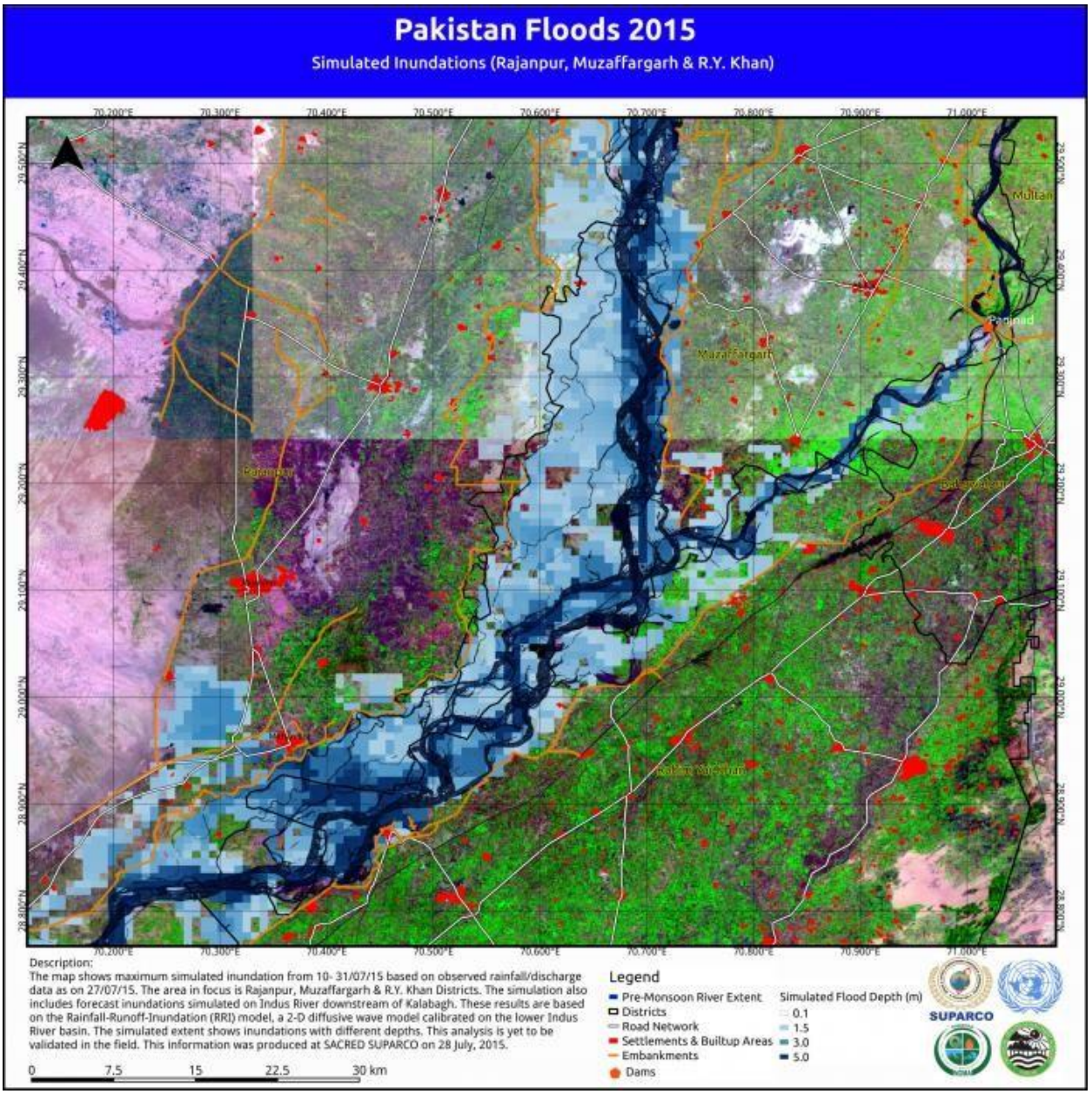


FIGURE 3.7: WATER LEVEL IN MONSOON 2016

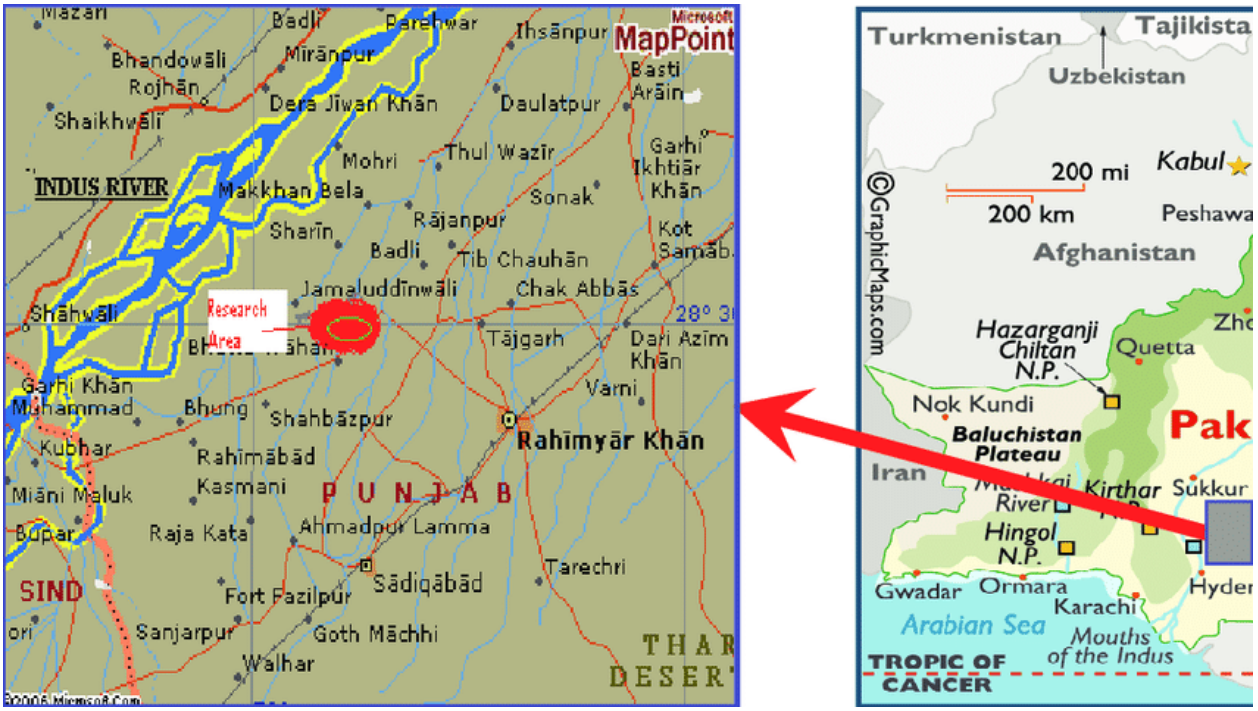


Figure 3.8: Drainage Map of the 10 km study area

3.9 **SEISMOLOGY**

In Pakistan, seismic zones are divided into five zones i.e. 1, 2A, 2B, 3 & 4. From Seismic Zone map, it appears that, the plant site as well as study area lies in Zone-2 A ofSeismic Zoning Map, and thus can be said to be located in an area of low seismic hazard by national standards. In this zone, the probable earthquake intensity of 3-4 Richter scale could be observed. Seismic Zoning Map of Pakistan showing the plant site is given in Figure 3.9. No defense installations or recreational sites, historically or archeologically important/ notified sites, ecologically sensitive sites, national parks, sanctuaries, biosphere reserves present in study area of 10 km radius.

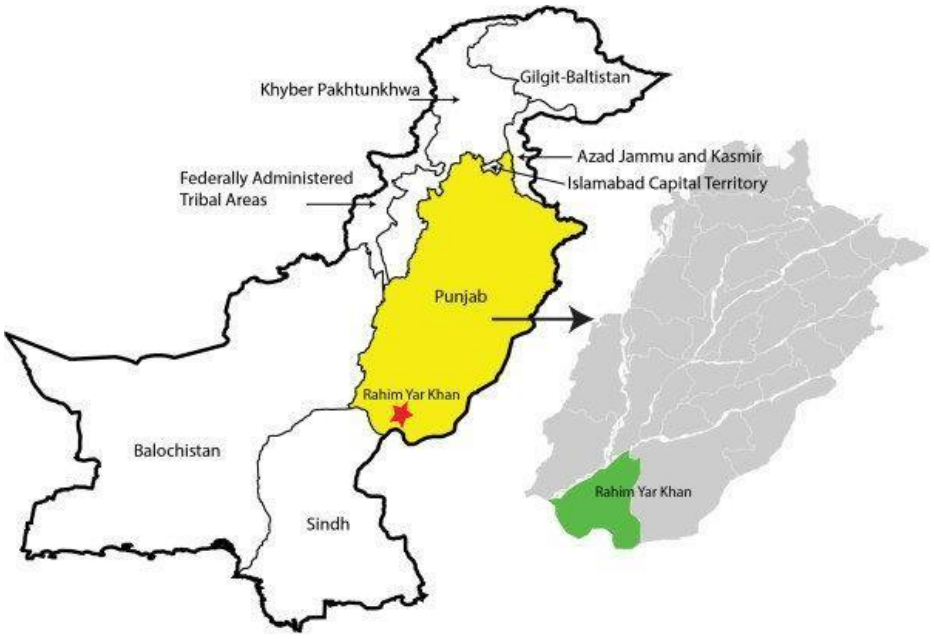


FIGURE 3.9: SEISMOLOGY MAP

3.10 METEOROLOGY

Meteorology plays a vital role in effective the dispersion of pollutants once discharged into the atmosphere. Since meteorological factors show wide fluctuations with time, meaningful interpretation can be drawn only from long-term reliable data. Pakistan Meteorological Department (PMD), which maintains a network of meteorological stations at several important locations and collect and accumulate meteorological data over a period of time to be used in future forecast. The nearest PMD station to the study area is located at Khanpur Rahimyar Khan. The Meteorological data with respect to temperature, humidity, rainfall, wind speed, and wind direction was obtained for winter Season from PMD which was recorded on daily basis.

3.11 CLIMATE

The climate of the district as a whole can be termed as semi-arid. The variation in the maximum temperature during the year ranges from 27^0C to 47^0 C and minimum from 13.9^0C to 20.6^0 C. The district experiences pleasant winters and hot dry summers. The hot season extends from March to August, during which the daily maximum temperature often shoots up to 47.0 ^{0}C. agro-climatologically the district can be divided into three zones i.e., “Northern transitional zone” and “Northern dry zone” from southwest to northeast respectively.

The average annual rainfall during the period 1971 to 2018 recorded in the district is 70 mm. The standard deviation and Coefficient variation of rainfall for the Rahimyar Khan district is 66.2 mm and 25.5% respectively (Table-5). The highest mean annual rainfall recorded in the district was 250 mm in the year 1964 and the lowest rainfall 55 mm in the year 2005.

The contribution by the northeast monsoon or post monsoon (Oct to Dec) is nearly 17.3% and the rest 11.1% is the contribution of the dry weather and pre-monsoon period (Jan to May).

3.12 **WIND SPEED & WIND DIRECTION**

Wind direction is the direction from which the wind blows and is based on surface observations. Over the course of a season, wind usually blows in all directions with varying frequencies. Certain direction, which occurs more frequently than others, is known as the prevailing wind direction.

The wind rose denotes a class of diagrams designed to display the distribution of wind direction experienced at a given location over a period of time — long for a climatological record of prevailing winds or short to show wind character for a particular event or purpose. Wind rose for the month of October, November, December is summarizing in Fig. 3.10.



FIGURE 3.10: WIND ROSE OF THE STUDY AREA

The wind rose diagram reveals that wind was blowing predominantly from the northeast direction speed in the range of 0.5-11.1 m/s. The onsite average wind speed was observed 1.79 m/s with frequency of calm winds 4.80% during the monitoring period.

3.13 BASELINE ENVIRONMENTAL STATUS OF AIR, WATER, SOIL & NOISE

The baseline environmental study was carried out for the Air, Water, Soil, Noise & Socioeconomic environment. The study was conducted from October, November, and December 2016. Locations have been selected within 10 km radius from the project site & environmental samples were collected from the selected locations. Primary data were verified by reviewing the secondary data. Sources of secondary data are Census of Pakistan 2017, Forest department, District & Villages, Internet etc. The scenario of environmental condition of the area revealed from the sample & data analysis is described below in subsequent paragraphs.

3.14 AIR ENVIRONMENT

As mentioned above, ambient air monitoring was conducted during the month October, November and December 2019. The monitoring frequency was selected as per the guidelines of CPCB. Based on the nature, characteristics and prevailing conditions, following parameters were selected for monitoring and details studies and evaluation.

While selecting the locations for baseline studies and to collect various types of samples and monitoring, following criteria was considered:

- Topography of the study area
- Population in the area
- Downwind direction
- Dominant wind Direction
- Availability of manpower, electricity, approach, structure and protection of samplers. The details of air monitoring locations including whether it was upwind, downwind or cross wind are tabulated in Table 3.5 and analysis results are given in Table 3.6.

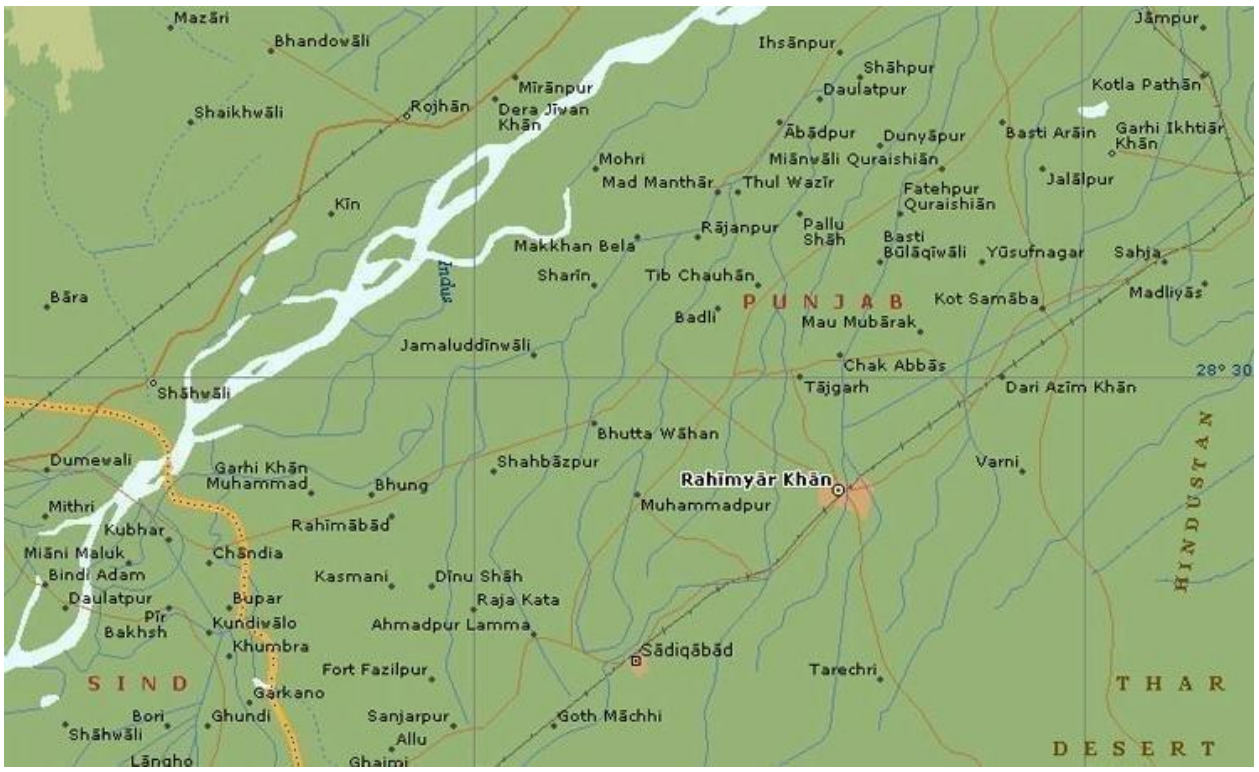


Figure 3.11: Air sampling location map of the 10 km study area

TABLE 3.5: AIR MONITORING LOCATION OF 10 KM STUDY AREA

#	Sampling Location	Coordinates	Direction	UW/ DW	Distance(km)
1	Project site	28 24’37.1”N70 33’08.0”E	-	-	Core
2	Chak 106/1-L	28.4119690 N, 70.5518032E	NE	CW	2.75
3	Chak 106/1-L	28.4103085 N, 70.5522344E	W	DW	1.94
4	Chak 106/1-L	28.4285413 N, 70.5735308E	SSW	CW	4.55

UW: Upwind, DW: Downwind, CW: Cross wind (please confirm the coordinates) we have selected coordinates from google.

TABLE 3.6: ANALYSIS RESULTS OF AMBIENT AIR SAMPLES

Sr. No.	Location	Description	$PM_{2.5}$ µg/m^3	PM_{10} µg/m^3	SO_2 µg/m^3	NO_2 µg/m^3	CO mg/m^3
		NAAQ Standards	**≤100**	**≤60**	**≤80**	**≤80**	**4**
1.	Project Site	Minimum	34.9	76.2	7.4	14.2	1
		Maximum	59.4	106.2	14.2	22.3	3

		Average	45.0	89.2	10.1	18.5	2.3
	Chak 106/1-L	Minimum	27.8	52.8	4.8	6.4	0
2.		Maximum	44.6	70.4	7.2	12.5	3
		Average	34.4	59.5	6.1	8.9	0.7
3.	Chak 108/1-L	Minimum	30.8	60.8	5.6	11.4	0
		Maximum	52.3	94.3	9.4	18.1	3
		Average	37.2	69.7	7.5	14.6	1.4
4.	Chak 103/ 1-L	Minimum	29.6	58.4	5.7	9.4	0
		Maximum	47.2	76.2	9.1	15.5	2
		Average	36.1	64.5	7.1	12.7	0.7

3.15 RESULTS AND DISCUSSION

Concentrations of PM_{10} and $PM_{2.5}$ for all 10 AAQM locations were found to be in the range of 47.8 to 89.2 µg/m^3 and 25.00 to 45.0 µg/m^3 respectively. SO_2 concentrations are found to be in the range of 4.0 to 10.1 µg/m^3 and NO_2 concentrations were in the range of 4.8 to 18.5 µg/m^3. From the results, it is revealed that the concentrations of all these pollutants are within the norms of National Ambient Air Quality Standards. From the results, it is understood that after project execution, all these values of various pollutants can be controlled to acceptable level with thehelp of development of proper green belt in and around the facility. And, simultaneously implementing the periodical monitoring programs for these pollutants to ascertain the concentrationindividual pollutants is within limits.

3.5.1 NOISE ENVIRONMENT

Sound is an important feature of our life and is the means of communication and entertainment in most animals including human beings. It is known that a low sound is pleasant whereas a loud sound is unpleasant and is commonly referred to as “noise”. Therefore, noise can be defined as an unpleasant and unwanted sound. Whether, a given sound is pleasant or unpleasant as it depends on its loudness, duration, rhythm and the mood of the person listing to it. But loudness is definitely the most significant criterion which converts sound into noise. Exposure to loud noise is indeed annoying and harmful too. Noise is a physical form of pollution and is not directly harmful to the life supporting systems namely air, soil and water. Its `effects are more directly on the receiver i.e., man. Noise pollution is the result of modern industrialized urban life and congestion due to over population.

Even though noise pollution is not fatal to human life, yet its importance cannot be overlooked because repeated exposure to noise reduces the sleeping hours and productivity or efficiency of a human being. It affects the peace of mind and invades the privacy of a human being. The importance of noise pollution as environmental problem is being recognized as the ill effects of noise on human health and environment.

Therefore, to identify the existing noise level in and around the project site within 10 km radius, monitoring of noise was undertaken at selected locations. With the monitoring activity, existing noise sources and background noise levels at sensitive receptors were identified within the study area. The source of noise pollution in the study area is particularly the vehicular movement. Noise pollution source in the factory premises is Sugar factory milling house, and vehicular movement from the adjacent road of the existing factory site. The details of locations monitored during day and night are given in Table 3.7 and Figure 3.12.

Monitoring results obtained at these locations are given in Table 3.8.

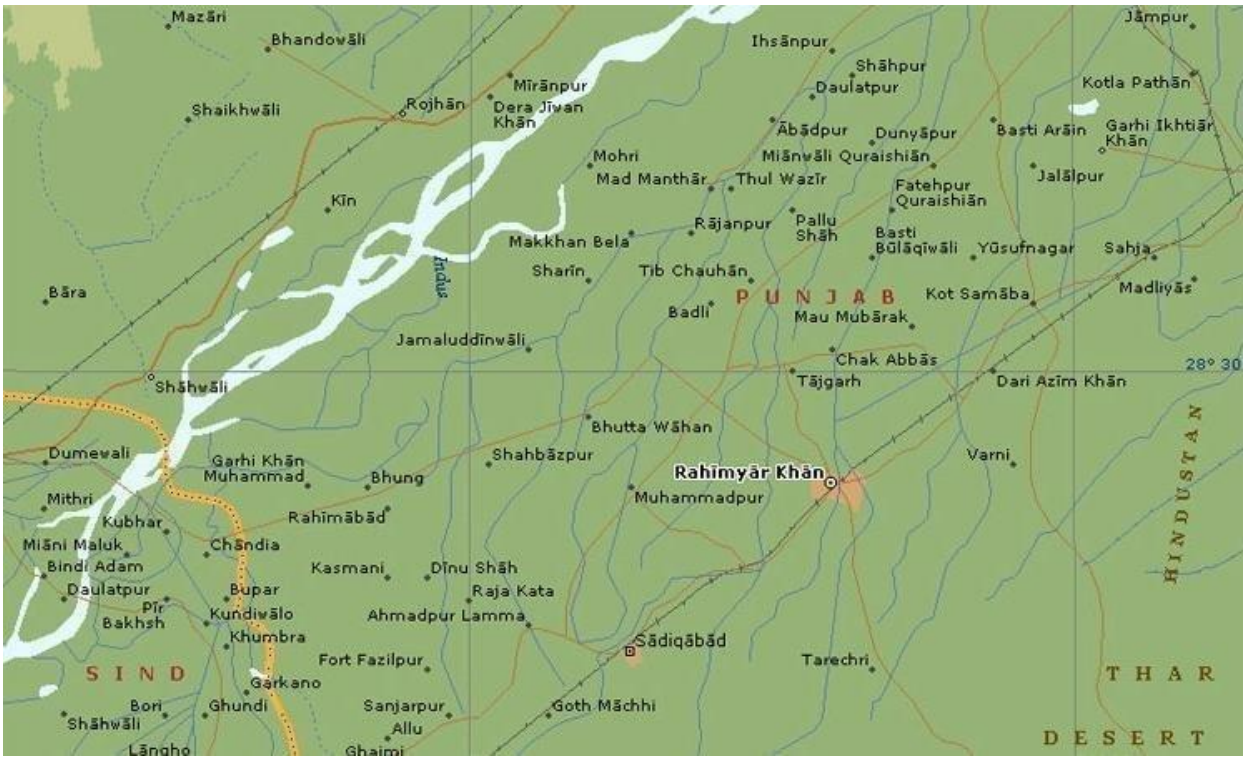


FIGURE 3.12: NOISE MONITORING LOCATION MAP OF THE 10 KM STUDY AREA

Table 3.8: Noise monitoring results

Location codes	Location	Equivalent noise level, leq in dB (A)		CPCB Noise standards in dB(A) for Residence	
1	Project site	73.8	75	67.5	70
2	Chak 106/1-L	48.2	55	38.4	45
3	Chak 106/1-L	48.9	55	43.7	45
4	Chak 106/1-L	47.6	55	40.3	45

3.5.1.1 Results and discussion

Noise levels were measured at 9 different locations in the study area to establish present scenario. The day and night time equivalent continuous sound level (Leq) varies from 40 dB

(A) to 45 dB (A) and 30 (A) to 40 dB (A) respectively. From the results it is found that noise level is much below the permissible limit of CPCB and there are no negative impacts on existing environment from the noise pollution.

3.5.2 WATER ENVIRONMENT

Water samples were collected once during the study period from Tenlocations for groundwater and for surface water. Ground water samples were collected from tube-well and dug wells from different locations in the study area. Surface water samples were collected from Rainy Canal and Sadiq Canal. All the samples were analyzed with respect to physical, chemical and biological parameters by Standard methods

Table 3.10: Analysis results of water samples

Locations **Parameters**	**Chak** 106/1-L	**Chak** 106/1-L	**Chak** 106/1-L	**Chak** 106/1-L	**Project site**	**IS 10500** **: 2012**
pH at 25˚C	6.92	7.15	7.15	7.26	7.21	-
Conductivity 25˚C (µmhs/ cm)	565	638	638	612	644	NS
Turbidity (NTU)	1.6	2.2	2.2	0.8	2.8	10
Odor (apparent)	**Unobjectionable**	**Unobjectionable**	**Unobjectionable**	**Unobjectionable**	**Unobjectionable**	UO
Color	<1	<1	<1	Colorless	<1	25

CHAK NO. 106/1-L, TEHSIL KHANPUR DISTRICT RAHIM YAR KHAN

(Hazen)						
TDS (mg/l)	394	456	456	220	472	2000

Total Hardness $CaCO_3$(mg/l)	210	216	216	168	224	600
Calcium Ca(mg/l)	44	46.4	46.4	33.15	46.4	200
Magnesium Mg(mg/l)	24	24	24	20.57	24	100
Total Alkalinit y $CaCO_3$ (mg/l)	238	274	274	144	268	600

Chlorides Cl (mg/l)	47	52	52	20	47	1000
Sulphate SO_4 (mg/l)	26	31.3	31.3	11.13	26.5	400

Locations Parameters	**Chak** 106/1-L	**Chak** 106/1-L	**Chak** 106/1-L	**Chak** 106/1-L	**Project site**	**IS 10500 : 2012**
Nitrate NO_3(mg/l)	1.35	1.42	1.42	1.63	1.35	NR
Phosphate PO_4(mg/l)	0.03	0.02	0.02	0.04	0.02	NS
Ammonia NH_3(mg/l)	BDL	BDL	BDL	BDL	BDL	NR
DO (mg/l)	6.2	5.9	5.9	5.6	5.4	NS
COD(mg/l)	15	23	23	18	20	NS
BOD(mg/l)	6	7	7	8	5	NS

CHAK NO. 106/1-L, TEHSIL KHANPUR DISTRICT RAHIM YAR KHAN

Sodium Na(mg/l)	23	28	28	19	22	NS
Potassium K(mg/l)	3	4	4	2.65	3.2	NS
Copper Cu(mg/l)	0.02	0.03	0.03	0.04	0.03	1.5

Iron as Fe(mg/l)	0.12	0.14	0.14	0.08	0.18	NR
Manganese Mn(mg/l)	BDL	BDL	BDL	BDL	BDL	0.3
Zinc as Zn(mg/l)	1.32	1.52	1.52	1.28	1.74	15
Fluoride F(mg/l)	0.26	0.29	0.29	0.22	0.31	1.5
Boron as B(mg/l)	BDL	BDL	BDL	BDL	BDL	1.0
Cadmium as	BDL	BDL	BDL	BDL	BDL	NR

CHAK NO. 106/1-L, TEHSIL KHANPUR DISTRICT RAHIM YAR KHAN

Cd						

Locations **Parameters**	**Chak** 106/1-L	**Chak** 106/1-L	**Chak** 106/1-L	**Chak** 106/1-L	**Project site**	**IS 10500** **: 2012**
Hexavalent Chromium as Cr^{6+}(mg/l)	BDL	BDL	BDL	BDL	BDL	NS
Total chromium as Cr (mg/l)	BDL	BDL	BDL	BDL	BDL	NR
Lead as Pb (mg/l)	BDL	BDL	BDL	BDL	BDL	NR
Arsenic as AS (mg/l)	BDL	BDL	BDL	BDL	BDL	0.05
MPN (mg/l)	260	298	298	253	260	Absent
E-coli (mg/l)	5	8	8	6	4	Absent

CHAK NO. 106/1-L, TEHSIL KHANPUR DISTRICT RAHIM YAR KHAN

Note:

- UO: Unobjectionable
- BDL: Below Detectable Limit
- NR: No Relaxation.
- NS: Not Specified



Photograph 3.1: Water sampling photographs





5.5.3.1 RESULT AND DISCUSSION

Water samples were collected from 10 different locations as mentioned in Table 3.10 and analyzed in the laboratory. The pH level was found to be in the range of 7.0 to 7.36 and Total Dissolved Solids were found to be in the range of 220 to 598 mg/l.

The above chemical analysis reveals that water from all sources is suitable for drinking purposes after disinfection, as E-Coli is present in all the surface water and some ground water samples collected. All other constituents are within the limits prescribed for drinking water standards of Pakistan Standards (14000: 2015).

3.5.3 SOIL ENVIRONMENT

To study the soil environment in and around the project site in the study area of 10 km radius, total ten samples were collected by the Team of Expert. After the collection of samples, analysis was carried out for all required Physio-chemical parameters. During sampling of Soil samples, standard procedure was followed and samples were collected in polythene bags. Soil sampling locations are presented in Figure 3.14 and the names of locations are mentioned in Table 3.11. During sampling of the soil, it is observed that the Soil is mostly alluvial, black lateritic, red and saline. The texture is sandy loam or clay loam. As the Project will be based on zero liquid discharge, hence no chance of adverse impact on the soil is envisaged from the project activities.

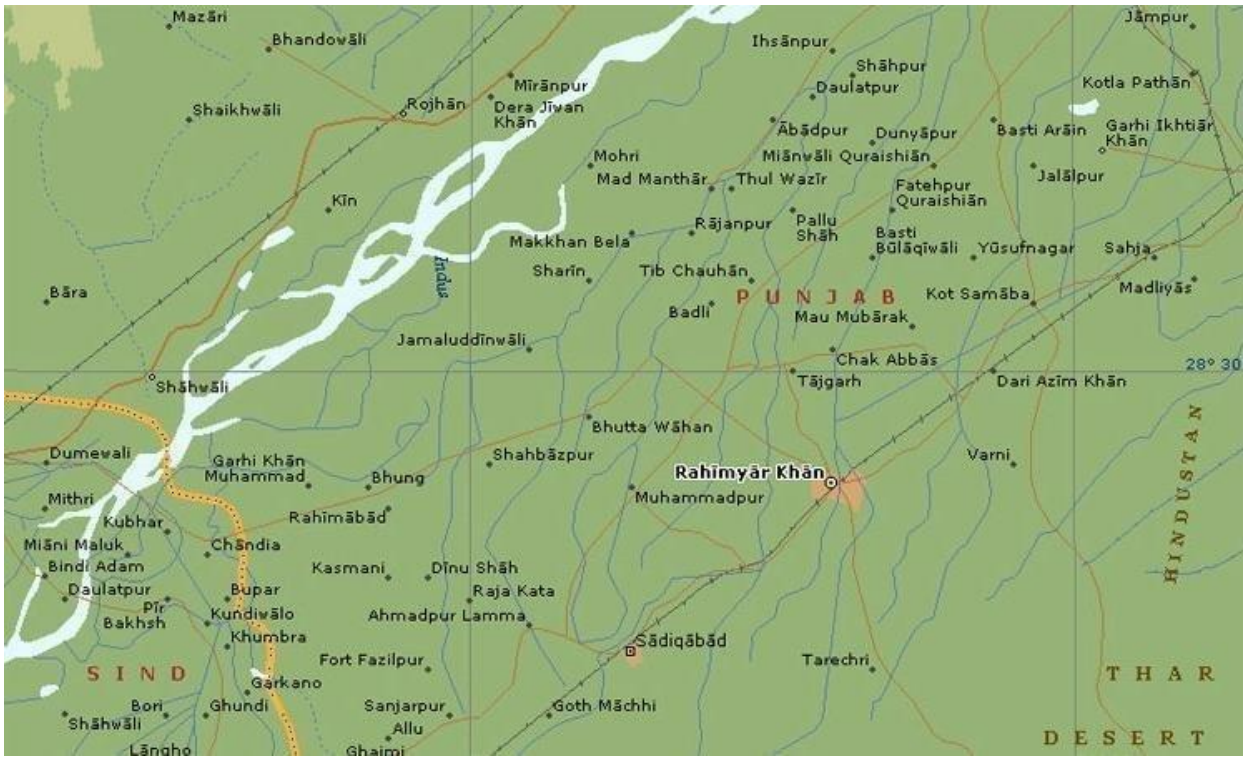


FIGURE 3.14: SOIL SAMPLING LOCATION MAP OF THE 10 KM STUDY AREA

Table 3.12: Soil analysis results

Parameters	**units**	**Projec tsite**	**Cha k** 106/L	**Chak** 106/L	**Chak** 106/ L
pH	-	7.23	7.18	7.08	6.98
Conductivity	µmho s/cm	1426	863	1012	966
Moisture Content	%	16.8	17.6	18.5	20.8
Bulk density	mg/kg	1.26	1.24	1.26	1.24
Water Holding capacity	mg/kg	3.5	50	49	52
Organic Matter	%	4.55	3.62	3.75	4.26
Total nitrogen	%	0.13	0.15	0.11	0.14
Phosphorus	mg/kg	6.8	5.2	6.3	7.1
Potassium as K	mg/kg	24.15	32.7	22.1	25.3
Calcium as Ca	mg/kg	426	388.4	410.3	386.4
Magnesium Mg^{++}	mg/kg	236	186.7	179.4	176.3

Sodium as Na	mg/kg	120.3	131.1	135	132
Sulphate as SO_4	mg/kg	316.2	402.8	413.9	342.5

Chloride as Cl	mg/kg	78.5	89.2	81.4	79.3
Boron	mg/kg	BDL	BDL	BDL	BDL
Iron as Fe	mg/kg	26.3	28.4	23.8	27.1
Zink as Zn	mg/kg	5.65	3.68	3.73	3.81
Copper as Cu	mg/kg	0.35	0.27	0.32	0.35
Nickel as Ni	mg/kg	0.02	0.01	0.03	0.01
Total Chromium-Cr	mg/kg	BDL	BDL	BDL	BDL
Lead as Pb	mg/kg	BDL	BDL	BDL	BDL
Mercury	mg/kg	BDL	BDL	BDL	BDL
Texture	mg/kg	Clay Loam	Clay Loam	Clay Loam	Clay Loa m





Photograph 3.2: Soil and Air Sampling



3.5.3.1 RESULTS AND DISCUSSION

In order to establish the baseline status of soil characteristics, soil samples were collected from eight sampling location. The analysis results of pH value ranging from 6.98 to 7.46 with organic contents of 3.5 to 4.26%. The phosphorus varies from 5.2 to 9.2 mg/kg. Potassium ranges from 20.6 to 32.7 mg/kg.

Thus, soil secondary nutrient shows good fertility. Heavy metal contamination signs not seen. Soil is medium fertile and shows good water holding capacity.

3.5.4 BIOLOGICAL ENVIRONMENT

3.5.4.1 Methodology adopted for Ecological study

Flora & Fauna data was collected on visual observation during the site visit by the experts and also the data collected from the secondary information available from the literature and local people. Authenticity of the primary data was checked by reviewing the data collected from Forest Department.

3.5.4.2 ECOLOGY

3.5.4.3 Flora

The moist vegetation is sustained by the heavy seasonal precipitation from the south-west monsoon which is active from June to October. The duration of the monsoon decreases from south to north. As there is a long dry spell from late October to early June the plant cover has

to survive despite the rainless period

3.5.4.4 OBSERVATIONS DURING SITE VISIT

During site visit, Expert from the Team, local People and the Proponent have observed the following variety of the Plants in the study area. They noticed and noted the following Trees, Shrubs, Herbs and grasses. All these plants were recorded during the site visit and while interacting with local people which are presented in Table 3.13. The name of observed / found plants is given along with their botanical names for easy identification.

TABLE 3.13: LIST OF PLANTS /FLORA OBSERVED DURING STUDY PERIOD

Sr. No.	**Common Name**	***Botanical Name***
1.	Aboli	*Crossandra infundibuliformis*
2.	Ain	*Terminalia alata*
3.	Ambotti	*Oxalis corniculata L.*
4.	American Soft head / Jharwad	*Lagascea mollis*
5.	Amla	*Emblica officinalis*
6.	Apata	*Bauhinia racemosa*
7.	Arjun	*Terminalia arjuna*
8.	Ashok	*Polyalthia longifolia*

9.	Asthma weed	*Euphorbia hirita*
10.	Australian acacia	*Acacia auriculiformis*
11.	Awala	*Phyllanthus emblica*
12.	Babul	*Acacia nilotica/ Vachellia nilotica*

13.	Babul	*Prosopis spicgera*
14.	Vilayati babul	*Prosopis Juliflora*
15.	Bamboo	*Bambusa vulgaris*
16.	Bambusa	*Bamboos*
17.	Banana	*Musa acuminata*
18.	Barleria	*Barleria prionitis L*
19.	Bechka /Gokhru	*Indigofera cordifolia*
20.	Bel	*Aegle marmelos*
21.	Besharam	*Ipomea aquatica*
22.	Bhrusunga Patra	*Murraya koenigii*
23.	Bishalya karani	*Tridax procumbens*
24.	Bitti	*Thevetia peruviana*
25.	Bogan wel	*Bougainvillea spectabilis*
26.	Bor	*Ziziphus Jujuba*
27.	Bottle brush	*Callistemon citratus*
28.	Celosia	*Celosia argentea*
29.	Chandan	*Santalum album*

30.	Chandni	*Tabernaemontana divaricata*
31.	Chinch	*Tamarindus indica*
32.	Chitrak	*Plumbago zeylanica*
33.	Christmas Tree.	*Araucaria columnaris*
34.	Coconut tree	*Cocos nucifera*

35.	Common groundsel	*Senecio vulgaris L.*
36.	Congress grass	*Parthenium hysterophorus*
37.	Copper pod/ Tamrashingi	*Peltophorum pterocarpum DC*
38.	Dalimb	*Punica granatum (L.)*
39.	Deepmal	*Leonotis nepetifolia (L) R.Br.*
40.	Deshi Badam	*Terminalia catappa*
41.	Dev Chapha	*Plumeraia alba Linn.*
42.	Devhari	*Ixora coccinea L.*
43.	Dhattura	*Datura stramonium*
44.	Dhatura	*Xanthium strumarium L.*
45.	Dhuranda	*Duranta rapens L.*
46.	Ekdandi	*Tridax procumbensL*
47.	Ficus tree	*Ficus benjamina*
48.	Vad	*Ficus benghalensis*
49.	Fire plant	*Euphorbia heterophylla*
50.	Fish tail palm	*Caryota urenes*

51.	Ghaneri,	*Lantana camara Var. aculeata (L.)*
52.	Ghayapat	*Agave desmettiana marginata*
53.	Glyricedia	*Gliricidia sepium*
54.	Gokhru	*Tribulus terrestris*
55.	Golden trumpet tree	*Tabebuia chrysotricha*
56.	Gulab	*Rosa*

57.	Gulbaks	*Mirabilis jalapa*
58.	Gulmohar	*Delonix regia (Boj.) Raf.*
59.	Hivar	*Acacia leucophloea*
60.	Pakistani bale	*Aegle marmelos*
61.	Pakistani Coral Tree	*Erthrina subrosa*
62.	Pakistani Cork	*Millingtonia hortensis*
63.	Pakistani rosewood	*Dalbergia sissoo*
64.	Ipomia	*Ipomia nil*
65.	Jacaranda	*Jacaranda mimosifolia*
66.	Jamun	*Syzygium cumini*
67.	Jaswandi	*Hibiscus rosa-sinensis L.*
68.	Kachaan	*Bauhinia purpurea*
69.	Kanchan	*Bauhinia sp.*
70.	Kanher	*Nerium indicum Mill.*
71.	Karanja	*Pongamia glabra*

72.	Kasid	*Senna siamea*
73.	khorjurri	*Phoenix dactylifera*
74.	Landga	*Acanthospermum hispidum*
75.	Lantana	*Lantana camara*
76.	Mango	*Mangifera indica*
77.	Mogara	*Jasminum sambac*
78.	Mogli Erand	*Jatropha curcas L.*

79.	Morpankhi	*Biota oriantalis Endl.(L.)*
80.	Neem	*Azadiracta Indica*
81.	Nilgiri	*Eucalyptus tereticornis Sm.*
82.	Palash	*Butea monosperma*
83.	Pangara,	*Erythrina indica L.*
84.	Papaya	*Carica papaya L.*
85.	Parthenium hysterophorus	*Congress grass*
86.	Peepal	*Ficus religiosa*
87.	Pichakari	*Spathodea campanulata*
88.	Piwala Dhotra	*Argemone maxicana Linn.*
89.	Prajakta	*Nyctanthes arbor-tristis Linn.*
90.	*Rui*	*Calotropis procera*
91.	Rain tree	*Albizia saman*
92.	Sadafully	*Catharanthus roseus*

93.	Sahadevi	*Ageratum conyzoides Linn.*
94.	*Saptparni*	*Alstonia scholaris*
95.	Shami	*Prosopis spicgera*
96.	Shevga	*Moringa oleifera Lamk*
97.	Silver oak	*Grevillea robusta*

98.	Siris	*Albizzia lebbeck*
99.	Sitaphal	*Annona squamosa L.*
100.	Singapore cherry tree	*Muntingia calabura*
101.	Sonaki	*Senecio grahamii*
102.	Suru	*Casuarina equisetifoli**a***
103.	Tagar	*Tabernaemontana divaricata*
104.	Tangle mat	*Alternanthera sessilis*
105.	Tarwad	*Cassia auriculata L*
106.	Teak	*Tectona grandis*
107.	Tentra	*Albizia procera*
108.	Terda	*Impatiens balsamina*

109.	Touch me not tree	*Mimosa pudica*
110.	Umber	*Ficus racemosa*
111.	Unhali	*Tephorsia villosa*
112.	Van Kapus	*Hibiscus vitifolius*
113.	Vedi Babhul	*Prosopis cineraria*
114.	Vilayati vakhandi	*Pithecellobium dulce*

115.	Karambal	*Justicia procumbens*
116.	Chikoo	*Manilkara zapota*
	Grasses	
1.	*Pennisetum pedicellatum*	
2.	*Bothriochloa bladhii*	
3.	*Dichanthium annulatum*	
4.	*Eragrostis unioloides (Retz.) Nees*	
5.	*Heteropogon contortus*	
6.	*Hierochloe odorata*	
7.	*Carex grayi*	
8.	*Sorghastrum nutans*	
9.	*Chloris*	
10.	*Cynodon dactylon*	

11.	*Cyperus rotundus*



Chloris



Pennisetum pedicellatum





Celosia argentea





Euphorbia hirita

Senecio grahamii

Crossandra infundibuliformis



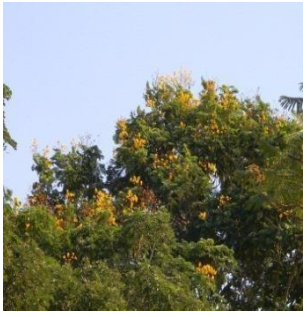
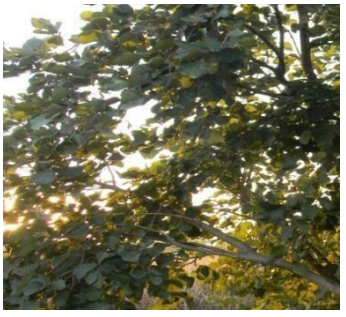



Ipomea indica ***Euphorbia heterophylla*** ***Lantena*** ***Leucas aspera***






Emblica officinali ***Terminalia catappa*** ***Tabebuia chrysotricha***


CHAK NO. 106/1-L, TEHSIL KHANPUR DISTRICT RAHIM YAR KHAN

Cocos nucifera ***Peltophorum pterocarpum*** ***Butea monosperma*** ***Azadiracta Indica***

PHOTOGRAPH 3.3: FLORAL DIVERSITY OBSERVED DURING VISITS

3.5.4.5 Vegetation Structure

The structure of vegetation does not only depend on the number of species. Out of hundred species present in the forest, a relatively few exert a major controlling influence by virtue of their size, structure, physio gamy and number. It is again dependent on the height difference.

Overall structure of the vegetation of this area is scattered scrubland interspersed with grasslands. It is dominated by few tree species like *Prosopis Juliflora, Acacia sp, Azadirachta Pakistan*. This vegetation structure is the result of extreme local environmental factors. The commonly observed naturally occurring trees species are *Prosopis spicgera; Acadia Nilotica, Acacia leucophloea and Azadirachta indica* are found growing on agricultural bunds. It was observed that vegetation along the dry streambedsis remarkably different than that of the other vegetation.

3.5.4.6 AGRICULTURAL PATTERN

Agriculture is the main resource of the district. Agriculture has played an important role in the economic development of the district and it is bound to be a prominent sector in the overall development of the district. Kharif, Rabi and summer are the three seasons. During Kharif season major crops like Cotton, Jawar, and Maize are grown. During Rabi season

Wheat, Rape seed, Sugar cane are grown. In summer season crops like Groundnut and vegetables are grown with the help of irrigation. Sugarcane, Cotton these are the cash crops in the district.

TABLE 3.14: MAJOR CROPS

Sr. No.	English name	Botanical name
1.	Wheat	*Triticum*
2.	Maize	*Zea mays*
3.	Jowar	*Sorghum*
4.	Bajra	*Pennisetum glaucum*
5.	Banana	*Musa acuminata*
6.	Groundnut	*Arachis hypogaea*
7.	Cotton	*Gossypium arboreum*
8.	Tobacco	*Nicotiana tabacum*
9.	Sugarcane	*Saccharum officinarum*
10.	Green vegetables	-



Nicotiana tabacum



Saccharum officinarum



Musa acuminata

PHOTOGRAPH 3.4: CROPS OBSERVED IN THE AREA

3.5.4.7 Fauna

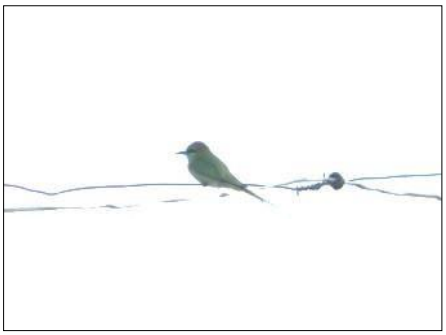
Rahimyar Khan District is endowed with a rich and variegated fauna. Animals are dependent directly upon plants. Among the domestic animals' cows and buffaloes, sheep, goat, pigs, horses, donkeys, mules, cats, dogs and fowls are prominent. Cows are rearedfor milk & draught purposes, while bullocks are used in Agriculture & transport. local breeds of buffaloes are noticed. Avifauna observed and during the site visit and while





interacting with local people which are presented in Table 3.15 and some pictures are given in below mentioned figure.

Black wagtail **Black wing stilt** **Red vented lapwing**





Green bee-eater ***Red-napped ibies*** ***Copper smith barbet***

Photograph 3.5: Fauna diversity observed during visits

Table 3.15: List of fauna

Sr. No.	Common name	Scientific name	Conservation status	IUCN status
Mammals				
1.	Cattle	*Bus indica*	_	LC
2.	Goat	*Capra aegagrus hircus*	_	LC
3.	Sheep	*Ovis aries*	_	LC
4.	Dogs	*Canis famiaris*		LC
5.	Pakistani languor	*Semnopithecus entellus*	II	LC
6.	Squirrel	*Funumbuls palmarum*	IV	LC
7.	Pakistann Rat	*Mus rattus*	V	LC
8.	Common mouse	*Mus musculus*	V	LC
9.	Common Mongoose	*Herpestres edwardsii*	II	LC
10.	Bat	*Chiroptera*	V	LC
Reptiles				
11.	King Cobra	*Naja naja*	II	LC
12.	Rat snakes	*Ptyas mucosa*	II	LC
13.	Ghonas	Russell's viper		

Amphibians				
14.	Common frog	*Rana tigrina*	IV	LC
15.	Toad	*Bufo melanosticus*	IV	LC
Aves				
1.	White throated kingfisher	*Halcyon smyrnensis*	IV	LC
2.	Green bee eater	*Merops orientalis*	IV	LC
3.	Pied bush chat	*Saxicola caprata*	IV	LC
4.	Lark	*Alaudidae*	IV	LC
5.	Pakistann Roller	*Coracias benghalensis*	IV	LC
6.	Common myna	*Acridotheres tristis*	IV	LC
7.	Common kingfisher	*Alcedo atthis*	IV	LC
8.	House sparrow	*Passer domesticus*	IV	LC
9.	House crow	*Corvus splendens*	IV	LC
10.	Black wing stilt	*Himantopus himantopus*	IV	LC
11.	Cormorant	*Phalacrocoracidae*	IV	LC
12.	Black drongo	*Dicrurus adsimilis*	IV	LC
13.	Common babbler	*Turdoides caudatus*	IV	LC
14.	Red vented bulbul	*Pycnonotus cafer*	IV	LC
15.	Pond heron	*Ardeola*	IV	LC

16.	Great egret	*Ardes alba*	IV	LC
17.	Cattle Egret	*Bubulcus ibis*	IV	LC
18.	Little Egret	*Egretta garzetta*	IV	LC
19.	Magpie robin	*Copsychus saularis*	IV	LC
20.	Brahmny kite	*Haliastur indus*	IV	LC
21.	Hoppo	*Upupa epops*	IV	LC
22.	River Tern	*Sterna aurantia*	IV	LC
23.	Rose ringed parakeet	*Psittacula krameri*	IV	LC
24.	Purple sunbird	*Nectarinia asiatica*	IV	LC
25.	Rock dove	*Columba livia*	IV	LC
26.	Shrike/ Khatik	*Lanius schach*	IV	LC
27.	Fly catcher	Fly catcher	IV	LC
28.	Red-wattled Lapwing	*Vanellus indicus*	IV	LC
29.	Kala Sharathi	*Red-naped Ibis*	IV	LC
30.	Barbet	*Copper smith barbet*	IV	LC
31.	Weaver bird	*Ploceus philippinus*	IV	LC
32.	*Large grey babbler*	*Turdoides malcolmi*	IV	LC

Table 3.16: List of butterflies

Sr. No.	Common name	Scientific name
1.	Plan tiger	*Danaus chrysippus*
2.	Small orange tip	*Colotis etrida*
3.	Small grass yellow	*Eurema brigitta*
4.	Dark glossy tiger	*Parantica agleoides*
5.	Brown king crow	*Euploea klugii*
6.	Common crow	*Euploea core*
7.	Glassy tiger	*Parantica aglea*
8.	Common grass yellow	*Eurema hecabe*
9.	Small grass yellow	*Eurema brigitta*
10.	Common emigrants	*Catopsilia pomona*
11.	Tawny coster	*Acraea terpsicore*
12.	Crimson rose	*Pachliopta hector*
13.	Common leopard	*Phalanta phalantha*
14.	-	Small Salmon arab (Yellow)

3.6 SOCIOECONOMIC ENVIRONMENT

3.6.1 RECONNAISSANCE

An essential part of environmental study, which deals with the total environment, is socio- economic environment incorporating various facts related to socio-economic situation in the area. These includes demographic structure of the area, provision of basic amenities viz., housing, education, health and medical services, occupation, water supply, sanitation, communication, transportation and feature of aesthetic significance such as temples, historical monuments and disease pattern. This would help in visualizing and predicting the likely impact depending upon the nature and magnitude of the project. Socio- economic study of an area gives an opportunity to assess the socio-economic conditions of the population staying in and around the project area.

3.6.2 BASELINE STATUS OBJECTIVES

- Demographic structure of the study area male/female ratio, occupational pattern, employment and income.
- Infrastructural resource base, viz. medical, education, water resources, power supply.
- Economic resource base, viz. agriculture, industries, forest, trade and commerce.
- Health Status, viz. morbidity pattern with reference to prominent and endemic

diseases.

- Socio economic status with reference to Quality of Life

- Cultural and Aesthetic attributes in the study region including places of historical/archaeological importance.

- Assessment of impacts on places of historical/ archaeological importance and aesthetic impairment.
- Awareness and opinion of people about the project

3.6.3 METHODOLOGY

For socioeconomic study of the project area, both qualitative and quantitative methods were adopted. Data regarding the study area were collected from secondary source like Censes of Pakistan of 2011, records and consultations with the locals. Data collected from various sources were tabulated, processed and computed.

3.6.3.1 SAMPLING METHOD

A judgmental and purposive sampling method was used for choosing respondents of various sections of the society i.e., Adult males and females, teachers, medical practitioners, businessmen, agriculture laborers, fishermen, unemployed group etc. Judgmental and purposive sampling method includes the right cases from the total population that helps to fulfill the purpose of research needs. Observations are restricted to this group & conclusions from these observations are generalized to the total population. Judgment or purposive sampling is very precarious, because must stronger assumption can be made about the population and sampling procedure than required while employing probability sampling.

3.6.3.2 DATA COLLECTION METHOD

In order to assess and evaluate the likely impacts arising out of for any area on socio- economic environment, it is necessary to gauge the apprehensions of the people in the project area. For the process of data collection through primary and secondary sources certain methods are used among that are:

3.6.3.3 FIELD SURVEY AND OBSERVATIONS:

Field Survey and Observations is made at each sampling village and the quality of life of that region is studied. Visits are made at hospitals, primary health centers and sub-centers to know the health status of the region. Various governmental organizations such as statistical department, department of census operations are visited to collect the population details of that region.

3.6.3.4 INTERVIEW METHOD

Structured interview method is used to collect data regarding the awareness and opinion from the sample selected of the various socio- economic sections of the community. Structured interviews involve the use of a set of predetermined questions that includes fixed and alternative questions. The questionnaire mainly highlights the parameters such as income, employment and working conditions, housing, food, clothing, water supply, sanitation, health, energy, transportation and communication, education, environment and pollution to assess the quality of lifeof that particular region and general awareness and opinion of the respondents about the project.

The interview method has the advantage that almost all perfect sample of the general population can be reached and respond to the approach. Interview method helps to collect more correct and accurate information as the interviewer is present during the field survey

Socio-economic survey was conducted in 01 town and 22 villages within the studyarea with reference to the project region.

The salient observations recorded during survey in the study area:

- Majority of the respondents are engaged in other activity while near about ¼th of the population are engaged in agricultural and its allied activities. The main crop grown in the study area is Sugar Cane and cotton.
- Sanitation facilities are unsatisfactory in the study area. There are open drains from where the domestic waste water is disposed. People are not at all aware and careful about hygiene and cleanliness, this has resulted to increase of health problems in the area
- Power supply facility is available in almost villages and town in the study area mostly for domestic purpose
- Drinking water sources is mostly from PWD water supply also from wells and hand pump. As regard to the drinking water facility people expressed that the quality and quantity of water is good.
- Medical facilities in terms of primary health center and primary health subcenters in the rural areas are good. The hospitals are available, have very good facilities. Doctors and nurse visit the villages for providing medical treatment. Primary Health Center Khanpur also have ambulance service for emergency and casualty Transportation facility is seen very satisfactory in the study area because the road conditions are very good and satisfactory.

- Almost all the people use LPG as a main source of fuel and very few people use kerosene and wood for cooking purpose
- Sufficient communication facility is available in the study area

- Educational facilities are available in the form of primary and middle schools.

  In some villages, it is extended up to high school. For higher studies people avail the facility from the nearest town
- Houses of the region are mostly Kuccha house

- Awareness among the people regarding the study region project is poor but when asked about their opinion regarding the water quality people complaint about the quality and they require checking of their water by laboratories.

3.6.4 INTRODUCTION OF RAHIMYAR DISTRICT

Rahim yar is a district in the Punjab province Pakistan. It is also called as the last district with Sindh province border, the city of Rahimyar Khan is the district headquarters. According to the 2017 Census of Pakistan, it has
a population of 4,814,006 of which 24.03% live in urban areas, making it the 8th most populous district in Punjab province (out of 30). The district has an area of 11,880 square kilometers, and is bounded on the west and west by Sindh Province, east by Bahawalpur District and north by Rajanpur District of Punjab province.

3.6.5 DEMOGRAPHY OF THE AREA

The study area comprises of 5 villages and 1 town of Rahimyar Khan District. Comparison of socio- economic attributes of the area with district and state is as follows:

The summary of demographic data based on district census, Karnataka 2011, household, population, density, sex ratio and literacy is presented in Table 3.17 and demographic data at a glance for rural & urban area are presented in Table **3**.18.

TABLE 3.17: SUMMARY OF DEMOGRAPHIC DATA OF KHANPUR

Particulars	**Study Area**	**District**
Population	2584 Sq Km	1,264,752
Sex ratio (no. female per 1000 males)	105.2	100
Literacy (%)	(33.1%)	418633 (33.10%)
Total Main worker (%)	(41.65%)	526769 (41.65%)

Source: Wikipedia

3.6.6 POPULATION

The significant demographic features of rural & urban area are:

RURAL AREA

- Total population of the region as per 2017 census is 1,264,751 out of which 663,994 are male and 600,757 are female
- Total number of households in the region about 35000

- Sex ratio (number of males per thousand female) in the region is 1005 this shows that male population is higher in the region as compared to the female population

- Out of the total population Scheduled Caste and Scheduled Tribe population is about 14.91% and 1.29% respectively
- Total main worker population is about 41.77%,7.96% comes under marginal worker category and 50.27 % belongs to non-workers category
- Literacy rate of the population in the study area is about 38.19%

URBAN AREA

- Total population of the urban area according to 2017 census is 123790 out of which 64990 are male and 58800 are female, total number of households in the region about 5080.
- Sex ratio (number of males per thousand female) in the region is 1005. This shows that male population is higher in the region as compared to the female population. Sex ratio of urban area is low as compared to the rural area.

- Out of the total population very less is the population of Scheduled Caste and Scheduled Tribe population that is about 15.55% and 0.74% percent respectively. Maximum population in the urban area belongs to other caste.
- Total main worker population is about 41.23%. Only 5.68% comes under marginal worker category while highest percentage of population i.e. 53.09% is shared by non- workers
- Literacy rate of the urban population is about 69.98%.

Table 3.20: Demography at a Glance within Study Area

Sr. No.	Demographic parameters	Details
1.	Number of villages	22
2.	Number of Towns	01
3.	Total no. of residential households	21543
4.	Total population	123790
7.	Sex ratio (male per thousand male)	1005
8.	Literates (%)	47040 (33.10%)
9.	Main workers (%)	42296 (34.16%)
10.	Marginal workers (%)	7543 (6.09%)
11.	Non workers (%)	73951 (59.73%)

3.6.7 INFRASTRUCTURE RESOURCE BASE

The infrastructure resources base of the study area with reference to education, medical facility, water supply, post and telegraph, transportation and communication facility and power supply etc. are available in the area. The infrastructure resources details have been abstracted from village Directory CD 2011 of Punjab province and are described below:

Education: Educational facilities are available at all of the villages in the study area. Literacy rate of the study area is quite good that is about 67.84%. Primary, Middle and Higher schools are available in the villages. College facility is available in nearby town viz. Tillu Bungalow. Female literacy is good; people attitude regarding female education is good.

Drinking Water: The water supply in the region is mostly through wells and hand pumps. For drinking purpose people are using only canal water supply, but supplied is not sufficient. People observed odor & oil contain in well water. Canals of the villages do not take any steps to treat water.

Communication and Transportation: Transportation is to the satisfactory level in the villages. Bus service is available in all most all villages. The roads condition is good and also properly maintained. Most of the villages in the study area have the communication facility

Power Supply: Almost all villages are electrified in the region and electricity is available for domestic purpose in all the villages while power supply used for agricultural purpose is rare.

Medical/Primary Health Care: Medical facilities in terms of; primary health center and primary health sub centers are adding medical facility in the villages. Primary Health Centre in the study area is available at a distance of 0-5 Kms i.e. in Chak 211/P village & primary health sub centers are also available in most of the village. Community Health worker doctors visit villages periodically & provide health facilities to the people. Vaccination & health camps are also organized by PHC to aware the people about family planning, hygiene,

& health care.

3.6.8 ECONOMIC ATTRIBUTES

Economy of the study area is mainly based on the Cultivation activity 42.32%, 31.68% work as Agricultural Labor and 23.75% population is engaged in other activity. The major crop grown in the study area is Sugar Cane and Cotton besides that other crops are jawar, Maize, Ground Nut and vegetables. The average monthly income of the villagers is approximately 5000-10000.

Main Workers; those who have worked for at least 183 days

Marginal Workers; those who worked less than 183 days

Work; Work may define as participation in any economically productive activity; such participation may be physical or mental in nature. Work involves not actual work but also effective supervision and direction of work. It also includes unpaid work on farm or in family enterprise.

The workers coming under the main and marginal workers category are; Cultivators, agricultural labors, livestock, forestry, fishing, hunting, and plantations, orchards and allied

activities, mining and quarrying, manufacturing, processing, servicing and repairs in household industry, construction trade and commerce, transport, storage andcommunication, other services

The employment pattern of the study area is described below and presented in Figure 3.15,

- Main worker population in the study area is 42296(41.65%)

- People in the region are mostly engaged in Cultivation activity and Agricultural labor

and rest of them are engaged in fishing, constructions, trade and commerce, transport, storage and communications, business and service. 42.32% population for cultivation 31.68% Agricultural Labor of and 23.75% engaged as other activity only 2.25% working as household worker.

- Cultivators i.e. a person engaged in cultivation of land owned or held from government or from private persons or from institutions by payment in money, kind or share are only 41.23% of urban and 41.77% of rural engaged in agriculture activity
- Unemployment level is high in the region as non-worker population shares more than half of the total population in the region i.e. 51722(50.93.%). Non-worker population includes student, household duties, dependent, pensioner, beggar and others.

3.6.9 suitability of site

The site does not fall in environmental sensitive area and all commodities are at a suitable distance from project site as they will not impacted by the construction activities even locals will get more benefits and job opportunities. No replacement, relocation and rehabilitation are required for the development of proposed project

3.6.10 CONCLUSION

All the basic facilities like road and rail connectivity, medical and educational facilities and other Required basic facilities are available in and around the project site to some extent. Due to upcomingProposed project, there will be additional requirement of facilities by the employees of the project.

Hence, required facilities will be developed by the people, who will definitely add into the development of the area. Therefore, by looking at the project, its requirement of raw material and associated facilities, there will be overall development of the area to fulfill the additional requirement created due to the project activities and employees. In addition to the direct requirement, there will be indirect requirement for the employees and their families with respect to housing, education, hospital, recreations which need to developed causing overall

development of the area.

Hence, to fulfill the demand of the area and also to have proper and timely service for other activities for the project, there will be overall development of the area, district and state and therefore of the country.



CHAK NO. 106/1-L, TEHSIL KHANPUR DISTRICT RAHIM YAR KHAN



CHAK NO. 106/1-L, TEHSIL KHANPUR DISTRICT RAHIM YAR KHAN



CHAK NO. 106/1-L, TEHSIL KHANPUR DISTRICT RAHIM YAR KHAN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EIA REPORT

M/S Etistar Bioenergy Pvt. Ltd, Situated at Chak No. 106/1-L, Tehsil Khanpur District Rahim yar khan.

CHAPTER IV

ANTICIPATED ENVIRONMENT IMPACT ANDMITIGATION MEASURES

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ANTICIPATED ENVIRONMENT IMPACT AND MITIGATION MEASURES

INTRODUCTION

This chapter deals with the prediction and evaluation of impacts resulting from the various activities during construction and operation phase of the proposed project. "Environmental Impact" refers to the alteration of environmental conditions or creation of a new set of environmental conditions, adverse or beneficial, caused or induced by the action or set of actions under consideration. Both the beneficial (positive) and adverse (negative) impacts on various components of environment are identified based on the nature of the various activities associated with proposed project. Predictions are superimposed over baseline environmental status to derive ultimate environmental scenario.The existing environmental conditions havebeen described in the Chapter 3 Impacts on various environmental attributes during construction as well as operation and mitigation measures have been discussed in this chapter.

4.1 Project location

The proposed project is located at Chak No. 106/1-L, Tehsil Khanpur District Rahim Yar Khan

4.2 IDENTIFICATION OF THE IMPACT

Impacts are identified during construction and operation phase. Below mentioned environmental parameters are considered while identifying the impact.

- *AIR ENVIRONMENT*

  Sources, ambient air quality, emission control, environment and health effects

- *WATER ENVIRONMENT*

  Sources, water & wastewater quality, environment and health effects

- *NOISE ENVIRONMENT*

  Sources, control measures, environment and health effects

- *SOIL/ LAND ENVIRONMENT*

  Land use, change in land use pattern, pollution sources, soil quality change, environment and health effects

- *BIOLOGICAL ENVIRONMENT*

  Flora and fauna of the study area, vegetation and habitat change and control measures

- *SOCIO-ECONOMIC ENVIRONMENT*

  Demographical details, economic status, employment status, infrastructure availability, environment and health effects

- *OCCUPATIONAL HEALTH AND SAFETY ENVIRONMENT*

  Identification of health hazard due to operation, material handling, exposure of hazardous chemical, health and safety plan and disaster management.

IDENTIFICATION OF IMPACT DURING CONSTRUCTION PHASE

Activities like leveling of site, construction and erection of main plant structures and equipment.

Impact matrix for different environmental components for construction phase is given in below mentioned table.

TABLE 4.1 CONSTRUCTION PHASE IMPACT MATRIX

Environment components	**Construction Phase**					
	Project activity →	**Site clearing**	**Site preparation**	**Transportation of material**	**Civil/construction work**	**Influx of construction workers**

	Impacts on					
Resources utilization	Fuel			√	√	√
	Electricity					√
	Water				√	√
	Construction material ex. Stone				√	
Air	Air Quality	√	√	√	√	√

Soil/Land	Soil erosion	√	√			
	Contamination			√		√
	Alteration of Soil properties/ Soil Quality	√	√	√	√	√
	Land topography	√	√		√	
Noise	Noise pollution	√	√	√	√	
Ecology	Effect on trees, grasses, herbs & shrubs	√	√	√		√
Occupational	Health				√	
Health & Hazards	Sanitation					√
	Generation of temporary and permanent Jobs	√	√	√	√	

4.2.1.1 Impacts on

Land<u>Activities</u>

- Excavation, land clearance
- Waste water and solid waste from construction activity
- Waste generation from labor force
- Sewage generation

<u>Impacts</u>

- Site preparation activities shall change land use and land cover which will result in loss of fertility of top soil and will change the natural terrain of the land. Fertile soil nature of terrain supports associated living of organisms. Change in land cover affects the specific niche of the organism.
- During site preparation change in land cover and land use was envisaged. Excavated top soil will be reused for backfilling and in green belt development.
- Proposed land is vacant land; hence there will be no tree cutting is envisaged.
- Construction debris leads to ground water pollution, surrounding aesthetics & human health.
- Spillage & leakage of fuel as well as contamination of land due to spill of construction material may impact the land to some extent.
- There will be generation of garbage and sewage by the worker and other staff involved during construction phase. Untreated sewage and garbage disposal on land might pollute

- the land which may change physical and chemical properties of soil. Change in soil properties ultimately affects the living organisms present in the soil. Open dumping or improper disposal of sewage and garbage provides breeding ground for pathogenic bacteria and other creatures which may spread diseases like Diarrhea, Infections with intestinal helminths (worms), Malaria, Typhoid and other infectious diseases.

Proposed mitigation measures:

- The construction activities like excavation for foundation, site preparation and vehicular movements will definitely bring the changes in the landscape. However, these changes shall be of short duration with no much impact. Excavated soil will be stored properly to avoid the spread of wind-blown dust and shall be reused for backfilling and landscape development.
- Spillage & leakage of fuel will be prevented by providing well lined/ paved area for the works having potential of leakage/ spillage of fuel or material. Hence contamination of land due to spillage/ leakage of fuel or construction material with soil would not arise.
- Disposal of untreated sewage & garbage generated by workers & other staff will be required in a systematic manner otherwise it will add into the contamination of land. Thesewage will be treated properly and garbage if any shall be disposed utilized to make composts to avoid the impact of these pollutants on the land.

- The packaging materials like wooden boxes and jute wrappers will be stored and disposed of properly.

4.2.1.2 IMPACTS ON AIR QUALITY

The impacts on the ambient air quality during construction phase will be temporary and restricted to project site. However, necessary mitigation measures like shutdown of machineries when not in use, sprinkling of water, cover excavated/ construction materials bysheets, etc. will be taken. Thus, no adverse impacts on the surrounding environment are anticipated due to proposed project.

Activities

- Dust will be emitted during the leveling, grading, earthworks, foundation works and other construction related activities and also during transportation

Impacts

- Marginal increase in the levels of SO_2, NOx, PM and CO within the plant area
- Dust accumulation on leaf retard the photosynthesis rate of plant which affect growth of plants
- Health problems to construction workers Ex. eye irritation, coughing & sneezing

Proposed mitigation measures:

- Excavation activity strictly restricted to in windy days
- Trucks will be allowed at site during construction phase.
- Frequently water sprinkling will be carried out in dust emission area.
- Use of Tarpaulin on the trucks to suppress the dust emission during transportation of raw material
- To avoid health hazards during construction phase, personal protective equipment's will be provided to workers as and when required

4.2.1.3 IMPACTS ON NOISE

QUALITY

ACTIVITY

- Digging and excavation etc.
- Construction material loading and unloading, fabrication and
- Handling of equipment and materials

Impacts

Predicted noise pollution sources and its impacts during the construction phase:

- Operation of construction machineries, equipment and associated mechanical works will generate the noise.
- Noise from Vehicular movement.
- Noise level will be in the range of 70 - 85 dB (A) at receptor point from the associated work of construction. This generation will be of temporary nature and limited up to project boundary.
- The exposure of workers to noise of high decibel may cause headache or other occupational health hazards.
- Noise pollution during construction phase is temporary and restricted to project boundary only.

Proposed mitigation Measures

- Noise from Vehicular movement will be within the limit by implementing the policy of maintenance of Vehicles and PUC.
- Transportation of construction machinery or raw material shall be allowed only during daytime to reduce the impacts of increased noise
- The construction equipment / machineries shall be turned off when not in use

- Loud horn of vehicles will not be allowed at project area. Regular maintenance & lubrication of construction equipment & machineries will be undertaken to reduce the noise generation.
- All rotating parts of construction machinery will be well lubricated

- Adequate Personal Protective Equipment (PPEs) like ear muff, ear plug, hand gloves, gum boots etc. will be provided to worker which helps to prevent occupation health problems.
- Overall, the impact of noise generated on the environment is likely to be insignificant, reversible and restricted to plant boundary.

4.2.1.3 IMPACTS ON WATER QUALITY

During construction water requirement will be 6-7 CMD & it will be met from water storage tank build in existing factory premises. Impact on water quality during construction phase may be due to sewage generated from the construction work force stationed at the site.

Further, the construction activities are more related to mechanical fabrication, assembly and erection, the need of water requirement will be small.

Activity

- Sewage generation maximum 15-20 CMD from construction labor (130-150)
- Runoff from construction activity during rainy season
- Stagnation of sewage and construction waste water if any

Impacts

- Disposal of untreated sewage will lead to ground pollution & foul odor in the area.
- Surface run-off during rainy season may contain more of eroded soil and other loose matter.
- Stagnant water attracts flies, mosquitoes, and growth of water hyacinth.

Proposed mitigation Measures

- Generated sewage 15-20 CMD will be treated in existing ETP/septic tank followed soak pit
- Temporary of toilet arrangement will be make available
- The earth work will be avoided during rainy season and will be completed during the winter and summer seasons only.
- Strengthening of the green belt in and around plant will be undertaken during the monsoon season which helps to avoid soil erosion.

4.2.1.4 IMPACTS ON BIOLOGICAL ENVIRONMENT

The project area does not encroach into any wildlife sanctuary/national park/eco-sensitive area/protected area. Hence project would not have adverse impact on the wildlife. Proposedsite is flat with some hilly terrene, however there is very little ground vegetation with some grasses and herby vegetation. It could, therefore, be concluded that the project would not have major. The construction of the plant is not likely to have any impact on aquatic eco- system, as there are no major surface water bodies in the immediate vicinity of the plant.

Activity

- Clearance of site

Impacts

- Loss of grass species
- Soil erosion

Proposed mitigation measures:

- Development of thick green belt and in a course of time\
- Emphasized on indigenous, local, nesting, tress while development of green belt

4.2.1.5 IMPACTS ON SOCIO-ECONOMICS

- Construction phase will be increase in floating population.
- Additional stress on road, transport, communication, drinking water, sanitation and other facilities will take place.
- The project will provide temporary employment of skilled and highly skilled manpower.
- Most of the people will be employees of contractors/sub-contractors.
- Most of the manpower during the construction period will be from local area.
- During the construction phase there will be increased demand of services

The influx of population is very limited it is anticipated hence, there will be no socialconflicts between the visitor and present communities.

4.2.1.6 OCCUPATIONAL HEALTH AND SAFETY

Construction activities involved many health & safety issues.

Activity

- Working at height
- Storage of hazardous material/ chemicals ex. diesel, petrol etc.
- Work without protective equipment and/or safety belt
- Site sanitation

Impact

- Loss of life due to accident such as falling, improper safety
- Fire & explosion due to hazardous material
- Foul odor due to degradation of food waste, other bio-degradable waste

Proposed mitigation measures:

- All personal protective equipment's will be provided. Mask, helmet, hand gloze etc.
- safety trainings will be conducted
- Helmet will be compulsory while working on construction site
- Safety instructions will be placed at construction area
- Emergency preparedness plan will be implemented from construction phase

 Sign boards such as safety, isolated area, risk prone area will be placed

4.2.2 IDENTIFICATION OF IMPACT DURING OPERATION PHASE

During operation phase emission from manufacturing processes will cause considerableimpacts on air, water and soil environment. Gaseous emission deteriorates the air quality, which ultimately will affect other environmental parameters. The impacts may be direct or indirect, short or long term and reversible or irreversible.

TABLE 4.2: OPERATION PHASE IMPACT MATRIX FOR CUMULATIVE IMPACT ASSESSMENT OF SUGARAND PROPOSED DISTILLERY

Environment components	**Operation Phase**									
	Activities → / **Impacts on** ↓	**Manufacturing**	**Boiler operation**	**Storage of raw material & Products**	**Fugitive and Stack emissions**	**Effluent generation**	**Solid disposal**	**Traffic**	**Runoff**	**Green belt development**
Resources utilization	Fuel		√		√					
	Electricity	√	√	√						
	Water	√	√							
Air	Air Quality	√	√	√	√	√	√	√		√

Soil/Land	Contamination			√		√	√		√	
	Alteration of Soilproperties/ Soil Quality			√		√	√		√	√
Noise	Noise pollution	√	√	v				√		√
Ecology	Effect on trees, grasses, herbs & shrubs, fauna				√	√	√	√	√	√
Occupational Health	Health	√	√	√	√	√	√	√	√	√
& Hazards	Sanitation				√	√	√	√		
	Generation of temporary and permanent Jobs	√	√	√						

On the basis of the above-mentioned impact prediction, the anticipated considerable impacts on the environment are,

- Ambient Air Quality
- Water Quality

- Noise Levels

- Water Resources

4.2.2.1 IMPACTS ON LAND/ SOIL

The solid waste generations from the proposed distillery project will be having negative impact on the soil characteristics. The negative impacts will be minimized by proper disposal of solid waste generated in the plant.

Proposed distillery industry will be established where existing no waste issues

Quantitative anticipated impact and measures

Activity

- Fermentation- yeast sludge

- Distillation

- Digester-Boiler operation- ash

- ETP operation – Sludge

TABLE 4.3: SOLID WASTE GENERATION QUANTIFICATION

Sr. No	Type of Waste	Quantity of waste	Remarks
1	Yeast sludge	28.5 TPD	Not Hazardous
2.	ETP sludge	40.0 TPD	Not Hazardous
3.	Ash	2 Ton/ Day	Not Hazardous
4.	Domestic waste	Negligible	Not Hazardous

Impacts

- Deterioration of soil characteristics within plant premises
- Ground water pollution due to disposal of waste
- Foul odor due to yeast and ETP sludge
- Negative effect on aesthetic environment

Table 4.4: Solid waste generation and disposal

S. No.	Type of waste	Disposal
1.	Yeast sludge	Sludge (Yeast and ETP) will be dried and used as fertilizer
2.	ETP sludge	Ash will be sent to Brick manufacturer, bagasse ash will be sold to farmer as manure
3.	Ash	Bagasse ash will be sent to Brick manufacturer, bagasse ash will be sold to farmer as manure
4.	Domestic waste	Septic tank followed by soak pit

Table 4.5: General Composition Bagasse ash

S. No.	Parameter	Bagasse (%)
1.	Al_2O_3	6.7
2.	CaO	2.80
3.	Fe_2O_3	6.3
4.	K_2O	2.4
5.	MgO	3.20
6.	MnO	0.1
7.	Na_2O	1.1
8.	P_2O_5	4.00
9.	SiO_2	73.0

TABLE 4.6: PROXIMATE ANALYSIS OF CONCENTRATE

S. No.	Constituent	Biogas %	Bagasse %
1.	Moisture Content	5.01	40 - 55
2.	Volatile Matter	35.69	16 - 30
3.	Ash Content	1.0-1.5	10 - 15
4.	Fixed Carbon	30	45-46
5.	GCV (kcal/kg)	2270	7000-7600

TABLE 4.7: ULTIMATE ANALYSIS OF BIOGAS

S. No.	Constituent	Value %	Bagasse %
1.	Carbon	20-35	8-12
2.	Hydrogen	6.06	6.06
3.	Nitrogen	.13	0.13
4.	Sulphur	2-2.5	0.08

4.2.2.2 IMPACTS ON AIR

During operation phase emission from manufacturing processes will cause considerableimpacts on air, water and soil environment. Gaseous emission deteriorates the air quality, which ultimately will affect other environmental parameters.

Activity

- Two DG sets of capacity 500 Kva which will be operated in case of power failure only.

- Air pollutants like PM_{10}, SO_2, NO_x, CO_2 & VOC's will be emitted from manufacturing process. Types of pollutant distillery unit is given in below,

TABLE 4.8: CUMULATIVE POLLUTANT POTENTIAL

1.	Flue gases from 20 TPH distillery	PM_{10}, SO_2, NOx, CO_2 & VOCs

- Dust generation is predicted from conveyors of bagasse, boiler ash generation and handling will be suitably covered with hood or enclosures to control fugitive emissions.
- Emission from vehicular movement. Particulate emissions in the project area envisaged primarily due to emissions from traffic of road, which is close to the project site. During the operation phase of the proposed project, movement of goods vehicles, loading and unloading operations may contribute to air emission.
- Other Air emissions like VOC from distillation columns, CO_2 and ethanol from fermentation process.

4.3 Impacts

- Marginal increase in the levels of PM, SO_2 and NOx as the Air Control Equipment-Electrostatic Precipitator will be installed.
- Emission from vehicular movement leads to increase in PM level
- Dust inhalation by workers will results in eye irritation, coughing & sneezing
- Dust accumulation affect growth of plants

TABLE 4.9: STACK DETAILS

S. No.	**Particulate**	**Proposed Distillery**
1.	Boiler capacity	20 TPH
2.	Fuel consumption	Bagasse and Biogas
3.	Stack height	30 m

4.	Diameter	1.67 m
5.	Stack gas exist velocity	18 m/sec
6.	Stack gas temperature	180^0C
7.	Flow rate	97500 Nm^3/sec
8.	SO_2 emission rate	1100+/- 25 Ppm v on 7% O_2 dry
9.	NO_x emission rate	300 g/sec
10.	PM10 emission rate	50 mg/Nm3

Proposed mitigation measures

- Major source of air pollution will the boiler stack. Height of the proposed stack will be 30 m height and the stack height designed on the basis of CPCB guidelines to ensure proper disposal of gas emissions. Stack height calculations are given in Table 4.9.
- Fugitive emissions from raw material storage yards, loading and unloading operations will be controlled water sprinkling system, whenever necessary.
- Electrostatic precipitator (ESP) will be provided in the additional boiler stack.

- Bagasse is used as fuel, to generate steam in the exiting boilers. Thus, the air pollution could be mainly due to burning of bagasse in the boilers. Generation of SO_2 and NO_X are negligible as Sulphur and nitrogen are present in bagasse are present.

- All internal roads shall be constructed as tar roads and regular water sprinkling shall be carried out on all the Kaccha roads for preventing fugitive dust emission

- Huge tree plantation will be carried out around plant area for minimizing environmental impacts of the proposed activities over a period of time. Plantation program shall be designed and a budget should be allocated for this purpose every year. Total 33% of the area will be developing for greening.
- Factory will maintain good housekeeping in all units

4.2.2.3 CUMULATIVE IMPACT ON TRAFFIC DENSITY

Incoming raw material for sugar factory is mainly molasses. The transportation shall be carried out by Tankers.

Existing Road network details

The Project site is located at Chak No. 106/1-L, Tehsil Khanpur District Rahim yar khan. The factory site is well connected by roads. Road is passing adjacent to the factory. It is well connected by roads to Ghotki and Rahimyar Khan Cities. The nearest airport is situated at 47.2 km from the factory at Rahimyar Khan City. Connected road network is given in Figure.

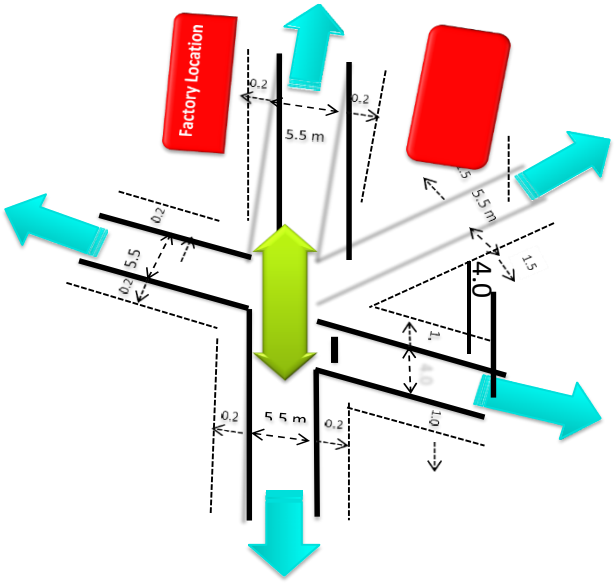

FIGURE 4.1: ROAD NETWORK NEAR TO FACTORY

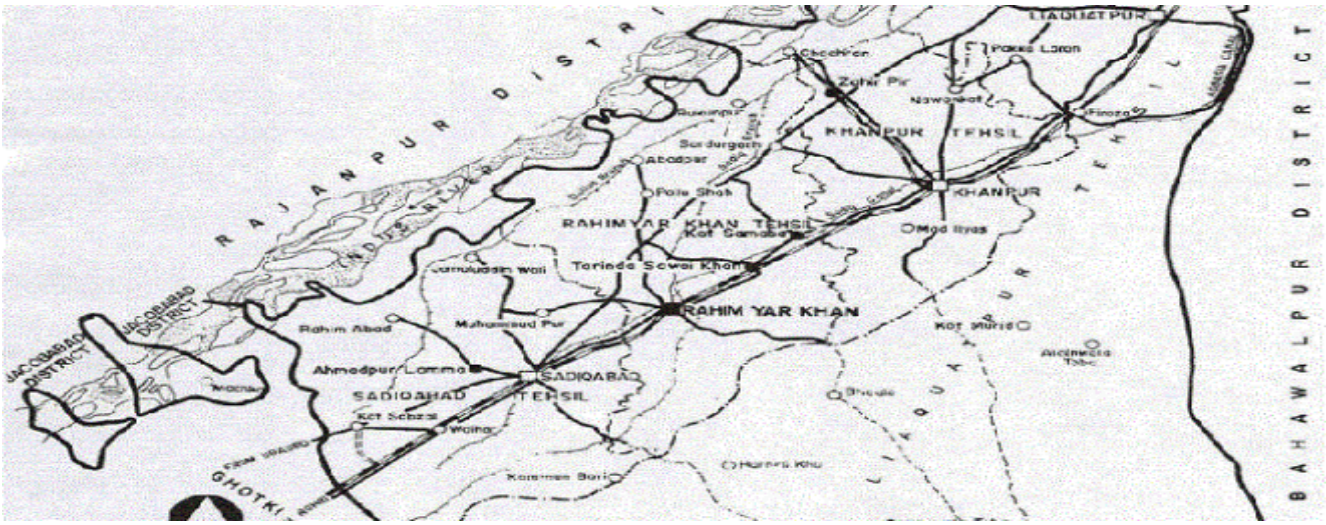

FIGURE 4.3: ROAD CONNECTIVITY RAHIMYAR KHAN

Existing traffic data

A 24-hour traffic survey was conducted on each of the aforesaid roads separately for ascertaining the existing traffic on each of the roads. The findings of the traffic survey are depicted in below mentioned table.

- The peak traffic hours on each of the roads were found to be from 9 a.m. – 12 p.m. in the morning hours and 4 p.m. – 7 p.m. in the evening.
- As is evident the major component of the traffic composition in terms of vehicles on SH-61 is Chingchi Rikshaw, motor cycle, tractor, and animal cots.
- The major component of the traffic composition in terms of vehicles on road, which is adjacent to the factory.

TABLE 4.10: EXISTING TRAFFIC COMPOSITION IN BOTH DIRECTIONS DURING CRUSHING SEASON(PER DAY) IN THE STUDY AREA

S. No.	Name of the road	Bullock cart	Agricultural Tractor/ Truck	Passenger car, tempo, Cars	Two wheelers	Total
1	Etistar Bioenergy (pvt) ltd	10	200	125	500	**835**

Roads of intermediate width, i.e., having a carriageway of 5.5 m with normal earthen shoulders should have 1000 Passenger car units per day in both directions. It has observed that vehicle count is less than standard PCU count (i.e., < 5000). Hence, the present road capacity is sufficient for the current traffic load.

Impact from Transportation of Raw Materials and Finished Products

Transportation of raw material and products will be mainly through RYK road and Tillu road. Presently, the background emissions in the project area are primarily due to emissions from the Vehicular Traffic on the RYK road. During the sugar mill crushing season, movement of goods vehicles and loading & unloading operations may contribute to emission of pollutants.The site will be properly regulated through strict and disciplined vehicular movement during crushing season of the sugar factory. It is recommended that good quality road network shallbe developed within the premises so that air pollution due to dust shall be minimized. However, factory will

ensure proper arrangement of transportation and their movement, for existing and proposed distillery unit and hence this would not lead to any major impact.

All the trucks, carrying various raw materials will be covered with tarpaulin. At loading and unloading points, arrangement for water sprinkling will be made so that dusts generation during transportation of materials will be minimized further

Estimated Traffic from Project

With the implementation of the project the traffic is likely to increase slightly on the existing road network near the plant and its surroundings during construction and operation phase. The raw material and finished products of the proposed distillery will be transported by the following roads enlisted below:

- Khan pur Road
- Tillu to factory road
- Sadiqabad to factory road

The impact of the traffic is assessed on the basis of;

- Adequacy of the existing road network
- Impact on air quality

Construction Phase

Trucks will be used in transporting construction material and plant components to the proposed plant site during construction phase. The estimated number of vehicles would beas tabulated in table below for a period of stipulated 14 months. Construction work of distillery will be done during offseason of the sugar to avoid additional load on road.

TABLE 4.11: TRAFFIC COMPOSITION IN BOTH DIRECTIONS

(Proposed traffic superimposed over baseline traffic during construction)

S. No.	**Name of the road**	**Bullock cart**	**Agricultural Tractor/ Truck**	**Passenger car, tempo, Cars**	**Two wheelers**	**Total**
1	Bagho Bahar Road	50	300	200	1500	**2050**

Roads of intermediate width, i.e., having a carriageway of 5.5 m with normal earthen shoulders should have 5000 Passenger car units per day in both directions. It has observed that vehicle count is less than standard PCU count (i.e., < 5000). Hence, the present road capacity is sufficient for the expected traffic load during construction phase.

Operation Phase

All the raw materials and finished products will be ultimately approached on Adjacent RYK road. Hence vehicular count on RYK road has been considered. The details of the likely generated traffic due to the proposed plant according to assumptions are given in below mentioned table.

TABLE 4.12: ASSUMPTIONS AND RESULTING ESTIMATED TRAFFIC DUE TO THE PROPOSEDPROJECT (OPERATION PHASE)

Sr. No.	Particulars	Quantity (MT/month)	Mode of transport	No. of Vehicles per day
1.	Raw material			
	• Molasses	20600	By road through tankers	12-15
	• Bagasse	2000	By road through trucks	1-3
2.	Finished products	3750 KL/M	By road through trucks	3-5

3.	Person vehicular movement	-	By road	15

The split –up of the generated traffic due to the proposed project in operation phase is givenin below mentioned Table.

TABLE 4.13: TRAFFIC COMPOSITION IN BOTH DIRECTIONS (PROPOSED TRAFFIC SUPERIMPOSEDOVER BASELINE TRAFFIC)

S. No.	**Name of the road**	**Bullock cart**	**AgriculturalTractor/**	**Passenger car, tempo, Cars/ tankers**	**Two wheelers**	**Total**
1	Bagho Bahar Road	50	300	200	1500	**2050**

Roads of intermediate width, i.e. having a carriageway of 5.5 m with normal earthen shoulders should have 1000 Passenger car units per day in both directions. It has observed that vehicle count is slightly lesser than standard PCU count (i.e. >1000). Hence, the present road capacity sufficient for the expected traffic loads.

Conclusion

The conclusion regarding adequacy of the existing road network is tabulated in Table 4.14

TABLE 4.14: CONCLUSION REGARDING ADEQUACY OF THE EXISTING ROAD NETWORK

Sr. No.	Road Name	Predicted Total PCU's	Existing carriagewaywidth(m) ofthe road	Recommended PCU's as per applicable IRC codes (IRC 73 - 1980)	Whether up-gradation / expansion of roads required (Yes / No)
1.	Main Road	1200	5.5	5000	No

Impact

As mentioned above the predicted final PCU's work out to be as follows:

1- Main Road adjacent to factory RYK road

MODEL INPUT

For modeling purpose, representing the worst prediction due to traffic, the peak hourly generated traffic on the state highway- 97 is considered, as it is the adjacent road to factory and which the main road for transportation. The data on the village road is not considered due to low volume of traffic. The Peak Hourly Traffic used for model prediction is tabulated below in

Table 4.15.

TABLE 4.15: PEAK HOURLY PROJECTED TRAFFIC – OPERATION PHASE

Time	**Name of the road**	**Agricultural**	**Passenger car,**	**Two**

		Tractor	**Chingchi**	**wheelers**
9 am- 11 am	RYK	40	50	235

The vehicle speeds for different categories of vehicles considered for the modeling purpose are provided in Table: 4.16

TABLE 4.16: SPEED OF THE VEHICLES (KMPH)

Bus / Truck / Tractors	**Agricultur alTractor**	**Passenger car, Chingchi**	**2 wheelers**
30	5-10	10-40	20-50

The vehicular emission norms in the year 200 recommended in Auto Fuel Policy decided by the EPA Punjab and EPA Pakistan have been used to provide the emission factors for the different vehicle types. These Emission factors are as specified in Table 4.17.

The air quality scenarios were developed for all stability classes using the representative wind speeds (minimum wind speed in the respective stability) for the particular stability class.

For model computations, the receptor locations have been chosen to account for its location with respect to center of the road. The scenarios were modeled for cross wind direction representing the worst -case scenario.

TABLE 4.18: RESULTS AND DISCUSSION:

Category **Pollutants**	**Two Wheelers (g/km)**	**Passenger Cars(Petrol) (g/km)**	**Passenger Cars(Diesel) (g/km)**	LCV **(Diesel) (g/km)**	HCV **(Diesel) (g/km)**
CO	94	65	14.4	109.8	372
PM	0.3525	0.2	3.8	14.25	76.88
NO x	58.75	0.5	0.7	0.70	0.70

Mitigation measures

- Roads and intersections up gradation
- Expansion of road width from 5.5 m to 6.5 m
- Maintenance of roads from time to time
- Maintenance of the vehicles

- Erection of traffic signals at strategic locations if required

- Overloading of the vehicles shall be avoided. Optimums loading of the trucks and cross checking at weigh bridge.
- Pollution under Control' (PUC) certificates shall be issued to the vehicles.

- Water sprinkling on roads leading to plant and within plant

- Dense tree plantation along the road side

4.2.2.2 IMPACTS ON NOISE QUALITY

Ambient noise levels will be increased during operation phase due to machineries and other industrial activities. However, the impacts of noise during this phase will be confined within plant boundary or within the source of generation.

DISTILLERY

Fans, blowers and compressors, steam turbines etc.

- Elevated workplace or environmental noise can cause hearing impairment, hypertension, ischemic heart disease, annoyance, and sleep disturbance.

4.2.3 Mitigation measures

- Vibrating pads & acoustic enclosure will be provided to noise generating equipment to control noise level within norms
- Latest technology and utmost care will be taken at the time of equipment / machinery installation
- Lubrication of moving/ rotating part or component of machineries will be done on regular basis
- The insulation provided for prevention of loss of heat and personnel safety gears will also act as noise reduce

- The operators working in the high-noise areas will be provided with ear-muffs orplugs
- Acoustic enclosures and silencers will be provided to the Equipment wherever necessary
- Proper green belt will be developed to reduce the noise level

Thus, it is envisaged that there will not be any adverse impacts of noise. The greenbelt developed within the premises will have significant beneficial impacts on reduction of noise within the periphery and outside the boundary.

4.2.2.3 ODOR

MANAGEMENT

ACTIVITY

- Typical compounds generating odor in sugar industry are acetic acid, ethyl alcohol / butyl alcohol, bacterial decomposition of organic matter (stale cane smell) & bacterial decomposition of Sulphur compounds (H_2S).
- Causes of odor are stale cane, bad mill sanitation, bacterial growth in the interconnecting pipes & unattended drains etc.
- Typical odor compounds in distillery are alcohol, iso amyl & iso butyl alcohol (fusel oils), acetic acid
- Causes of odor are bad management of fermentation house, long retention of fermented wash, unattended drains & ETP.

Impacts

- Nausea, insomnia and discomfort.

- Nasal irritation; trigger symptoms in individuals with breathing problems or asthma.

Mitigation measures

- Better cane management to avoid staling of sugar

- Use of mill sanitation bio-cides to minimize the growth of aerobic / anaerobic micro–organisms
- Steaming of major pipe lines

- Proper cleaning of drains

- Regular use of bleaching powder in the drains to avoid growth of Sulphur decomposing micro-organisms to control H_2S generation.
- Better housekeeping by regular steaming of all fermentation equipment's

- Regular steaming of all fermentation equipment.

- Use of efficient bio-cides to control bacterial contamination.

- Control of temperature during fermentation to avoid in-activation / killing of yeast.

- Avoiding staling of fermented wash.

4.2.2.4 IMPACTS ON WATER QUALITY

Direct discharge of untreated sewage & effluent on land, generated from proposed

Distillery will lead to ground pollution as well as soil quality. Various activities their impacts and mitigation measures for the same has been describes in below mentioned paragraphs.

Activities

- Surface water extraction

- Effluent generation from distillery

- Run off storm water

Impacts

- No negative impacts are envisaged on surface water availability and drawl will be restricted during lean season. The industry has constructed water storage reservoir of foruse of fresh water during lean season. The reservoir will be filled up with storm water available at the premise.

- Distillery generates huge amount of effluent. Normally, 8-10 L/L of alcohol effluent willbe generated. If effluent is not treated properly before disposal, it will pollute land and ground water quality and thereby will change the existing characteristics of soil and water.
- Discharge of waste water within & outside plant boundary will lead to the ground water pollution.
- Discharge of distillery effluent loss of soil fertility and deteriorate the soil quality

- Discharge of effluent in the surface water body alters the water characteristics and may leads to eutrophication of water bodies. Further, its dark color hinders photosynthesis by blocking sunlight and is therefore deleterious to aquatic life.

Mitigation measures

- The total fresh water requirement for distillery for startup will be around 2100 m3/day, and after recycling daily fresh water requirement will be 1800 CMD. Water storage facilities will be made with Distillery.
- 1600 KLD will used through Effluent Treatment Plant and produce Biogas for Boiler
- Process condensate, boiler and cooling tower blow down will be the major effluent streams. Details of effluent generation and its characteristic are described in the following Tables.
- Process condensate around 400 CMD will be treated in condensate treatment plant.

- Domestic wastewater is generated from the proposed plant, will be sent to Wet Land.

TABLE 4.19: SUMMARY OF EFFLUENT GENERATION FROM PROPOSED DISTILLERY, EXISTINGSUGAR AND COGENERATION UNIT

Source	Effluent	Quantity	Disposal
Distillery	**Wastewater**	• **Raw generation 1400 CMD**	**Sent to Effluent Treatment Plant**

Table 4.20: Composition of manufacturing process

Sr. No.	Parameter	Outlet of Biogas Digesters wash (mg/l)
1.	Total volume expected	1600 CMD
2.	Color	**Dark brown**
3.	pH	7.2-7.6
4.	COD	25000-35000
5.	BOD	5000-8000
6.	Total Solids	12000-18000
7.	Chloride (Cl)	16,000 -17,500
8.	Sulphate (SO4)	18,500 - 20,000
9.	Nitrogen (TKN)	2,000 - 2,500

10.	Potassium(K2O)	25,000 -28,000
11.	Sodium (Na)	4,000 -4,500

Table 4.21: Characteristics of Spent Lees

S. No.	Parameter	Range
1.	Volume	240 CMD
2.	pH	3.6 – 4.5
3.	COD	5000 - 6000 mg/l
4.	BOD	200 – 300 mg/l
5.	Dissolved Solids	5000 – 6000 mg/l
6.	Suspended Solids	500 – 1000 mg/l
7.	Chlorides	50 – 100 mg/l

Table 4.22: Characteristic of wastewater from cooling tower and boiler blow down

Sr. No	Parameter	Range
1.	Quantity	110-120 CMD
2.	pH	8.0-9.0
3.	COD	1500
4.	BOD	60-70 mg/l
5.	Suspended solids	800-1500 mg/l
6.	Total dissolved solids	1500-3000 mg/l

TABLE 4.23: INLET AND OUTLET CHARACTERISTICS OF PROCESS CONDENSATE TREATMENT UNIT

Sr. No	Parameter	Inlet	Outlet	Unit
1.	Flow	550	467	CMD
2.	pH	3.5-4.0	6.5-7.5	-
3.	COD	<4500	<100	mg/l
4.	BOD	<3000	<10	mg/l
5.	Total dissolved solids	<100	-	mg/l

Table 4.24: Characteristic of wastewater generated from sugar factory

S. No.	Parameter	Inlet characteristics	Outlet characteristics
1.	pH	5.4	6.4
2.	BOD	8445.00	90
3.	Total Suspended Solids	1293.00	92
4.	Oil and grease	BDL	BDL

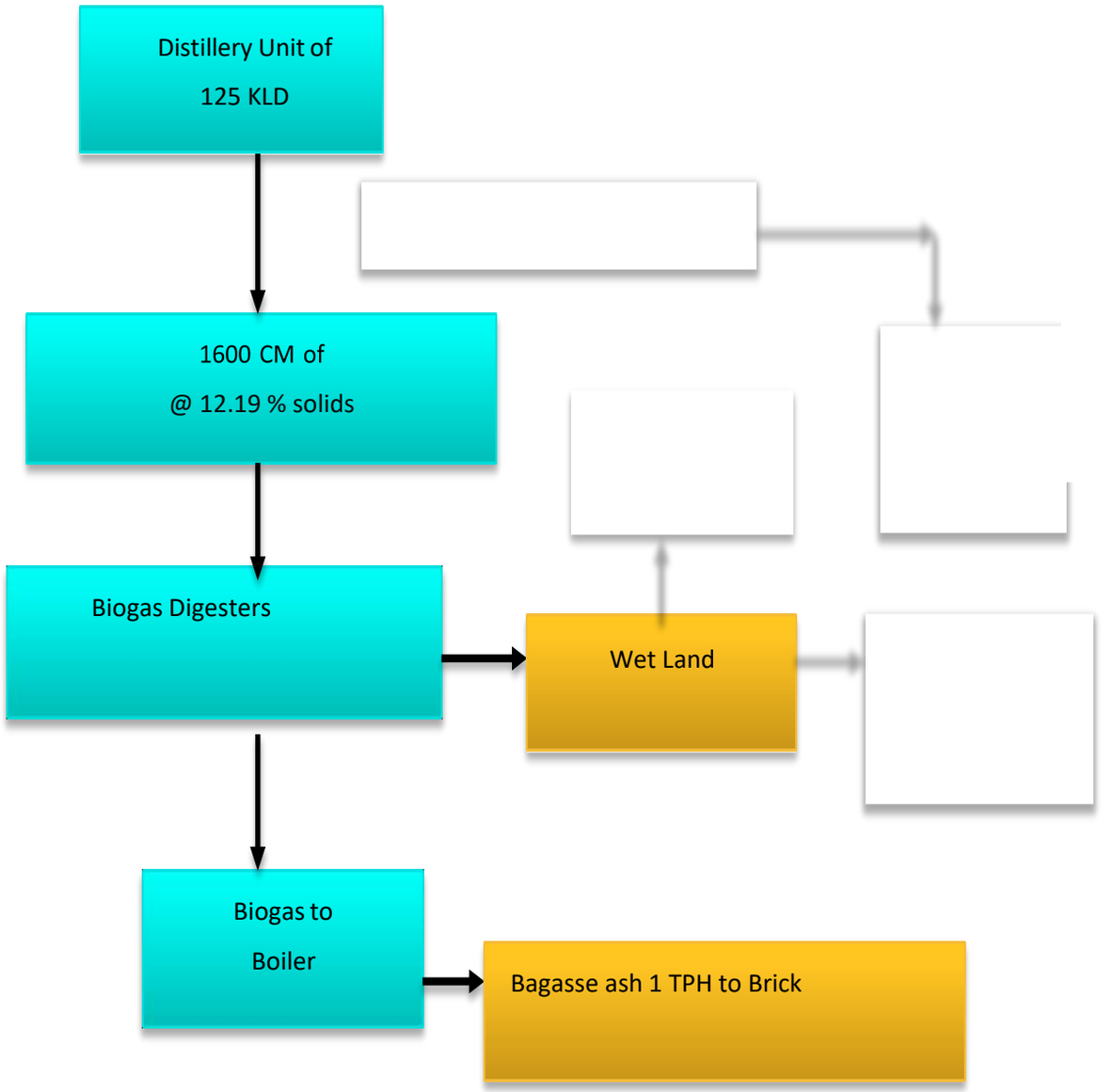

Figure 4.4: Waste water balance chart of proposed distillery

4.2.2.5 Impacts on Biological environment

There will be no impacts on natural vegetation and species diversity due to the proposed distillery unit. There will be no tree cutting or shrub removal will take place. The proposed green belt development help to control temperature and keep the surroundings cool. It will attract avifauna and create suitable habitat to micro flora and fauna. The green belt will help as a sink to dust and gaseous pollutants. While developing proposed green belt native, ornamental, medicinal values trees will be planted; which results in enrichment of biodiversity & beautification of area.

There are no wild life sanctuaries with in the study zone. Within the 10 km from project site dry vegetation is found. The impact on flora is insignificant. As site is flat with some undulating patches, very little leveling activities will be required. Hence no impact on existing landscape is anticipated.

Activity and its impacts

Impacts on ecology shall be from the following sources:

- Flue gas emissions in the air will lead to increase in concentration of Particulate Matter, Sulphur Dioxide and Oxides of Nitrogen. An increase in air pollutants may affect the vegetation growth in and around the area
- Dust emission is envisaged during material handling & transportation, which affects the growth of vegetation.

- Disposal of solid / hazardous waste on land pollute the soil, which eventually affect the vegetation

Mitigation measures

To mitigate the above-mentioned impact following mitigation measures will be implemented:

- Air pollution control equipment like Electrostatic Precipitator (ESP) will be provided to reduce the emission of particulate matter
- Well-designed material storage area as well as handling facilities will be provided to prevent particulate emissions from the storage, handling & transportation activities.
- Solid waste storage area will be designed as per the guidelines to avoid the leachate percolation into the ground or water bodies.
- Distillery process condensate effluent will be treated in condensate polishing unit and recycled in the process.

- Greenbelt area will be developed in & around the plant premises and shall be maintained properly.

- There is no any discharge from the project activities. Existing sugar ETP treated water is used for exiting green belt development and irrigation purpose. However, no any impact on the biological environment has been found any alteration or destruction to the biological environment.

- All efforts will be put-up by the factory management to maintain the ecological balance and improve the environment in terms of ecology and green Belt development. Industry will follow the zero discharge norms. Hence no adverse impacts on surrounding ecology.

4.2.2.6 *IMPACT ON SOCIO-ECONOMIC ENVIRONMENT*

- The impacts of the proposed distillery will lead to the positive impact on surrounding. The proposed project will generate the employment to local people. Thus, the said project will not have any significant impact on Socio-economic pattern of the surrounding region.
- The distillery plant will provide stability to sugar factory in financial terms. This ultimately benefited to farmers and employees.

4.2.2.7 *OCCUPATIONAL HEALTH & SAFETY*

- Workplace area involving production unit, distillation unit, Boiler section, turbine section, raw material handling area etc.

- It is envisaged that occupational health hazards shall be associated with operational activities such asspillage and exposure to the chemical, mechanical hazards like cuts and hits and electrical shocks.
- Accident due to fall from height, burn injury and trap in the machine or motors during operation.

All these above-mentioned impact or risk associated with various operational activities of the plant shall bemitigated by implementing the following measures:

- All safety signs will be placed at proper location.
- First aid kits will be made available at every department
- Pre-employment Medical checkup and periodical medical checkup shall be undertaken to know the occupational health hazards at the early stage.
- Work permit system will be introduced to avoid the entry or un-authorized working to avoid the incidences which can lead to the accident if proper care is not taken
- All arrangement required for Fire hydrant system shall made at every vulnerable location to have the firefighting facility.
- Apart from above, all required Fire Extinguishers shall be provided at appropriate locations

- All staff and workers will be trained in firefighting operations and emergency preparedness plan or to tackle the accident
- Apart from all engineering control measures, if required necessary PPEs shall be provided as last protection measures to the employees.

Good housekeeping also plays important role in avoiding the undesirable incidences / accidents, hence good housekeeping practices will be employed throughout the Factory premises.

4.3 IMPACT ASSESSMENT MATRIX

Impact matrix facilitates to identify components and phases of project activities for determination of likely impacts. Matrix identifies the interaction between project activities and environmental components using a grid like table. Entries are made in the cell which highlights impact severity in the form of symbols or numbers or descriptive comments. The impact of different project activities on various environmental components like biological environment, air environment, aesthetics and socio-economic have been summarized in a form of a matrix in Table 4.25.

Environmental Pollution

- Water: surface and ground water pollution
- Air: Ambient air quality

- Soil: Soil quality
- Land: Change in land use pattern and topography

Biological Environment

- Existing Flora and fauna
- Aquatic Ecosystem

														economic activities	
													Commercial value ofproperties		

	Raw Material / Finished Products Storage	**14**		0	
	Storage of raw material and finished	**15**		0	
	Operation of cooling system	**16**		0	
	Pollution control	**17**		0	

	temporary and permanent Jobs	0	0	0	0	0	1	0	0	0	+1	1	+1	+1	0	0
	Effect on crops	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1
	Reduction of farmland productivity	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1
	Income for the state and private sector	+1	0	0	0	+1	0	0	+1	0	+2	0	0	0	0	0
	Savings in foreign currency for the state	0	0	0	0	0	0	0	0	0	+2	0	+1	0	0	0

	Training in new technologies and new skills to workers	0	0	0	0	0	0	0	0	0	+1	+1	0	0	0	0
	Political/social Conflicts	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-2

	Land use change	0	0	-1	-1	0	0	-1	0	0	0	0	0	0	0	0
	Aesthetics and human interest	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1
	Cultural status	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Evaluation marking criteria

Description	Value	
No / Zero Impact	:	0
Minor/ Negligible negative impacts	:	-1
Minor / Negligible positive impacts	:	+1
Significant negative impact	:	-2
Significant positive impact	:	+2
High negative impact	:	-3
High positive impact	:	+3

4.2.3.1 Conclusion of impact matrix assessment

Proposed project will not have any significant negative impacts on the environment. In absence of pollution control equipment, project will have high negative impact. Appropriate Environmental Management Plan (EMP) nullifies all high potential adverse impacts. Moreover, implementation of EMP helps to convert negative impact into positive impacts. Thus, proposed project is certainly safe from the environmental point of view.

4.4 SUMMARY OF ANTICIPATED IMPACTS AND PROPOSED MITIGATION MEASURES

Significant impact from the project activities and its mitigation measures are summarize in Table 4.26.

TABLE 4.26: IMPACTS AND MITIGATION MEASURES

Sr. No.	Environment Aspects	Potential sourceof Impact	Proposed mitigation measures

1.	Air Environment	Stack emissions, vehicular movement, raw material handling	• will be installed which has 99% efficiency. • PUC of the vehicles shall be checked periodically • Periodical maintenance of vehicles • If required spraying of water on the road to suppress thedust emission

2.	Odor	Fermentation, Molasses,	• Fermentation process will be in closed container
3.	Water Environment	Exploitation of surface water and disposal of waste water on land	□ Process condensate treated water will be recycled back into process. □ Domestic effluent Septic tank followed by soak pit system
4.	Land	Land use	• Currently, land does not have any agricultural uses • It is open land and without any human settlement

5.	Soil	Disposal of waste on the land	□ Bagasse ash will be sold to brick manufacturers; Biogas Outlets will be used for Wet Land plantation □ Yeast and ETP sludge will be used as a manure in greenbelt □ Effluent will be treating in process
			Condensate treatment plant. Hence no effluent disposal on the land or in water body
6.	Noise	During Operation	• Acoustic enclosure will be provided, Proper PPE will be given • Sound from the machineries or from other operation shall be restricted within plant boundary

7.	Ecology	Release of pollutant in environment and loss of vegetation during construction	• No vegetation clearance is required • All required pollution control equipment will be provided to ensures the control of pollution
8.	Socio economic	Influx of people, settlement and existing resource utilization	• Over all positive impact is envisaged • CSR activities by proponent will be beneficial to localpeople

9.	Occupational Health and safety	Exposure to the chemicals, Operation of machines, Fire hazardous	• All safety measures and safety equipment's will be in place. • PPEs will be provided to workers and associated staff

4.5 CONCLUSION

The anticipated/identified potential environmental impacts of proposed projectwill be mainly from solid waste disposal, effluent disposal, ground water exploitation and flue gaseous emissions. However, an effective mitigation measurereduces level of significant impact on the environment. Hence proposed projectwill be safe as there won't be disposal of effluent on the land or into the water body. Moreover, all required control measures and required equipment shall be provided to mitigate the impacts.

EIA REPORT

M/S Etistar Bioenergy Pvt Ltd, Situated at Chak No. 106/1-L, Tehsil Khanpur District Rahim yar khan.

CHAPTER NO V

ANALYSIS OF ALTERNATIVES

CHAPTER V

ANALYSIS OF ALTERNATIVES

5.1 INTRODUCTION

Chapter provides the information on various alternatives for the site and technology. The industry shall explore and adopt cleaner technologies and improve the management practices to reduce generation of pollutants.

5.2 SITE SELECTION

Proposed 125 KLPD Distillery will be located at Chak No. 106/1-L, Tehsil Khanpur, District Rahim yar khan.

Factory possesses 25 acres land for Distillery Plant, which excludes 200 acres land for Wetland Technology nearby the distillery plant. Site selection for the existing site was made consideringthe following points,

Availability of raw material/fuel

Proximity of molasses as a raw material and cost-effective transportation logistics

Availability of water supply

The availability of water from the source is adequate to meet the requirement of the proposed distillery.

Availability of infrastructural facility

Industrial infrastructural facilities such as roads, transport, security, water, power, administration etc. are available at site. The plant area does not fall under the industrial areas/ cluster.

Environmental features of site

There are no any eco-sensitive areas such as biosphere, mangrove, protected forest, national parks etc. or environmental sensitive locations such as protected monuments, historical places within 10 km from the site.

5.3 TECHNOLOGY ALTERNATIVES

The technology selection is done on the basis of following considerations

- Least Stress on Resources
- Reduce, recycle and reuse of wastes
- Reduce the pollution from the industry
- No risk to human and property

Technology selection will be done on the basis of efficient utilization of raw material, water, electricity, fuel and considering the recycle and reuse of wastes generated from industry.

The operations of distillery will be mainly Batch Fermentation & Multi-Pressure Distillation

5.3.1 Fermentation process

The fermentation processes are classified as Batch fermentation. In batch fermentation, the bacteria are inoculated into the bioreactor. Then, under controlled conditions (temperature 30^0C-32^0C, pH 4.8-5.8, aeration, etc.) the bacteria go through all the growth phases (lag, exponential, stationary). At last, the fermentation is stopped and the product is collected.

Then, after cleaning and sterilization of the fermenter, the fermenter is ready for another batch.

In batch fermentation**,** the fresh medium flows into the fermenter continuously and part of the medium in the reactor is withdrawn from the fermenter at the same flow rate of the inlet flow.

The technology options for the proposed plant were considered based on efficiency of fermentation and distillation, efficient utilization of raw materials, fuel and water along with efficiency in power generation.

Hence Batch fermentation process has been selected for proposed Distillery project

5.3.2 DISTILLATION

Distillation is a process of separating the component substances from a liquid mixture by selective and condensation. In alcohol production the boiling points of the components in the mixture will be sufficiently close. It is the separation of a mixture into its component parts, or fractions, separating chemical compounds by their boiling point by heating them to temperature at which one or more fractions of the compound will vaporize. Therefore fractional distillation is used in order to separate the components by repeated vaporization-condensation cycles within a packed fractionating column. This separation, by successive distillations, is also referred to as rectification.

Fractional distillation separates alcohol with other fractions at their respective boiling

Points and extracts the alcohol concentration up to 95-96 % v/v. The obtained alcohols are

termed as Rectified Spirit (RS) and distill further to produce extra neutral alcohol.

Proposed distillery is proposes multi pressure/vacuum distillation. Multi pressure / vacume distillation has following advantages,

- Lower steam consumption
- Lower scale formation
- Reduced by-product formation in the mash column

In Multi Effect Evaporated distillation the mash column is operated under vacuum and is heated by overhead alcohol vapors from the rectifying column. Thus, steam supply to the mash column is saved. Similarly, other columns are also operated 'in-pair' using overhead vapors from one to heat the other. There could be nearly a 50% saving in energy.

Technology for producing alcohol from fermentation is well proven technology over a few decades all over the world. No adverse impacts are anticipated due to proposed project**.** Hence no alternative technologies are considered**.**

5.4 WASTEWATER TREATMENT OPTIONS

During the process of distillation will be treated in anaerobic Digesters having the volume of about 60,000 Tons to be processed later on that treated water will be sent to Wetland System which have already an area of 200 acre obtained for this.

Considering the aspect reuse of water recycling, cost of the technology and treatment efficiency, the industry has decided to adopt Biogas Treatment Plant or Effluent Treatment Plant to be installed and sent the out of Effluent Treatment Plant to Wet Land, where we can get Potash rich liquid and solid fertilizer from it.

5.5 CONCLUSION

Technology selection is done on the basis of efficient utilization of raw material, water, electricity, fuel and considering the recycle and reuse of wastes generated from industry. Considering the advantages and technology feasibility, distillery will be operated through Continuous Fermentation & Multi Pressure Distillation.

Produced at Distillery later on outlet of Aerobic Digesters will be sent to Wet Land for further process.

EIA REPORT

CHAPTER NO VI

M/S Etistar Bioenergy Pvt Ltd, Situated at Chak No. 106/1-L, Tehsil Khanpur DistrictRahim yar khan

Environment Monitoring Program

CHAPTER VI

ENVIRONMENT MONITORING PROGRAM

6.1 INTRODUCTION

Present chapter delivers environment monitoring program, its frequency, parameters and methodology for air, water, noise, and solid hazardous waste/ soil environment. It also furnishes the information of reporting system of environmental parameters and responsibility of environmental monitoring program.

An environmental monitoring plan provides a delivery mechanism to address the adverse

environmental impacts of a project during its execution by periodic monitoring of important environmental parameter so as to maintain the environmental quality within the standards, and to introduce standards of good practice to be adopted for all project works.

An environmental monitoring program is important as,

- It assists in detecting the impacts and control measures.

Evaluates the performance and effectiveness of mitigation measures proposed in the Environment Management Plan (EMP) and suggests improvements in management plan, if required.

An Environmental Monitoring Program has scheduled with the following objectives

- To verify the result of the impact assessment study with respect to new developments
- To study the parameters which have been identified as critical?
- Status of pollution load within the project site and its vicinity
- Generation of data for predictive or corrective purpose in respect of pollution
- To check or assess the efficiency of controlling measures

6.2 ENVIRONMENT ASPECTS TO BE MONITORED

Proposed project shall monitor the following environmental aspects to ensure effectiveness of EMP and mitigate any impact envisaged during the commissioning and operation phase.

6.2.1 Ambient air and stack monitoring

Ambient air quality will be monitored at three locations and pollutants monitored will be Respirable Suspended Particulate Matter (PM 10, 2.5), Sulphur Dioxide (SO_2) and Oxides of Nitrogen (NOx).

- Monthly monitoring of stack will be carried out for the parameters such as PM, SO_2 and NOx to assess the performance of pollution control facilities installed for the unit

6.2.2 Water and waste water quality

- Surface and ground water samples towards downstream of project will be collected and analyzed periodically.
- Characteristics of Cooling Tower and Boiler feed water will be check periodically.
- Environment Statement Reports will be filed as per the schedule prescribed by Pollution Control Board
- Analysis of water, wastewater will be in laboratories approved by Environmental Protection Agencies.

6.2.3 Soil and Solid/ Hazardous Waste

- One surface soil sample from proposed ETP, storage lagoon and projectsite will be taken and analyzed as per the standard method.
- Solid hazardous waste will be disposed of regularly as per EMP. Management will keep record of Ash generation and its disposal i.e. by selling.

6.2.4 Noise monitoring

Ten noise monitoring location will be selected considering noise generation area

- Personal protective equipment like ear plugs/ear muffs will be provided to employees working near such noisy area.
- The noise attenuation measures will be taken at the design stage.

6.2.5 Occupational health and safety

Routine medical examination of personnel will be carried out at regular intervals and followed for all workers to determine any changes in health condition due to the working conditions. Pre-medical check-up will also be carried out at the time of employment.

6.3 ENVIRONMENT MONITORING PLAN

The post project monitoring plan will be as follows,

- Prior to the commencement of operation
- After 6 months of commencement of operation
- Once in a year from the commencement of operation

Environmental parameters to be monitored and its frequency after commissioning of proposed project is mentioned in Table 6.1

Table 6.1: Environmental monitoring schedule

Sr.	Particulate	Parameters	Number of locations	Frequency
1.	Ambient air quality	PM_{10}, $PM_{2.5}$, SO_2, NOx, CO, etc.	Ambient air quality at minimum 3-5 locations. 1 location within the plant premises, 1 location in upwind, 1 location in downwind direction and 1 location in cross wind	Monthly
2.	Stack gas	PM, SO_2 and NOx	Number of stacks	Monthly
3.	Work place	$PM_{2.5}$, SO_2, NOx, CO, O_3	Process emission in workplace area/plants (for each area/plant minimum 2 locations and 1 location outside plant area near vent)	Monthly
4.	Waste water	pH, EC, SS, TDS, O&G, Ammoniacal Nitrogen, COD, BOD, Chloride, Sulphide etc.	Wastewater from all sources. Inlet & outlet of ETP, Condensate treatment plant	Monthly

5.	Surface water and ground water	pH, Salinity, Conductivity, TDS, Turbidity, DO, BOD, Phosphate, Nitrates, Sulphates, Chlorides,	3-5 location Ground as well as Surface water	Half yearly
6.	Solid waste	Ash	• Process dust generated sludge and ash.	Monthly

7.	Noise	Equivalent noise level - dB (A) at min. Noise Levels measurementat high noise	5 location At all source and outside the Plant area.	Monthly
8.	Green belt	Number of plantations (units), number of survived plants/ trees, number of poor plant/ trees.	In and around the plant site	Monthly

9.	Soil	Texture, pH, electrical conductivity, cation exchange capacity, alkali metals, Sodium	2-3 near Solid/ hazardous Waste storage. At least five locations from	Quarterly
10.	Occupational health	Health and fitness checkup of employees getting exposed to various hazards and all other staff	All worker	Yearly/ twice a year

6.3.1 Monitoring methodologies

Environmental samples will be collected as per the guidelines provided by EPA Punjab. The method followed for monitoring will be recommended/ standard method approved/ Recommended by EPA Punjab. Detail of the same is mentioned in Table 6.2.

Table 6.2: Methodology of Environmental Monitoring

Sr.	Description	Method	
		Sampling/ Preservation	Analysis
1.	Ambient air monitoring	Samplers (Designed as per EPA Punjab) to collect PM 2.5, PM10 & the gaseous samples	Standard method mentioned EPA Punjab standard
2.	Stack gas monitoring	Samplers (Designed as per EPA Punjab) to collect particulate matter & the gaseous samples	- Standard method mentioned EPA Punjab standard
3.	Water and waste water	Standard methods for examination of water and wastewater	Standard methods for examination of water and wastewater published
4.	Noise monitoring	Instrument: Sound level meter	-

5.	Soil monitoring	Collected as per soil analysis reference book, M. I. Jackson and soil analysis reference book by C.A. Black	Analysis reference book, M. I. Jackson and soil analysis reference book by C.A. Black

6.4 REPORTING AND DOCUMENTATION

All the necessary reports and documents will be prepared to comply with statutory rules and regulations. The records of the monitoring program along with the results of all the parameters being monitored will be maintained on regular basis.

The environmental monitoring activities will be recorded and the following documents are proposed to be maintained,

1. Log sheets of operation and maintenance of pollution control facilities/ equipment such as ETP boiler operation and test results of inlet and outlet.
2. Instruction manuals for operation and maintenance of pollution control facilities/ equipment like ETP as well as for manual for monitoring of water, solid and gaseous parameter discharged from the project.
3. Statutory records as per the environment related legislation.
4. Monthly and annual progress report.
5. Bi-annual compliance statement for Regional Office, EPA.
6. Annual environmental audit statements and compliance to NOC/ Consent conditions to EPA Punjab Lahore / Regional Office, EPA.

6.5 FORMULATION OF ENVIRONMENT MANAGEMENT CELL (EMC)

The Environmental Management Cell shall be responsible for the environmentalmanagement, monitoring and implementation activities of the proposed unit. EMC will carry out various activity of environment under the supervision of the Head of the plant. EMCcell shall be responsible for;

- Monitoring of efficiency of pollution control equipment's
- Preparation of maintenance schedule of pollution control equipment and treatment plants and see that it is followed strictly.
- Monitoring activities within core and buffer zone of proposed project as per monitoring schedule.
- Inspection and regular cleaning of setting tanks, drainage system etc.
- Greenbelt development and maintenance
- Water and energy conservation measures
- Good housekeeping

6.6 LABORATORY FACILITY

The plant will have an in-house environmental laboratory for the routine monitoring of water and wastewater. The outside agencies can also be hired for analysis of other environment aspects like air, noise and soil. The following equipment's are recommended

to the project proponent for implementing the post project environmental monitoring

program. Following are the list of instruments which are suggested to implement at thesite for proper monitoring of operation of the plant.

Table 6.3: List of laboratory instruments

Sr. No	Name of equipment
1.	pH meter, TDS Meter,
2.	COD Digester
3.	BOD Incubator
4.	Oven
5.	Analytical Balance
6.	Hot Plates & Water Bath
7.	Refrigerator
8.	Magnetic Stirrer
9.	Vacuum Pump
10.	DO Meter
11.	Required Glassware's, chemicals and reagents

6.7 BUDGETARY PROVISION FOR ENVIRONMENT MANAGEMENT

The costs involved in environmental monitoring and management to mitigate the adverse effects will be put on account for the proposed project. The approximate cost for the EMP will be Rs. 22.5 Million PKR. Bifurcation of the EMP cost is given in Table 6.4.

Table 6.4: Environment Management Cost

Sr. No	Description	Capital Cost (Rs. in Million)	Recurring Cost (Rs. in Million)
1.	Air Pollution Control	10	1
2.	Water Pollution Control	7.5	1
3.	Solid waste Management	1.0	0.3
4.	Environmental Monitoring and Management	_	2
5.	Rainwater Harvesting	2.0	.5
6.	Occupational Health	1.0	.6
7.	Green belt development	1.0	.5
	Total	**22.5**	**5.9**

EIA REPORT

M/S ETISTAR BIOENERGY PVT LTD, SITUATED AT CHAK NO. 106/1-L, TEHSIL KHANPUR DISTRICT RAHIM YAR KHAN

CHAPTER NO VII

ADDITIONAL STUDIES

CHAPTER VII ADDITIONAL STUDIES

7.1 INTRODUCTION

Additional studies like review of social impact and public consultation were undertaken. Apart from the public consultation, major portion is dedicated to the study of hazard identification and risk assessment. It also covers the requirement for onsite and offsite disaster (natural and manmade) preparedness plan including emergency management plan including.

7.2 SOCIAL IMPACT ASSESSMENT STUDIES (SIA)

Rehabilitation and Resettlement (R & R) and Social Impact Assessment (SIA) studies has not found any relevance for the proposed project site as there would not be any temporary or permanent displacement of the personnel or goods as the proposed project will be located on unoccupied open land. At present no agricultural cultivation of the crops is being takenon the proposed land. Hence, no R & R and SIA studies or plan were undertaken for the particular site.

Proposed project activity will not cause any negative impacts on the environment and on the society as it will increase the direct and indirect job opportunities along with indirect work to the local people residing in the area

There will be some development of secondary service market near the site which will be beneficial to the local economy.

7.3 PUBLIC CONSULTATION

Hence, Public consultation is applicable to the proposed project. The Public Hearing will be conducted after the submission of the draft EIA to the EPA Punjab. The details of public hearing minutes will be unified in this report after completion of Public Hearing. Public Hearing for the proposed project will be conducted. Draft EIA/EMP report with executive summary in English and local language will be submitted to EPA Punjab. The news of Public Hearing tobe conducted on the above-mentioned date will be widely published in the English & Local Newspaper for the knowledge of local people and stakeholders before one month. The copies of EIA report in English and local language will be made available with the officeof EPA Punjab and its local office Rahim yar Khan. During the public consultation, all the dignitaries including Collector, SRO, RO and local Number-Da will be present for the meeting.

7.4 HAZARD IDENTIFICATION

In practical terms, hazard identification is a thorough look at the workplace and processes to identify those things, situations, processes that may cause harm, particularly to the working force and nearby population. After identification of the potential hazards, one has to evaluate it potential to cause harm and then decide what type of control measures shall be taken to control it from the happening. Hazard identification is very important tool as it is integral part of a good occupational health and safety management plan. The aim of the hazard identification process is to reduce level of risk by taking precautions or initiating control during project execution.

The various hazard analysis techniques that may be applied are Hazard and Operability (HAZOP) studies, Fault – Tree Analysis (FTA), event –tree analysis and failure and effects

mode analysis.

7.4.1 Hazard Identification & Risk Assessment (HIRA)

The purpose of a Hazard Identification and Risk Assessment (HIRA) is to understand what risks or threats to public safety, property or the environment exist.



Figure 7.1 (a): Hazard Identification & Risk Assessment (HIRA) process

Hazard Identification and Risk Assessment (HIRA) Process**,**

- Identification of hazards
- Analyze or evaluate the risk associated with the hazards
- Determine appropriate ways to eliminate or control the hazards
- Evaluate the likelihood of an injury or illness occurring, and its severity
- Review of all available health and safety information about the hazard including MSDS,
- manufacturer’s literature, information from organizations and results of testing
- Identify actions necessary to eliminate or control the risk

- Monitoring to confirm the risk is controlled

- Keep any documentation or records that may be necessary. Documentation may include detailing the process used to assess the risk, outlining any evaluations, or detailing how conclusions were made.

7.4.2 Identification Hazard

Details of major anticipated risks from the Hazards is given in Table 7.1

Table 7.1: Hazards of the proposed plant

Sr. No.	Name	Description	Severity	Hazard
1.	Transportations of raw material	Molasses	Major	Exposure
		Bagasse	Minor	-
		Yeast, urea	Minor	Exposure &
		Sulphuric Acid, Di ammonium Phosphate, Anti-foam reagent, Caustic soda	Major	Exposure & inhalation
2.	Storage of Molasses Products	Molasses, RS/ ENA/ Technical Alcohol, fussel	Major	Explosion, Fire

3.	Manufacturing process	Fermentation	Major	Fire
		Distillation Unit	Major	Heat & fire
		Power Plant	Major	Heat fire &
4.	Utilities	D.G set, Boiler, Turbine	Major	Heat, fire &
5.	Other accidents	Leakages from the vessels, Catastrophic rupture of	Major	Exposure & fire

7.5 RISK ASSESSMENT

Risk analysis deals with the identification and quantification of risks, the plant equivalent and personnel are exposed to, due to accidents resulting from the hazards present in the factory. Risk classification table is given in Table 7.2.

Table 7.2: Risk classification and score table

Impact \ Likelihood	Rare (1)	Unlikely (2)	Possible (3)	Likely (4)	Almost Certain (5)
Catastrophic (5)	Moderate Risk	Moderate Risk	High Risk	Critical Risk	Critical Risk
Major (4)	Low Risk	Moderate Risk	High Risk	High Risk	Critical Risk
Moderate (3)	Low Risk	Moderate Risk	Moderate Risk	High Risk	High Risk
Minor (2)	Low Risk	Low Risk	Moderate Risk	Moderate Risk	Moderate Risk
Insignificant (1)	Low Risk	Low Risk	Low Risk	Low Risk	Moderate Risk

Table 7.3: Risk Impact and rating matrix during constructionphase

Activity	Associated	Health impact	Risk	Proposed mitigation
Site Leveling	Vehicular movement, Insect/snake bite	Physical injury,and organ damage	M	• Providing PPEs to workers • Appointing the

7.5.1 Potential risk and mitigation measure for during construction phase

Risk impact and mitigation measures during construction phase are describes in Table7.3

Activity	Associated	Health impact	Risk	Proposed mitigation
				• Providing Training
Loading and Unloading of material	**Accidents**	Physical Injury	M	• Providing PPEs toworkers • Training to workers

Excavation	• Falling objects or objects near an excavation • Slips, trips, and falls	Property Loss Physical injury	M	• Work Permit Systemwill be followed. • Excavated material will be stacked safely. • Area will be

Construction	• Structure may fall down • Workers may fall down from the height.	Physical Injury Physically handicapped Property Loss	H	• Work Permit System will be followed. • Height work permit will be issued to the person.

Cutting and Welding	fire or explosion Electric shockfrom electrical welding	Physical InjuryBurn Injury Property loss	H	• Standards Work Procedure • Training will be provided • Proper PPEs will be • Provided. • Regular monitoring of Electrical equipment's to avoid loose connection • Area will be barricaded
Installation of Machineries.	Structure may collapse	Property loss Physical Injury	M	• Only authorized person will operate the machine • Appropriate platform will be

7.5.2 Potential risk and mitigation measures duringoperation phase

7.5.1.1 Operational Phase

The potential risk and its mitigation measures for operation is given in Table 7.4.

Table 7.4: Risk Impact and rating matrix of operation phase

Sr. No.	Activity	Associated Hazards	Health impact	Risk ration	Proposed mitigation and control measures
1.	Working near Boiler	High noise	Noise induced hearing loss	M	Required PPEs need to be used
2.	Boiler maintenance	Mechanical hazard	Physical injury	M	PPEs Regular monitoring for checking leakages

3.	High Pressure Steam	Explosion	Risk of severe injury, damage to equipment	H	• Required PPEs • Good housekeeping • Regular monitoring of the storage facility • Flammable chemicals stored away from the source of ignition • Firefighting facility • Provision of First aid Box

4.	Incomplete Combustion	Asphyxiation n from carbon monoxide	Possible fatality	H	• Online CO monitors • Regular checking of workplace • Individual alertness and precaution
5.	Maintenance work	Slips, Trips and Falls	Physical injury	M	• PPEs • Individual alertness and precaution

6.	Electrical maintenance work	Electricity	Electric shock, Possible burns	H	• Regular checking and maintenance of electrical units • PPEs • Provision of First aid box
7.	Maintenance of burner	Burn injury	Severe Physical injur yor burn	M	• PPES will be provided. • Work will be carried out under proper supervision. • Follow of SOPs. • Individual alertness and precaution is important Provision of First aid box

7.5.2.2 Risk during D.G. set operation

Table 7.5: Risk Impact and rating matrix for D.G. set operation

Sr.	Activity	Associated	Associated Risk	Risk	Proposed mitigation
1.	Working	High noise	Noise induced	M	• Use of PPEs
2.	Maintenancee	Fire	Burns, Serious injury	H	• Restricted Entry • Use of flame proof
3.	HSD Storage	Leakage / Fire	Risk of severe physical injuryand burn	H	• Storage will be awayfrom ignition source • Regular monitoring to check the leakages and spillages

4.	DG set maintenancee	Mechanical Hazard	Physical injury	M	• PPEs • Leakage and heat inthe joint will be checked before maintenance • First aid box at approachable place

7.5.2.3 Hazard & associated Risk of storage and handling of raw material

Impact matric for risk associated with storage and handling of material is given in Table 7.6. Grain and alcohol storage Tanks details are given in Table 7.8. Material safety data sheets for Chemicals are enclosed as Annexures.

Table 7.6: Impact matrix of Storage and handling of raw material

Sr. No.	Activity	Associated Hazards	Associated Risk / Health impact	Risk rating	Proposed mitigation measures
1.	**Storage, handling, loading & Unloading of**	**Exposure, leakage, Fire, Explosion**	**Physical Injury, burn, Eye irritation and respiratory problem**	**H**	• **Provision of Eye wash** • **Inspection and regular monitoring of storage area**
	material				Training to PPEs will be provided as Nose mask, Hand gloves. Proper system for loading operation to prevents spillage Provision of level indicators for storage Tanks Spill kit for Acid and other chemicals Proper ventilation First Aid boxes

2.	Transportation	Fire, Accident,	Burns, serious injury	H	[Firefighting facility [Training to Driver [TREM Card [First Aid Box

7.5.2.2 Hazard & associated Risk of Molasses storage tank

Molasses can ferment if excessive moisture contamination is allowed. Fermentation canyield carbon dioxide with possible traces of ethanol or volatile fatty acids (e.g. acetic, propionic, lactic, or butyric) and if exposed to a spark or flame may result in an explosion. Fermentation may also occur in dilute surface layers formed by condensation from the headspace above the liquid.

Table 7.7: Impact matrix of storage of molasses

Sr.	Activity	Associated	Associated Risk/	Risk	Proposed mitigation
	Storage and Handling	Explosion	• May cause slight irritation • May cause irritation	H	• Proper ventilation shall be provided • Inspection and regular monitoring of storage area • Training to Workers for proper handling • PPEs will be provided as Nose mask, Hand gloves. • Provision of level indicators for storage Tanks

					If causes eye irritation wash area with soap, flood eye with water and water

Table 7.8: Storage Tanks

S.No	Description	No	Volume/Weight/Capacity
1	Molasses Storage Tank	3	15,000 Ton
2.	A Grade Daily receiver	2	150,000 Liters
3.	B-Grade Daily receiver	2	15,000 Liters
4.	A Grade Final Storage	2	4,000,000 Liters
5.	B Grade Final Storage	1	4,000,000 Liters
6.	Denatured Storage	1	500,000 Liters
7.	Fussel Oil Storage Tank	1	200,000 Liters
8.	Furnace Oil Storage	1	500 Tons
9.	Bagasse storage yard	1	3000 MT

7.5.2.3 Risk associated with alcohol storage and its mitigation measures

Material Safety Data Sheet (MSDS) for ethyl alcohol is enclosed as Annexure. Impact matric of risk associated with storage and transportation of alcohol along with control and mitigation measures are given in Table 7.9

Table 7.9 Impact matric of risk associated Alcohol storage

Sr.	Activity	Associate	Health impact	Risk	Proposed Control and
1	Storage of Alcohol	Exposure, inhalation, ingestion & Fire, cause eye and skin irritation	Exposure to over 1000 ppm may cause headache, drowsiness and lassitude, loss of appetite, and inability to concentrate. Throat Irritation • Ingestion causes depression of central nervous system, nausea, vomiting, and diarrhea	H	**Storage** • Storage will be away from process area with well-ventilation. Avoid all possible sources of ignition like spark orflame. • Use spark/flame proof hand tools • Electrical wiring will be flameproof type • Based on the leakagequantity, wiped out with or dilute by spraying the water to suppress the vapors

			• Liquid or vapor may		
			• PPEs will be		

7.6 SAFETY MEASURES RECOMMENDATION

7.6.1 Storage and material handling area

- Proper ventilation shall be provided
- Area will be marked as “No Smoking Zone”
- Use of proper PPEs
- Pressure relief valves shall be provided
- Provision of Safety valves and rupture disk
- Adequate distance between the storage Tanks
- Provision of dyke wall to the Tanks
- Proper earthing to the Tank

7.6.3 DG Sets

- Acoustic enclosures to be provided
- Entry near the unit shall be restricted
- Qualified and highly trained engineers shall be appointed

7.6.4 Boiler

- Work permit system will be evolved and will be followed during maintenance work
- Proper ventilation shall be maintained
- Entry shall be allowed only after proper checking of gases, if any
- Worker should be trained properly
- Working should be under supervision of qualified and trained personnel

7.6.5 Storage and Handling of Alcohol

- Keeping away from oxidizers, heat and flames.
- Avoidance of plastics, rubber and coatings in the storage area.
- Cool, dry, and ventilated storage and closed containers.
- Leakage should be washed out and diluted.
- Regular monitoring and maintenance to avoid leakages.
- If major leakage in tanks can be mitigated by transferring the material to another tank.
- Transfer the material to another tank.
- Grounding of the container and transferring of equipment to eliminate static electric\ sparks. In case of any emergency following measures would be taken:

  – First Aid Measures

  – Use of extinguishing media surrounding the fire as water, dry chemicals (BC or ABC

powder), sand, dolomite, etc.

- Foam system for firefighting will be provided to control fire from the alcohol storage tank. The foam thus produced will suppress fire by separating the fuel from the air (oxygen), and hence avoiding the fire and explosion to occur in the tank. Foam would blanket the fuel surface smothering the fire. The fuel will also be cooled by the water content of the foam. The foam blanket suppresses the release of flammable vapors that can mix with the air.

  Special Fire Fighting Procedures; Keeping the fire upwind. Shutting down of all possible sources of ignition, keeping of run-off water out of sewers and water sources. Avoidance of water in straight hose stream which will scatter and spreadfire. Use of spray or fog nozzles will be promoted, cool containers will be exposed to flames with water from the side until well after the fire is out.

7.6.6 Molasses storage

- Store in good quality ventilated and leak-proof tanks (mild steel, stainless steel, polyethylene, PVC) at ambient temperatures, out of moisture.
- Continuous mixing of molasses should be done.
- If there is increase in temperature beyond 30 ^{o}C external cooling of tanks should be provided. A temperature recorder should be provided to the tanks.
- Avoid microbiological contamination or dilution with water.
- Regular monitoring and maintenance to avoid leakages.

7.6.7 Building & workspace

- Adequate space will be provided for equipment repair or removal
- Equipment maintenance shops will be set up with appropriate safety provisions for

hazards associated with maintenance activities

 Lightning protection will be provided

7.6.8 Electric items

 Medium and high voltage cables will be completely enclosed

 Electrical equipment will be grounded adequately

 Wiring will be properly insulated, grounded, and non-exposed

 Emergency shutoff switch, clearly labeled, at all machinery units will be provided

 DG set will be provided as stand by source of power

- Maintenance tools with insulated handles will be provided

7.6.9 Fire

The fire protection system is to provide for early detection, alarm, containment and suppression of fires. The complete fire protection system will comprise of the following. Fire hydrant network will be provided for firefighting in the entire project area along with following firefighting equipment will be provided

- Different type of Fire Extinguishers, Detectors and fire Alarm shall be provided
- Fire hydrant system
- Fire Tender with chemicals foam and required arrangement for firefighting to control

the fire from the alcohol storage

- Foam system shall be contained aqueous film forming compound of 3 to 6%alcohol resistance foam concentrated with ISI mark 4889
- Water storage Tank exclusively for firefighting operation
- Rubber mat will be used near panel area
- Periodical training to the identified supervisors and Employees in the field of Firefighting and safety
- Emergency exits at specific locations and will be marked on the layout
- Cautionary note, safety posters, stickers will be displayed at appropriate locations
- First Aid boxes will be made available at appropriate locations
- Emergency Control Center Provision shall be made to establish an Emergency Control Centre (ECC) from which emergency operations are directed and coordinated. This center is activated as soon as on–site emergency is declared. ECC is equipped with adequate communication systems in the form of telephones (Emergency telephone numbers.) and other equipment's to allow unhampered organizations and other nearby facility personnel.

7.6.10 Occupational health hazard and safety measures

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During operation handling of chemicals and other material used, a practice of preventive maintenance shall be adopted to take care of employee's health. The various safety equipment such as breathing apparatus, gum boots, goggles and helmets will be provided to the workers/operators. Besides, all the first aid, firefighting devices will also be inspected,tested and maintained periodically so that it is available in ready to use condition. Provision of pre-medical and periodical health check-up for all the employees shall be implemented and record maintained. If any abnormality is noticed due to occupational exposure, necessary

Treatment will be assured from qualified physician. Following measures shall be implemented to avoid the occupational hazards to the employees:

- Regular housekeeping of the entire plant area
- Regular or preventive maintenance of floor, platforms, staircases and passages toavoid the slip incident
- Provision of obstruction free walkways and workplace
- Periodical training to the employees for the proper operation of the Plant andvarious processes
- Restricted entry into the plant premises
- Checking and calibration of all Instruments and Fire Devices to keep them in proper operating conditions
- Installation of Electrical devises as per the prescribed standards
- Provision of D.G. Sets to avoid the complication during power failure
- Provision of required fire Extinguishers at different locations for easy access

- Provision of lighting Arrester
- Various types of PPEs like breathing apparatus, ear muffs, earplug, masks, leather hand gloves; asbestos hand gloves; acid/alkali proof rubber hand gloves; electrical resistance hand gloves and gum boots, goggles and helmets will be made available

Provision of First aid Boxes and periodical checking for required medicine and other material to take care of superficial bodily injuries during work

7.7 DISASTER MANAGEMENT PLAN (DMP)

A disaster is an unforeseen combination of circumstances that causes serious body injuries, loss of life or extensive damage to the plant, Machineries or to the environment.

Following uncontrollable situation may lead to disaster or plant emergency:

7.7.1 Manmade

- Plant failure
- Rupture or damage of the line, vessel or Tank
- Excessive leakage of flammable material

7.7.2 Natural

- Cyclone
- Earthquake

- Flood
- Fire
- Terrorist attack

Disaster management plan is a written document where all the details regarding the causes of disaster are noted along with required control measures. It also gives details about the responsible personnel shall be available on-site during emergency and their role to control the disaster to a minimum level or from spreading the outside to protect the plant and machinery including employees and nearby areas. The DMP to tackle the emergency can be divided into the two parts for the ease of operation and to effectively control the emergencies within shortest possible time.



Figure 7.2: Disaster management process

7.7.3 Onsite Emergency Plan

If an accident / incident takes place in a factory and its effects are confined to the factory premises only, then it is termed as an Onsite Emergency. It involves employees and other infrastructure within the organization. In this plan, the company officers and employees are given pre-decided responsibilities to handle the emergency. All other required resources to tackle this type of emergency are available from within the factory. The individual employee or designated persons will be held responsible to take or initiate appropriate action as and when required. All the employees / responsible persons required to take or initiate the action at the time of emergency are trained appropriately so that they can perform their task without any difficulty. To make the handling of emergencies absolutely perfect, mock drills need to be conducted periodically for a particular scenario. During mock drills, particular scenario is simulated to understand the gravity and requirements of action. During the mock drills, all the important points or happenings are noted and discussed tofind out the lacunae or for the further improvement in the written plan.

7.7.4 Offsite Emergency Plan

If the accident or incident occurred in the factory premises, factory will need help from outside sources because of magnitude of emergency then it termed as Offsite Emergency. This offsite emergency cannot be controlled only by using the internal resources and need timely help from the outside companies or from the government authorities to tackle such type of emergencies to avoid the loss of property, human health or environment in and around the premises. An offsite emergency management plan involves government bodiesas well as nearby industries for necessary help and to control the emergency.

7.7.5 Objectives of disaster management

- To control the incident or accidents from the happening
- To eliminate the emergencies if possible
- Prepare for the emergency handling
- To see whether required activities are performed in right order by the individuals or not
- To find out the required changes for coordinated activities
- To reduce the time of activities to control the emergencies
- To minimize the effects of the incident on person, property and environment
- Continuous improvement

7.7.6 Onsite Emergency Preparedness Plan

Main elements of on-site Emergency Preparedness Plans are:

- Leadership and emergency management cell
- Defined role and responsibilities of the key personnel
- Emergency actions to be executed by the Members of the Committee
- Protective and rescue equipment
- Medical care Unit
- Training and periodic review

- Periodical Mock drills, its monitoring and analysis to find out the short coming for the improvement
- List of available firefighting equipment, its maintenance and records
- Training to the committee members and feedback on requirements if any
- Line of command
- Requirement of Siren and alarm system
- Written document
- List of available resources with the Company
- List of resources available from outside during the emergency
- Important phone numbers of authorities

7.7.6.1 Disaster Management Cell

Disaster Management Cell (DMC) consisting of authorized head that will be responsible for the handling of emergency situations. All the details of team members will be available atthe site; their contact details will be displayed in the plant and will be informed to other employees. DMC will make the employees to understand and aware about the hazards and associated risks that may give rise to an emergency situation at the plant. DMC will train and inform the employees regarding their role and responsibilities during emergency and dos and don'ts. Following team of personnel will be required to fulfill their responsibilities to tackle the emergency.

TEAM A

The distillery general manager (GM) along with manager of each section will be responsible for handling of any kind of emergency in the factory. They will inform the concern employees or authorities about the emergency situation and action that need to be initiated. They will take initiative in directing the action of the people.

TEAM B

After knowing the emergency situation, in-charge of individual section / department will communicate with In-charge **(HSE)** for any specific instruction and then he will guide other employees of the section to leave the workplace after taking safe shut down. They will be asked to assemble at Assembly point upwind of the Factory. After reaching the assembly points they should watch the activities undertaken by the Team A and wait for further instruction if any form the Manager. The Manager / Supervisor will act as an Incident Controller at his Section or the Emergency location and need to wait for further instruction from Disaster Main Controller

TEAM C

The maintenance In-charge and other maintenance head from each department such as Mechanical Engineering, Electrical Engineering, Instrumentation and Civil Engineering along with Safety and Fire will form this Team who will actually fight the situation to control the emergency. All the required equipment and firefighting accessories will be available to their disposal. They will have all safety appliances in their custody / use and they will act to minimize effect of incidence.

After the emergency is under control, they will inform the DMC and DMC will inform all other teams involved that emergency is under control. The HSE shall appraisethe situation and

if found Ok, he will inform control room to declare all clear sound / sirenso that employees can resume the duties.

TEAM D

This Team is mainly concern with the security and outside news and will take the instruction from the DMC. It will consist of security department and welfare officer who will be available at the office with all necessary records including names of Team Members and other required help from outside. They will have the list of people along with their addresses and telephone numbers. They will keep the records of important offices of the Government authorities such as Directorate of Industrial Safety and Health, Boiler Inspector of factory, Commissioner of Police, local Police station, Fire Brigade, company Doctors, private Doctors and other important contact which will be helpful during and after the emergency.

All required facilities shall be made available at a particular location in the Factory for emergency use. All the personnel involved in emergency shall proceed or will be brought to the factory. Based on the information gathered and provided by the incident controller of particular section where there is emergency, if required emergency shall be declared by the during emergency and as per the information received by the HSE from IC, the Team members from the Rescue team shall look out for the casualties if any on the site and will provided necessary help. The required medical and other help shall be provided based on the requirement and assessment of the gravity of the situation. The team will also carry out the head count if required and as per the instruction of HSE or the Occupier. Further, the detail shall be provided to outside agencies by the nominated authorized person from the Factory to avoid the mismatch of the situation so that right message goes to the media. During emergency, care shall be taken to avoid the panic situation within and outside the factory premises or in the general public.

7.7.6.2 Key Personnel

The actions necessary in an emergency will clearly depend upon the prevailing circumstances. Nevertheless, it is imperative that the required actions are initiated and directed by nominated people, each having specified responsibilities as part of coordinate plan. Such nominated personnel are known as Key Personnel.

The Key Personnel are:

- General Manager Site/Project
- HSE Manager
- Production Manager
- Fire and Security Officer (FSO)
- Team Leaders (TL)

7.7.6.3 Requirement of Equipment and Materials

- Based on actual assessment of emergency, there can be requirement of Extra First Aidpersonnel to deal with casualties and need to be provided from outside
- All types of PPEs
- Emergency engineering works, provision of extra or replacement of light, isolation ofequipment, temporary by pass electrical lines etc.
- Assembly point, emergency control center, sign boards
- Moving Tankers or other vehicles from area of risk
- Fire protection and firefighting facilities
- Emergency lighting and standby power
- Material safety data sheets for hazardous chemicals
- Plan showing hazardous material storage area



- List of emergency equipment
- List of important telephone numbers and addresses
    - Nearest hospitals and ambulance service center
        - Nearest fire station
        - Govt. Officials

Names and address & contact telephone number of key personnel. The onsite emergency plan will be documented and circulated to all concerned for knowledge, study, to understand and easy follow up. The emergency plan will be rehearsed and practiced at regular intervals i.e. Mock drills shall be conducted at suitable interval to test efficiency of plan, personnel, equipment and coordinated efforts to increase confidence level of personnel during emergencies.

7.7.6.4 Training

- Training on fire fighting
- Training on spill control
- Training on toxic release control
- Training on good housekeeping
- Training on use of PPEs

7.7.6.5 Communication

Following means of communication will be been made available,

- Telephones
- Walkie-talkies
- Mobiles
- Public announcement system
- Emergency Siren

7.7.7 Offsite Emergency Plan

In case the hazard spreads out-side the premises Team A under the instruction of DMC will communicate to the District Magistrate, Commissioner of the Police and inform the situation as Off-Site Emergency. Types of emergency facilities/actions required from outside bodies are,

- Firefighting facilities required: Factory will have its own firefighting facilities but during emergency, fire brigade may be called from nearby areas or other establishments
- Police help shall be required during emergency for control of people, traffic and security arrangements
- Medical help required: seriously injured personnel may be referred to the Hospital/Primary Health Centre depending upon injuries

7.7.8 Information to authorities

- Emergency situations will be informed to the local Panchayat official regarding the likely hazards from the industry and the steps to be taken when there is an Off-Site Emergency. It is preferable that the Local Panchayat Officials are also trained on simple protective methods through demonstrations and practice
- Deputy Commissioner, SSP of the Police and District Control Room if exists

7.7.9 General Natural Disaster Management Measures

As Project site is Situated at Chak No. 106/1-L, Tehsil Khanpur District Rahim yar khan. 28024'37.6" N and 700 32' 52.7" E at Seismic zone for the proposed project site comes under zone III (Moderate).

- Factory Management shall train their staff to manage emergencies arises from fire,flood, lightning and leakages.

- As soon as the emergency warning receives from District Disaster Management Authority, the raw materialas well as finished products shall be kept to a minimum to avoid spillage or misuse
- All the material and products shall be stored properly to avoid the damage or mixingwith other

All the employees will have the list of important phone numbers and contact details to help in getting therequired help in time. These numbers shall be displayed at distinct location within Factory premises

Company's designated person from Team A will be main contact person for all the employees for any type required help from outside

- District level disaster management units
- Health & Family Welfare
- Nearest Doctors & Ambulance

- Forest & Environment department
- Police Station
- Village heads & Panchayat
- Company's Emergency Management Cell Members
- Transport
- Electricity
- PWD
- Substation details from where Company takes power
- Civil Supplies
- Animal Husbandry
- Agriculture

7.8 CONCLUSION

Project proponent will implement all preventive measures to tackle all type of emergencies arising out of operation or malfunction of individual units. The required resources for Onsite and Offsite emergency management plan will be properly planned and provided to implement the plan effectively. The factory shallgive highest priority towards Health and safety of the employees and people residing nearby areas.

Management shall conduct the training to the nearby villagers to appraise them about their role during emergency. All nearby people shall be given training on do's and don'ts during emergency situation.

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CHAPTER VIII

PROJECT BENEFITS

CHAPTER VIII PROJECT BENEFITS

8.1 INTRODUCTION

Project benefit chapter furnishes the benefits of the project towards the society. This chapter is intended to give improvements in the physical infrastructure, improvements in the social infrastructure, employment potential – skilled, semi-skilled and unskilled and other tangible benefit from this project

8.2 PROJECT BENEFITS

8.2.1 Improvements in the physical infrastructure

The industry is established in the rural region of the province. The establishment of industry will provide direct and indirect employment to more than 350 local rural persons. Major part of these labors will be mainly from local villagers who are expected to engage themselves both in agriculture and project activities. This will enhance their income and lead to overall economic growth of the area. It helps to sustain the development of this area including further development of physical infrastructural facilities

The following physical infrastructure facilities will improve due to proposed project.

- Road transport facilities
- The road connectivity will get improved due to the industry.
- This improved physical infrastructure will be an added facility to the community for surface transport.
- Water supply
- Efforts will be more focused on recycling of wastewater after adequate treatment. Thus, water extraction for process will be minimized.

8.2.2 Improvements in the social infrastructure

The industry will be established in the rural region and economically backward. Creation of job opportunity and other business activity will improve the economy and attitude of the public towards education and health. This may result in the creation of additional education and health care facilities in this rural area.

The proposed project will change the pattern of demand of various items of food and non-food products. It will help to generate sufficient income to local people.

Living in harmony is an important aspect of the society. This can happen only if, all the components are comfortably placed. Persons engaged in their respective vocation and accruing job satisfaction leads to this. This will become possible by this venture

Rural sector economy is generally growing slow because of lack of amenities and facilities. Proposed project helps to provide steady support of money-flow, such utilities can come to that area and sustain.

This improved physical infrastructure will increase purchasing power of the farmers. They will be able to invest in modern agricultural practices.

It will develop economy brings with literacy and healthy living. Ultimately educational and health level will increase, if there is confirm income source.

8.2.3 Employment Potential

- The industry will be established in the rural region of the state.
- The industry will provide skilled, semi-skilled, unskilled people, direct and indirect employment to more than 350 local rural persons.
- It can be stated that by this activity employment potential is certainly increasing in all walks of life – skilled, semi-skilled and unskilled.

8.2.4 Advantages of Distillery

- The importance and utility of alcohol is well known as an industrial raw material for manufacture of a variety of organic chemicals including pharmaceuticals, cosmetics, polymers etc.
- Alcohol is a potential fuel when blended with petrol. In the presence of ethanol, petrol burns with more efficiency and low toxic smoke.
- Alcohol is an eco-friendly product and is a substitute to the imported petroleum.
- As sugar cane cultivation is enhances in the country, the production of molasses from the sugar industry has greatly increased.
- Establishment of distillery will enable sugar factories to give better prices to the farmers supplying sugar cane.

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CHAPTER IX

Environment Cost Benefit Analysis

CHAPTER IX
ENVIRONMENT COST BENEFIT ANALYSIS

9.1 INTRODUCTION

This chapter provides information about benefits of the proposed project to the environment. Project is aimed to fulfill the objective of sustainable development. In what way and to what extent this will reachis submitted herein below.

9.2 ENVIRONMENTAL BENEFITS

- Alcohol is well known as an industrial raw material for manufacture of a variety of organic chemicals including pharmaceuticals, cosmetics, polymers etc.
- A large demand is anticipated for alcohol as a fuel. Alcohol is an eco-friendly product and is a substitute to the imported petroleum.
- Indeed, fuel ethanol production has been promoted for a variety of reasons as mentionedbelow,

– It has less severe impact on the environment than conventional gasoline and less dangerous to health. As oxygenates are compounds such as alcohols or ethers which contain oxygen in their molecular structure. Oxygenated fuels tend to give a more complete combustion of its carbon-to-carbon dioxide (rather than monoxide) which leads to reduced air pollution from exhaust emissions.

– It reduces the dependence on oil imports.

– It helps to maintain rural economy.

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CHAPTER X

ENVIRONMENT MANAGEMENT PLAN

CHAPTER X ENVIRONMENT MANAGEMENT PLAN

10.1 INTRODUCTION

Environment Management Plan (EMP) is a system to address potential adverse impacts, to instruct project proponent to introduce standards of good practice to be adopted for all project activities. EMP is a site-specific document for the project, to ensure that the project will be implemented in an environmentally sustainable manner and where all concerned persons of the industry as well as contractors, understand the potential environmental risks arising from the proposed project to implement appropriate actions so that risk can be managed properly. Detail description pertaining to identification of pollution sources, its assessment and related impact along with mitigation measures are given in Chapter IV.

In this chapter all the required details of Environment Management Plan and its implementation is given for identified impacts. Similarly, various systems and their functionsare also given.

10.2 OBJECTIVES OF EMP

1. To control the pollution by implementing environment management plan all environment aspects such as air, water, noise and soil.
2. To ensure health & safety of human beings, plant and machinery by adequate risk & hazard management to protect the environment in general. To comply with all regulations stipulated by Central /State Pollution Control Boards so that environment is protected from the adverse impact of various plant activities.
3. Contribute to sustainable development.

4. To plan and implement CSR activities to take care of stakeholder and their socioeconomic status and to bring improvement in the nearby area.

10.3 ENVIRONMENT MANAGEMENT PLAN FOR CONSTRUCTION PHASE

Anticipated environmental impact due to proposed project during construction phase has been discussed in chapter IV along with mitigation measures. To implement the identified mitigation measures effectively, following environmental management plan is prepared and presented below to mitigate adverse impact.

- Minor vegetation clearance will be required at site along with soil excavation. However, identified impacts would be of temporary type and within the plant boundary. Excavated soil will be covered with tarpaulin sheet or shall be kept in such way that dust emission will be avoided.
- During transportation of Men, Machine and Materials, care shall be taken to avoid spread of particular matter into the air.
- Regular sprinkling of water around vulnerable areas of the construction sites tocontrol the dust spread or emission into the atmosphere
- Green belt area shall be developed to reduce air and noise pollution impacts
- All Equipment and Machinery to be used for the construction activities shall be in good condition and need to operated and maintained properly to avoid the emission of pollutants
- All Vehicles to be used on the site shall be PUC certified and well maintained
- No idling of Machine shall be allowed during construction activities

- Night time construction activities and vehicular movement shall not be allowed

- Personal Protective Equipment like ear muffs or ear plugs, masks etc. will be provided to workers who will be exposed to high noise.
- First Aid facilities shall be made available during construction.
- All necessary infrastructural services like water, drainage facilities and electrification will be provided as per requirement
- Drainage network will be properly channelized. Storm water drainage will be developed properly. This network will be checked & maintained regularly.

10.4 ENVIRONMENT MANAGEMENT PLAN FOR OPERATION PHASE

Factory proposes comprehensive environment management plan to combat pollution arising from the project activities. Detailed EMP is described below for various environmental parameters.

10.4.1 AIR POLLUTION MANAGEMENT

- Baseline ambient air quality monitoring has been carried out during the month of Jan 2020 to Mar 2020. It is observed that the concentrations of PM_{10}, $PM_{2.5}$, SO_2 and NOx are well within the prescribed limits as per the National Ambient Air Quality Standards. The major sources of air emissions from the proposed projects include non-point and point source emissions.

- The major sources of air pollution from the proposed projects will be from flue gas emission, process emission and vehicular emissions. The emission details from the stacks are given in Table 10.1 and emissions from the various processes are described in Table 10.2.

- Electrostatic Precipitator will be provided as air pollution control equipment for proposed distillery. The emissions from the distillery are passed through ESP before releasing into atmosphere through the Stacks. The proposed distillery stack heights of 62 m will be provided for proper dispersion of the air pollutants
- Fly ash collection system will be installed with ESP. Process flow diagram of ESP is given in Fig. 10.1. Bag filters/ dust collectors and proper ventilation will be installed wherever particulate matter emission is likely to be occurred.

Table 10.1: Stack Emission

S.No.	Particulate	Proposed
		Distillery
1.	Boiler capacity	20 TPH
2.	Fuel consumption	Biogas with Bagasse
3.	Stack height	30 m
4.	Diameter	1.67 m
5.	Stack gas exist velocity	18 m/sec
6.	Stack gas temperature	180^0C
7.	Flow rate	97500 Nm^3/sec
8.	SO_2 emission rate	1100+/- 25 Ppm v on 7% O_2 dry
9.	NO_x emission rate	300 g/sec
10.	PM10 emission rate	50 mg/Nm3

- To control the vehicular pollution, control measures will be implemented such as periodical check of Vehicle for its fitness and PUC certificates. Observance of periodical maintenance schedule and its proper implementation.

Table 10.2 emissions from the various processes

Sr. No.	Description	Process emissions
1.	Fermentation	CO_2, VOC, alcohol vapor
2.	Distillation	VOC, alcohol Vapor
3.	Molasses	Odor

10.4.2 Noise pollution management

- Construction work shall be carried out during day time only.
- The workers working near noise producing machineries or noisy areas shall be provided with ear plugs / muffs.
- Construction equipment and vehicles shall be maintained in good running condition.
- Noise producing machinery shall have acoustic enclosures / acoustic rooms to reduce the noise levels. Roads need to be maintained in good condition to reduce the noise as well as dust emission due to traffic.
- Green belt shall be developed in and around the project site which will help to reduce the noise pollution.

10.4.3 WASTE WATER MANAGEMENT

- Lakhi Minor of Sadiq Canal will be the main source of fresh water for different activities of the project during construction and operation phase. Necessary permission for water extraction is available with the factory

It is estimated that around 1800 CMD of water shall be required for initial startup and thereafter intake of fresh water will be reduced due to use of recycled water. During operation, steam condensate will be recycled back into the process. Around 960 CMD of water will be recycled and remaining quantity of 704 CMD will be required on daily basis as fresh water. Water and wastewater balance is given in Table 10.3 and flow chart for of wastewater generation and its recycling is described in Fig. 10.2.

- Waste water generation from existing sugar and cogeneration unit and ETP for sugar factory is given below.
- Sewage will be disposed through septic tank via soak pit.
- The process condensate effluent from evaporation processes shall be treated Process Condensate Treatment Plant. Details are mentioned below:

TABLE 10.3: QUANTIFICATION OF WATER AND WASTEWATER GENERATION

Sr. No.	Water inputs	CMD
1.	Process water for fermentation section and CO_2 scrubber	1200
2.	DM water for RS dilution	10
3.	Water for vacuum pump, pump sealing, air blower & others	30
4.	Soft water makeup for cooling towers	500
5.	Other domestic usage, laboratory uses, cleaning	10
6.	Boiler	480
7.	Total water input at start-up	2230

	Water out Put	
1.	Spent Lees (PR & Rect.)	240
2.	Process condensate	480
3.	CT Evaporation & Drift Losses	545
4.	Water losses from vacuum pump, pump sealing, Air blower	1.0
5.	Cooling tower and boiler blow down	134
6.	**Total Water Output**	1400
	Detail of water Used/Recycled	
1.	Lees recycle for cooling tower make up	240
2.	Process condensate fermentation	400
3.	Process condensate to cooling tower, CIP, Fermentation	180
4.	Pumps Sealing Water Recycle cooling tower	9
5.	CO_2 scrubber beer well to process water for fermentation	1
6.	**Total Recycling water per day**	**830**
	Daily fresh water input	**1400**

10.4.4 LAND ENVIRONMENT / SOLID HAZARDOUS WASTE MANAGEMENT

- The zero-discharge system will be implemented for proposed molasses based distillery.
- Mainly, Yeast sludge shall be the main source of solid waste generation. Apart from this, ETP sludge, Boiler ash, and discarded Container will be generated. Details of solid / hazardous waste generation and its disposal are mentioned in Table 10.5.
- The Yeast sludge and sludge from ETP can be used as manure

TABLE 10.4: QUANTIFICATION OF SOLID WASTE

Sr. No	**Solid Waste**	**Quantity**	**Disposal (Required proper formatting)**
1.	Yeast sludge	28.5 TPD	Shall be used as a manure
2.	Ash	Bagasse: 5-7 TPD	Bagasse ash will be disposed at boundary wall surrounding,
3.	Domestic waste	25-30 kg/d	Local waste collection system
4.	Discarded drums and containers	Negligible	Will be sold to authorized Recyclers

10.4.5 Greenbelt development

Development of greenbelt in and around the industrial complex is an effective way to attenuate air pollution. The degree of pollution attenuation depends upon height, width, foliage, surface area of leaf and density of planted trees. Greenbelt will be developed as per CPCB guidelines.

10.4.5.1 THE OBJECTIVES OF THE PROPOSED GREENBELT DEVELOPMENT WILL BE:

- Mitigate impact due to dust emissions
- Control and assist to mitigate odor and air pollution impacts

- Create an aesthetic environment
- Enhance the bio-diversity of the vicinity
- Prevent soil erosion and surface run-off
- Spatial-visual separation of larger parts of the premises
- Entrance and roadside greenery helps in separating the main industrial structures
- Provision of greenery along all interior pedestrian network

10.4.5.2 SELECTION OF PLANT SPECIES WILL BE BASED ON THE FOLLOWING CHARACTERISTICS

- Fast growing
- Thick canopy cover
- Perennial and ever green
- Large leaf area
- Preferably Indigenous
- Resistant to pollutants and should maintain ecological balance for soil and geo hydrological conditions of the region.

Approximately more than 1000 Trees shall be planted around the proposed distillery unit and around the existing sugar and cogeneration unit. Factory has already started extensive tree plantation. Photographs of tree plantation are given below. Factory has run the tree plantation program and planted more than 4000 trees in and around the factory. The plant species will be selected according to EPA Punjab guidelines and pollutant tolerance capacity of specific Tree. Large trees will be planted along the boundary of the project and planted in the initial phase of construction. Shrub and medium growing Trees will be planted along the road side. Plantation inside the project boundary will be done after completion of inside construction. Tree plantation with location and numbers are given in Table 10.6. List of recommended Tree species for greenbelt development is given in Table 10.7.

TABLE 10.6: TREE PLANTATION

Sr. No	**Location**	**Type**	**Tree density**	**Trees interspacing**
1.	Boundaries of small units, landscape area	Shrubs, small and medium Trees	20-25	3 x 3 m
2.	Boundaries of units/internal roadside	medium to large size Trees	7-10	5 x 5 m
3	Around the industry	Large trees /Large canopy trees	1	1.5 m X 1.5m or 2.5 m X 2.5 m
4.	Road sides	Large size Trees	5-6	20-25 m

Table 10.7: Type of Tree recommended for Greenbelt Development

Sr. No.	**Botanical Name**	**Local name**	**Type**	**Location**
1.	*Terminalia arjuna*	Arjuna	T	Around the industry or Avenue plantation

2.	*Terminalia elliptica*	Ain	T	Around the industry or Avenue plantation
3.	*Millingtonia hortensis*	Pakistan Cork		Around the industry
4.	*Tamarindus indica*	Chinch	T	Around the industry
5.	*Azadiracta indica*	Neem	T	Around the industry or Avenue plantation
6.	*Bauhinia purpurea*	Kanchan	T	Around the industry
7.	*Bauhinia variegata*	-	T	Around the industry or Avenue plantation
8.	*Emblica officinalis*	Avala	T	Avenue plantation / around the units
9.	*Erythrina*	Pakistani Cora lTree	T	Around the industry or Avenue plantation
10.	*Ficus glomerata*	Cluster fig Tree	T	Around the industry or Avenue plantation
11.	*Ficus religiosa*	Peeple	T	Around the industry or Avenue plantation

12.	*Ficus benjamina*	Weeping fig		Around the industry or Avenue plantation
13.	*Michelia champaca*	Champak	T	Internal road of industrial complex/ ETP
14.	*Polyalthia longifolia*	Ashoka	T	Around the industry or Avenue plantation
15.	*Aegle marmelos*	Bel Tree	T	Around the industry
16.	*Butea monosperma*	Palash	T	Around the industry /ETP/ Avenue plantation
17.	*Ravenala madagascarien sis*	Travellers palm	T	Around the industry /Avenue plantation/ industrial units
18.	*Pongamia pinnata*	Karanj	T	Around the industry /Avenue plantation/ industrial units/ETP
19.	*Dalbergia sissoo*	Sisoo	T	Around the industry /Avenue plantation
		Bahava,		Avenue plantation, around
20.	*Cassia fistula*	Amaltash	T	the units, ETP and open plots
21.	*Caesalpinia pulcherrima*	Shankasur	T	Avenue plantation, around the units and open plots

22.	*Alstonia scholaris*	Saptaparni	T	Avenue plantation, around the units/ETP and open plots

Table 10.8: Flowering and foliage shrubs recommended for greenbelt

Sr. No	Flowering plant (Shrubs)	Location
1.	*Palm spp.*	Potted plants/ Internal roads/open plots
2.	*Ixora Spp.*	Internal roads/open plots/ around the units
3.	*Tabernaemontana divaricata (Tagar)*	Avenue plantation, around the units, ETP and open plots
4.	*Cassia biflora*	Avenue plantation, around the units, ETP and open plots
5.	*Calliandra haematocephala (Powder puff)*	Avenue plantation, around the units, ETP and open plots
6.	*Nerium oleander (Nerium)*	Avenue plantation, around the units, ETP andopen plots
7.	*Allamanda cathartica (Alamanda)*	Avenue plantation, around the units, ETP andopen plots
8.	*Plumbago zeylanica (Plumbago)*	Avenue plantation, around the units, ETP andopen plots
9.	*Hemalia petans*	Avenue plantation, around the units, ETP andopen plots
10.	*Vinca rosea*	Avenue plantation, around the units, ETP andopen plots

11.	*Cestrum nocturnum (Night Jasmin)*	Avenue plantation, around the units, ETP andopen plots
12.	*Canna indica*	Avenue plantation, around the units, ETP andopen plots
13.	*Chrysanthemum indicum*	Avenue plantation, around the units, ETP andopen plots
14.	*Muscanda spp.*	Avenue plantation, around the units, ETP andopen plots
15.	*Hibiscus spp.*	Avenue plantation, around the units, ETP andopen plots
16.	*Jasmin Spp.*	Avenue plantation, around the units, ETP andopen plots
17.	*Powder puff spp.*	Avenue plantation, around the units, ETP andopen plots

10.4.5.1 Tree Plantation Planning

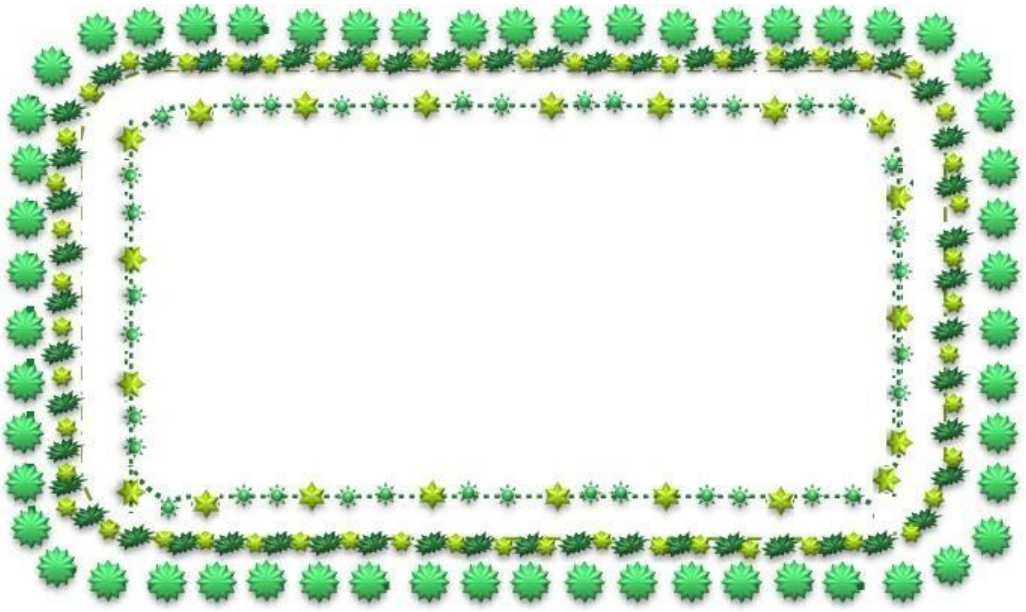
The plantation programs have to be implemented in phase wise manner. To ensure the effective plantation of various kinds of trees, a four-year plantation programs with numberof Tree/ shrubs to be planted is given below in Table 10.9

TABLE 10.9: TREE PLANTATION PROGRAM

Sr. No.	Year	Greenbelt area (acres)	Total plants	Location
1	2021	1	1000	Around the industry in first tier
2	2022	0.5	1000	Around the industry in second and third tier
3	3	0.3	1000	Around the units and internal road side

More than 1000 plants shall be planted in the span of three year plantation program. Required nutrients / water/ manure and protection shall be provided. Plantation is suggested in three tier system around the factory. Anticipated total length of three tier will be 8-10 m. Schematic of Three plantation is shown in below mentioned figure.

FIGURE 10.4 SCHEMAT



IC OF GREEN BELT DEVELOPMENT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10.4.6 Odor Management Plan

Anticipated odor generation sources will be molasses, fermentation unit, , ETPseptic tank, Yeast storage & ETP sludge.

Following control measures shall be implemented to avoid the odor in the atmosphere:

- Better house-keeping
- Fermentation unit will be provided with proper cover to avoid the spread of odor and regular steaming ofall fermentation equipment's; temperature will be kept under control during fermentation to avoid inactivation/killing of yeast; stalingof fermented wash would also be avoided.
- Use of mill sanitation biocides to minimize the growth of aerobic /anaerobic micro– organisms.
- Regular use of bleaching powder in the drains to avoid generation of putrefying micro-organisms.
- ETP and Yeast sludge will be used as manure.
- Steaming of major pipelines
- Proper operating condition will be maintained.
- Proper cleaning of drains.
- Efficient operation of ETP.
- Greenbelt will be developed in and around the plant premises to suppress the odor.

10.4.7 Management of traffics

- The site is adjacent to Bagho Bahar road and connected to it.
- There will be enough space for movements of vehicles and parking.
- The traffic management on the project site will be easily and smoothly monitored without any hindranceto the regular flow of traffic on the main road.
- Flow of traffic is eased out by providing adequate entries and exits from parkingareas

10.4.8 RAIN WATER HARVESTING OBJECTIVES:

- To arrest ground water depletion and to augment ground water table
- To improve the water quality of Aquifers
- Rain water harvesting will be an important activity to conserve the rainwater for reuse and thus reducing the overall raw water consumption for the plant. Rain water harvesting aids in meeting the non-potable water usage like
- Water for gardening
- Water for sprinklers to suppress the dust

RAINWATER HARVESTING MANAGEMENT WATER HARVESTING POTENTIAL

The quantum of water that could be generated in the Plant area is calculated using the formula:

VOLUME OF RUNOFF GENERATED = AREA (M^2) X RUNOFF COEFFICIENT X ANNUAL RAINFALL (M)

For the area it has been calculated to be 75918 m^3 per annum, considering an average annual rainfall of Khanpur Tehsil is 66 mm within a time span of 90 days of monsoon.

10.4.9 OCCUPATIONAL HEALTH AND SAFETY (OHS)

The main aim of occupational health and Safety will be to take care of Employees and plant and machinery to avoid any type of harm to human beings and environment. It will also be to provide safe workplace to the employees and workers working in the plant. It is the responsibility of the management to provide safe workplace so as to avoid any type of incidence or accident at the workplace due to malfunctioning of any type of equipment or units. By having safe and healthy work environment, the employees will provide work safely so that their family members, employers, customers, and others will be protected from the indirect adverse effects.

Following control measures will be taken for the employees and workers engaged in work:

- Personal protective equipment's will be provided to all concern staffs and workers.
- All safety signs will be placed at proper location

- First aid kits will be made available at every department
- Medical checkup at regular intervals for monitoring of health status of all workers
- Work permit system will be introduced to avoid un-authorized person's entry
- Fire hydrant system, fire extinguishers will be provided at specific locations
- All staff and workers will be trained to fight the emergency situation
- Good housekeeping also plays important role in avoiding the undesirable incidences.

Therefore, good housekeeping practices will be employed.

Facilities such as provision of good quality water, sanitation and clean room for eating and resting shall be provided. It is evident from the project details that the risk or accidental spillage of chemicals may cause ill effects on the health of employees involved. In view of the effect on the health of workers from various activities and exposure during the work, required mitigation / control measures shall be implemented to reduce the associated risk and hazards.

10.4.10 SOCIOECONOMIC DEVELOPMENT

Proponent is planning to implement the CSR activities for the nearby areas like infrastructure facility development, to make the provision of health and sanitation facilities in the required areas after talking to the Number-Daror local people. which is about 2.5% of project cost (Rs. 4000 Million PKR) within a period of five years.

10.4.11. **Proposed CSR activities:**

- Tree plantation with tree guards and maintenance as per green belt development guideline
    - Construction village roads in the locality
    - Renovation of school building
    - Furniture facility for Schools
    - Implementation of Different schemes for women empowerment in the study area

- Scholarships for students
- Arrangement of Books for School Children
- Computers for school so as to improve the educational level
- Lighting by CFL bulb / solar street lamps in villages.
- Construction village roads in the locality
- Free health camp
- Drinking water facilities

TABLE 10.11: CSR ACTIVITY ACTION PLAN

CSR activity						**Total Investment (Million)**
Tree plantation	0.2	0.1	0.1	0.1	0.1	0.6
Lighting by Solar Light	0.35	0.3	0.15	0.1	0.1	1.0
Free health camp	0.6	0.3	0.2	0.2	0.2	1.5
Construction villageroads in the locality	2.5	2.5	2.0	1.0	1.0	9.0
enovation of school building	1.5	1.0	1.0	0.8	0.8	5.1
Computers for school	1.0	0.50	0.35	0.35	0.3	2.5
Scholarships for students	0.25	0.25	0.25	0.25	0.25	0.125

Books for School Children	1.5	1.0	1.0	0.8	0.8	5.1
Provision of computers in schools	0.35	0.3	0.15	0.1	0.1	1.0
Drinking water facilities	1.0	0.50	0.35	0.35	0.3	2.5
Total	**9.25**	**6.75**	**5.55**	**4.05**	**3.95**	**29.55**

10.5 ENVIRONMENT MANAGEMENT CELL (EMC)

The EMC will be developed to co-ordinate the project activities in an environmentally friendly manner without harming human health or the environment. The main aim of EMC shall be the effective implementation of environment management system during construction and operation phase. In the EMC, all HODs will be included so that they can co- ordinate the activities in effective way or as per the standard laid down norms. The EMC will monitor the general and preventive maintenance of pollution control system / equipment undertaken by the maintenance department to achieve optimum efficiency. The EMC will co-ordinate all the activities of the plant and process in an environment friendly manner to avoid any type of adverse effect on the human health or the environment. Structure of EMC is given in below table

TABLE 10.12.: EMC CELL STRUCTURE

Sr. No.	Designation	Responsibility
1.	Chairman	Managing Director
2.	Coordinator/Environ: officer	Enviro: Engineer ETP in charge/EHS officer
3.	Members	Distillery Manager, Chief Engineer, Chief Chemist,Civil Engineer, H. R. Manager, ETP quality control.

10.5.1 Responsibilities of Environmental Management Cell

The EMC has the responsibility to supervise all the activities in the plant to ensure that those are being carried out as per the standard operating procedure to avoid any type harm to the environment. The EMC also undertake periodical monitoring or survey of various environmental parameters including monitoring and analysis of effluent, air, water andnoise to ensure that these parameters are maintained within the prescribed limits. If any deviation observed, they will inform to initiate corrective action by the concern department or they will do themselves if required.

They also undertake the physical survey of the green belt to ensure required growth and survival rate of the plant. They will also inform the concern department for corrective actionif any to have proper growth of the plants.

Environmental monitoring:

EMC will ensure that pollution is well below the prescribed limits or there is no much difference between the present concentrations and baseline data. If wide difference is observed then they will need to initiate required correctiveaction either by optimizing the treatment process or by

providing equipment or improving the performance of existing pollution controls equipment. In case the results indicate parameters exceeding the prescribed limits, remedial actions will be taken through the concerned plant people. The actual operation and maintenance of pollution control equipment will be the responsibility of respective department head or a plant in charge.

- **Legal and statutory compliance:** EMC will also supervise the work of other department pertaining to the activities of preparation of environment statement report, environment audit, Water Cuss return and consent application as per the requirement under various Rules and regulations. They will also guide the HODs of individual department to fulfill the statutory requirements under various acts and applicable rules. Following Rules shall be applicable to the facility:
    1. The Punjab Environmental (Protection) Act, 1997 (Amended 2012-2017)
    2. The Environmental Samples Rules,2001
    3. Environmental Tribunal Rules, 2012
    4. Punjab Environmental Quality Standard for Ambient Air
    5. Punjab Environmental Quality Standard for Noise
    6. The Punjab Environmental Quality Standard for Industrial Gases
- **Documentation**: The cell will also be responsible for maintaining the records of data, documents and information in line with the legislative requirement and will regularly furnish the same to the concern statutory authorities.

10.6 POST CLEARANCE MONITORING PROTOCOL

- After grant of environmental clearance by the EPA Punjab. All such compliance reports submitted will be the public documents. Copies of the same will be made available to the stakeholder upon the request.

ENVIRONMENT MANAGEMENT COST

Table 10.13: EMP cost bifurcation

Sr. No	Description	Capital Cost (Rs. in lakhs)	Recurring Cost (Rs. in lakhs)
1.	Air Pollution Control	100	10
2.	Water Pollution Control	75	5
3.	Solid waste Management	8	3
4.	Environmental Monitoring and Management	_	7
5.	Rainwater Harvesting	20	3
6.	Occupational Health	10	5
7.	Greenbelt development	10	3
	Total	**223**	**36**

10.7 Schedule of implementation

The proponent is waiting for the environmental approval from environmental protection department. No Construction work has been initiated so far as the company is waiting for the Environmental Approval from the Department. After the approval, the project construction work would be carried out within 6-8 months.

Sr. #	Activities	2.5 Months			2.5 Months			2.5 Months			2.5 Months		
		4W	4W	2W	4W	4W	2W	4W	4W	2W	4W	4W	2W
1	Detailed Designing												
2	Mobilization of Contractors												
3	Lean Development Period												
4	Peak installation Period												
5	Plantation at Site												
6	Commissioning												*
W=Weeks													

Environmental Practitioners and Experts

Name	Post	Qualification
Talha Abid	HSE Manager	MPhil Environmental Sciences (NEBOSH)
Ali Malik	HSE Officer	MPhil Environmental Sciences
M Abuzar	Senior Environmentalist	BS Environmental Sciences
Iqra Zahid	Senior Environmental Officer	MPhil Environmental Sciences
Mubeen Sohail	HSE Officer	BS Environmental Sciences
Ramsha Shakeel	Environmentalist	BS Environmental Sciences

Ahsan Mushtaq	Environmentalist	BS Environmental Sciences

Following functionaries will be involved in the implementation of EMMP:

- The project Proponent as owners of the EMMP.
- Project contractor(s) as executors of the EMMP during installation and operational phase of the project.

  Operational & Maintenance (O&M) and the Health, Safety and Environment team of the project as an executor of the EMMP during the installation and operational phase of the project

Designation	Responsibilities
Manager	• Direct operations at the site. • He will act as team lead. • Interact with other executives, mine staff and community residents. • Effectively motivate staff to follow protocols and to work productively. • Look after the Health and Safety Related issues. • Responsible for scheduling staff and ensuring that supplies are stocked. • He will play a direct role in developing business goals for the mine they run, and he will help to produce a business plan to ensure that those goals are met.

Accountant	• Proper management of the funds for the CSR. • Development of fund proposal for environment related expenses. • Ensuring the smooth transaction of funds for environmental related projects/activities. • He will prepare the yearly budget. • Taking minutes in meetings and other administrative duties. • During his shift timings, he will be responsible to look into smooth functioning of the process in environmentally sustainable way. • He will be responsible to rectify any problem regarding environmental matter in collaboration with concerned authorities. • Prepare reports on different events and incidents. • He will report all matters regarding E.M. to the manager.

10.8 Responsibilities of Functionaries

- Responsibilities of Management of Project

Management of the project will be responsible for the environmental management and supervisory affairs during the project activities. Environmental personnel designated by the management of the project will look after the environmental related issues during the project activities. The responsibilities of environmental personnel are as follows:

- Monitoring progress of the project as per planned schedule of activities.
- Exercising oversight over the implementation of environmental mitigation measures by the

contractor.

- Documenting the experience in the implementation of the environmental process.
- Preparing training materials and implementing programs.
- Maintaining interfaces with the other lined departments/ stakeholders and
- Reporting to the management of the project on the status of EMMP implementation.

10.9 Proposed Environmental Management and Monitoring Plan (EMMP)

The Environmental Management and Monitoring Plan (EMMP) will be used as a management and monitoring tool for implementation of the mitigation measures identified in the EIA report.

The EMMP matrix lists down:

- The required mitigation measures recommended in the EIA report.
- The person/organization directly responsible for adhering to or executing the required mitigation measures and monitoring adherence to the mitigation measures.
- The parameters, which will be monitored to ensure compliance with the mitigation measures.
- The timing at which the mitigation or monitoring has to be carried out.
- Budget allocated for management practices (cost of EMMP)
- Project Proponent will hold primary and overall responsibility for ensuring full implementation of the EMMP.

10.10 EMP Review and Revision

The EMP shall specify the procedures for the review and revision of the EMP during Project implementation and have a version control procedure. At a minimum, the site-specific EMP shall be reviewed by the Contractor to determine if an amendment or a major revision is warranted:

- At least once every six (6) months or on a seasonal basis
- As a result of changes in the project or changes in the anticipated environmental effects of the project;
- After corrective actions have been taken in response to an environmental incident; after an adaptive management measure has been proposed
- A material revision is one which would be relevant to the question of whether an adverse environmental effect is more likely to occur, or become more adverse, and be significant;
- After a material revision of the EMP is proposed that changes a commitment such as: a reduction or increase of monitoring or reporting requirements; or making a specification less stringent or more stringent

10.11 CONCLUSION

Major potential environmental impacts from proposed project will be from solid waste generation, wastewater generation, ground water exploitation and flue gas emission. However, an effective environment management plan reduces level of significant impact on the environment. Factory will implement effective occupational health and safety measures.Hence, proposed project will be environment friendly and safe.

EIA REPORT

M/S Etistar Bioenergy Pvt Ltd, Situated At Chak No. 106/1-L, Tehsil

Khanpur District Rahimyarkhan

CHAPTER XI

STAKEHOLDER CONSULTATION

INVOLVEMENT OF STAKEHOLDER/ PUBLIC CONSULTATION

11.1 EIA and Public Consultation Process

Stakeholder participation in planning and management of the social and environmental issues assists in reducing the concerns of stakeholders and hence increases public acceptance towards development programs. Consultation process entitles the stakeholders with opportunities to participate in key decisions that will affect their lives. Therefore, detailed public consultation meetings were arranged at different levels of the planning process. For this purpose, periodic consultation meetings were held with various project stakeholders. Different aspects and impacts of the proposed project were highlighted regarding their impacts on the physical, biological, and socio-economic environment of the project area. Stakeholders' trepidations regarding various aspects like existing environment, and impacts of the project on the surrounding environment were emphasized and have been added to this EIA report.

11.2 Objectives of the Public/Stakeholders Consultation

Public consultation plays a vital role in studying stakeholders' perspectives regarding the project and henceforth the successful implementation and execution of the proposed project. Public involvement is a compulsory feature of Environmental Impact Assessment, which leads to improved and acceptable decision-making. The primary objective of the stakeholders' consultations was to learn and know the apprehensions, concerns, and opinions of the key stakeholders over environmental implications of the project activities from public perception. The consultation sessions also served as a source of firsthand information about the users and the beneficiaries' expectations from the project. Dialogue with the stakeholders and recording their concerns at appropriate stages of the project would help to tailor the project in line with stakeholders' aspirations and so increases the likelihood for public acceptance of the project and its subcomponents. It also helps to develop and maintain communication links between the project proponents and stakeholders, providing opportunities to the public to influence the project design in a positive manner. This ensures that the views and concerns

of the stakeholders are incorporated into the project design and implementation with the objectives of reducing or offsetting negative impacts and enhancing benefits of the proposed project.

11.3 Methodology

11.3.1 Responsible Authority

The consultation process began with the identification of the most pertinent stakeholders. Identification of the stakeholders for the proposed project plays a crucial role in development and also assists in quantifying the role of different stakeholders involved. Impacts identified by the stakeholders are measured through matrix method and mitigation measures are proposed according to the intensity of the identified impacts. Efforts were made to identify the relevant stakeholders through a systematic process based on the nature and degree of their actual and perceived stakes related to the project.

11.3.2 Issues Discussed with the stakeholders

Following issues were discussed during the stakeholder consultation meetings:

- Concerns, apprehensions, and views of the community and the stakeholders over the project activities relating to design, construction and operational aspects.
- Probable adverse impacts of the project activities on various components of the environment i.e., physical, biological, and social components
- Possible remedies for the concerns and apprehensions, how the concerns can be effectively addressed?
- Identification of any specific personal or site related concerns
- How the project operations can happen in accordance with user/beneficiaries' expectations?

- Beneficial factors and involvement opportunities of the local people in the set of activities of project during construction and operational phases.
- Material's transport management during construction and operational phase of the project.
- Management of water, wastewater and solid waste during construction and operational phase of the project.

11.3.3 Meetings With Stakeholders/ Environmental Practitioners and experts

A series of consultation was carried out with stakeholders and general public in Sundar Industrial Estate and nearby areas.

- The purpose of this survey was to achieve the objectives of the consultation, highlight the main issues in the implementation of the proposed Project and finally propose mitigation measures.

Open and close ended questionnaire was used to collect the views concerning the assessment survey. Scoping sessions and informal group discussions were also carried out with local residents and local government representatives regarding the proposed Project. The outcome of whole consultation process was very encouraging. The following issues were

discussed during Informal Meetings with local representatives:

i. Brief Description of the Project
ii. Current economic condition in the area
iii. Suggestions for improvement in the current industrial system and all activities related to industry
iv. Perceptions about the proposed Project

v. Perceived impacts of the proposed Project

The local poor people predominantly requested for unskilled and semi-skilled jobs during implementation of the Project. On the basis of the consultations so far, it appears that the Project will have no insurmountable environmental and social impact. The community generally supported the proposed Project. They have opinion that the Project will not only provide livelihood during construction stage, but also will help to eradicate the burning issue of regarding import of materials.

11.3.4 Other Departments and agencies

Proponent applied for other department NOC and will be provided in an operational phase of the project

11.3.5 Responsible Authority

HSE manager will be responsible for all the operational activities

Environmental Practitioners and Experts

Name	Post	Qualification
Talha Abid	HSE Manager	MPhil Environmental Sciences (NEBOSH)
Ali Malik	HSE Officer	MPhil Environmental Sciences
M Abuzar	Senior Environmentalist	BS Environmental Sciences
Iqra Zahid	Senior Environmental Officer	MPhil Environmental Sciences
Mubeen Sohail	HSE Officer	BS Environmental Sciences
Ramsha Shakeel	Environmentalist	BS Environmental Sciences
Ahsan Mushtaq	Environmentalist	BS Environmental Sciences

11.3.6 Proponent Environment Management Team

Talha Abid	HSE Manager
Ali Malik	HSE Officer
M Abuzar	Senior Environmentalist

11.3.7 Affected and Wider Community

There is no population present in the safe radius of the site that's why community will not be disturbed due to project operation. Although the opportunity of employment will increase if the project will approve.

11.3.8 Summary Of Issues Raised By Stakeholders

A summary of the key issues raised by stakeholders and how these are being addressed by Project Proponent is provided in Table below.

Issue	**Aspect/Concern raised by Stakeholders**	**Project Proponent Commitments**
Employment Opportunities	Expectations of employment are very high. Job opportunities are less for herders as they generally have less skills and training.	Employment is the main priority of the industry. Mostly locally skill and unskilled labor will be prioritized and also there will be job in executive level. Around 100 people will be employed by the industry.
Training Opportunities	People are keen to consult with subject industry if the Project offers training and upgrading opportunities to enhance their trade or professional skills.	Development of the Training Strategy, including commitment of allocation of budget investment for training infrastructure, delivery and design. Installation of training facilities in for worker

		of the company and students will also be accommodating. The internship program will offer to the students to develop professional skills.
Health & safety	Truck traffic is a main concern because the road used by the Project passes through a number of small communities and different industries and there will be a high volume of trucks transporting concentrate.	Development of Transport Management Plan including traffic safety training. Traffic advisory signs will be installed along project site and all nearby specific areas.
Local economy and business development	Local service providers are keen to participate in providing services to provide raw material and expect to receive in order to adjust their businesses to meet specific needs. Local/regional companies and entrepreneurs have limited understanding about meeting the high volumes required by the Project and the quality standard, but are keen to know these requirements so they can become suppliers.	Proponent has main focus that they will all the material regarding construction and plant operation to buy from the local market. This will help the local and small business and to people who are keen interested to become suppliers.

Environmental Issues	Dust and noise impacts, particularly from the construction activities and in operation of mechanically unfit machines, are of concern to herders and other residents. Environmental degradation during road construction and use. Loss and change of vegetation due to soil degradation.	Implementation of controls under the Environmental Management Plans, including on and off-site dust and noise monitoring. A Participatory Environmental Monitoring Program will be launched to spread awareness.
Water quantity and quality	Water quality and quantity, and impacts from the wastewater disposal are all key concerns for nearby herders.	Implementation of consultation in relation to water use and development of the Participatory Environmental Monitoring Program. Water treatment will be done by the proponent that will help to safe disposal of the water.

EIA REPORT

M/S Etistar Bioenergy Pvt Ltd, Situated At Chak No. 106/1-L, Tehsil Khanpur District Rahimyarkhan

CHAPTER XII

SUMMARY AND CONCLUSION

SUMMARY AND CONCLUSION

12.1 Introduction

This chapter executes summary of whole EIA report which includes project description in brief, environmental setting in 10 km radius, impact identification and mitigation measures and environmental management plan. Moreover, brief information of Post mentoring program and risk assessment is also furnished in this chapter. An EIA report for proposed project has been prepared as per the TORs issued on dated December 2021 by and as per generic structure as per EIA Notification of EPA Punjab 1997 (Amended 2012-2017) and amendment thereof. EIA report prepared by IES Environmental Solutions (Pvt.) Ltd. Consultant

12.2SCOPE OF THE STUDY

EIA study has been conducted prior to commissioning of proposed project and in accordance with the standard TORs issued by EPA Punjab. The EIA study of proposed project is limited to the project site and study area of 10 km surrounding the project site. Baseline data collection and environmental monitoring of study area was carried out for the period of October 2021 to December 2021.

12.3 SALIENT FEATURES OF THE PROPOSED PROJECT

Etistar Bioenergy (pvt.) Ltd. is proposing 125 KLPD molasses-based distillery. The Manufacturing of Rectified Spirit/ Extra Neutral Alcohol/ alcohol for making liquor/ fuel will be done by adopting continuous fermentation method. The fermented wash will be distilled in a pressure vacuum distillation to obtain rectified spirit and Extra Neutral Alcohol will be from Rectified Spirit. The impurities in Rectified Spirit will be reduced by diluting and redistilling the spirit. The impurities like aldehydes, ketones, acids, esters, higher alcohols are minimized by controlled condition. Project highlights are given in Table 11.1

12.4 RAW MATERIAL

Daily consumption of the raw material required for production is described in Table 11.2.

TABLE 11.2: LIST OF RAW MATERIALS

#	Raw material	Quantity	Storage	Transportation
	Distillery			
1.	Molasses	480-520 TPD	3 X 15000MT	Tanker
2.	Bagasse	65 TPD	-	Trucks
3.	Sulfuric Acid	10 kg /kl	-	Trucks/tempo
4.	Urea	5 kg/kl	-	Trucks/tempo
5.	Di-ammonium Phosphate	4 kg /kl	-	Trucks/tempo
6.	Anti-foam reagent	2.5 kg/kl	-	Trucks/tempo
6.	Caustic soda	0.150 MTD	-	Trucks/tempo

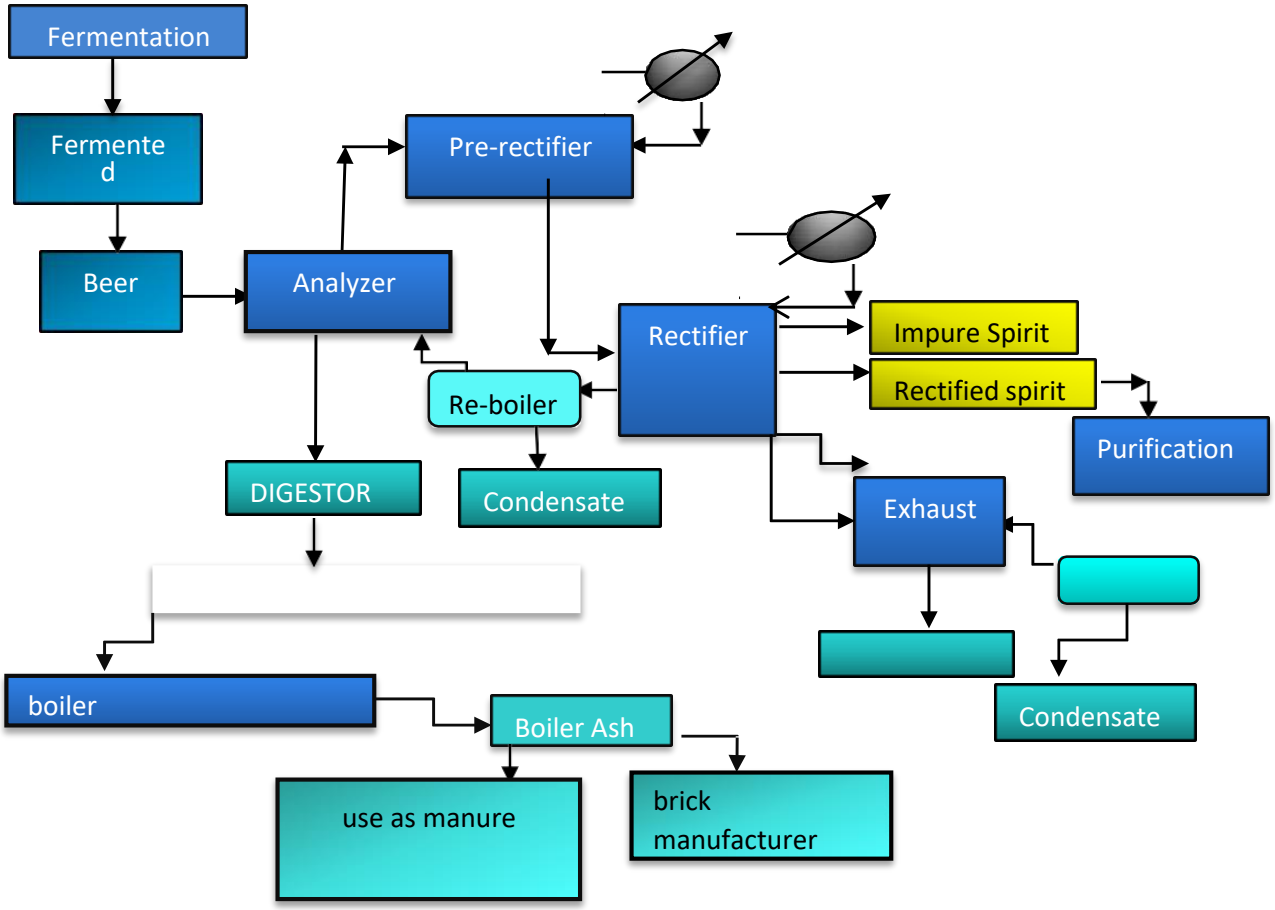


FIGURE 11.1: MANUFACTURING PROCESS FLOW CHART

12.5 Manufacturing process

12.6 DESCRIPTION OF THE ENVIRONMENT

Environmental monitoring is carried out for air, noise, water, biological and socioeconomic. The baseline environmental study has been conducted for the study area for the period of October 2021 to December 2021. Frequency of sampling with location and parameters are mentioned in Table 11.3.

TABLE 11.3: SAMPLING PLAN

S.No.	Attribute	Parameter	Location	Frequency
1.	Ambient AirQuality	$PM_{2.5}$, PM_{10}, SO_2 & NOx,	10 location	24 hourly, twice a week during study period
2.	Noise	Noise Levels in dB(A)	10 location	Once in Study Period
3.	Ground Water	pH, Electric Conductivity(EC) TDS, TSS, Total hardness, Total alkalinity, , DO, Chlorides, sulphates, Phosphate, nitrate, Fluorides , Potassium, Most probable number (MPN) coliform	Grab samples of 10 Locations	Once in Study Period

4.	Surface water	pH, Conductivity TDS, TSS, Total hardness, Total alkalinity, DO, Chlorides, sulphates, Phosphate, nitrate, Fluorides , Potassium, Most probable number (MPN) and total coliform	Grab samples of 4 Locations	Once in Study Period
5.	Soil	Texture, pH, EC, metals, Sodium Absorption Ratio (SAR), Permeability, Water holding, capacity, bulk density, Porosity, Nitrogen, Phosphorus, Potassium, Moisture, organic content	10 locations	Once in Study Period
6.	Ecological Data	Existing flora & fauna	10 km study area	Once in Study Period
7.	Socioeconomic Data	Demographic Structure, Education, Infrastructure, Economic, Health status and specific area information	Within 10 Km radiusof study area	Once in Study Peri

11.6.1 Ambient Air Quality

It has been observed that all ambient air results are within prescribed limits as per ISO 14001-2015. Detailed ambient air samples results are mentioned in chapter III. Major highlights of the results are mentioned below,

11.6.1.1 Maximum concentration of PM 10 found at 47.8 to 89.2 µg/m^3

11.6.1.2 Maximum concentration of PM 2.5 found **at** 25.00 to 45.0 µg/m^3

11.6.1.3 Maximum concentration of SO_2 found at 4.0 to 10.1 µg/m^3

11.6.1.4 Maximum concentration of oxides of nitrogen 4.8 to 18.5 µg/m^3

From the results, it can be concluded that the ambient air quality of the study region is good as all the results are well within the limit.

11.6.2 WATER QUALITY

Ground water and surface water sample result summary of some major parameter is descried as below,

11.6.2.1 It has been observed that pH range was between 7.0 to 7.36

11.6.2.2 Average total dissolved solids were in the range of 220 to 598 mg/l

11.6.2.3 Chlorides was in the range of 15.0 to 76.1 mg/l.

11.6.2.4 As microbiological parameters MPN and total coliform analysis was also carried out and it was found that *E. Coli* are detected in river water sample as well as some well water samples. Moreover, MPN count was also found high as per ISO-14001 specifications.

The above chemical analysis reveals that water from all sources is suitable for drinking purposes after disinfection, as E-Coli is present in all the surface water and some ground water samples collected. All other constituents are within the limits prescribed for drinking water standards of Pakistani Standards (14001: 2015).

11.6.3 SOIL QUALITY

Soil sample result summary is described below,

11.6.3.1 Results of pH were varying between 6.98 to 7.46

11.6.3.2 Organic matter in the soil samples was found in the range of 3.5 to 4.26%.

11.6.3.3 Total Phosphorous content was found in the range of 5.2 to 9.2 mg/kg.

11.6.3.4 Potassium ranges from 20.6 to 32.7 mg/kg.

11.6.4 NOISE QUALITY

Noise level was monitored in **9** locations. Average noise level found in between **40 to 45** dB

(A) during day time and it is within the prescribed limits.

12.7 PROPOSED IMPACTS & MITIGATION MEASURES

Summary of probable impacts due to proposed project and its control measures are briefed in Table 11.4.Table 11.4: Project activities, anticipated impact and mitigation measures.

S. No	Activity	Impact Identification	Mitigation Measures
1		Waste water from distillation. Groundwater and soil pollution if directly disposed of on the land. Surface water pollution if it disposed of into water body. Disposal of untreated wastewater causes health effects on community, changein physical and chemical properties of soil and water which ultimately affects organism present. **Noise generation** Noise due to operation of machineries/ equipment. Occupational health hazardous can be faced by operators and other staff whoever working in that area	in condensate polishing unit. • Treated water willbe recycled back into the process. • Noise will be concise inthe working area only. • PPEs will be provided tooperators/ workers to avoid the occupational health hazards

		Solid waste generation • Yeast sludge • Ash (Fly and bottom ash) • ETP sludge Other hazardous/ non-hazardous waste like empty containers, batteries.	• Yeast sludge is no hazardous and can be used as manure. • Ash will be sold to brick manufacturer • Disposal of hazardous waste to solid dump area/ sold to authorize buyers if any.

2.	Transportation of raw material and product	Major pollutant during transportation is dust and other fugitive emissions, which causes health effect and loss of vegetation of nearby area due to deposition of dust on the leaves of trees.	• Use of vehicles meeting the statutory norms related to emission. • Use of vehicles withPUC certificates • Proper traffic management Tar road will be developed hence, no major dust emission is anticipated.
3.	Handling and storage of raw material	• Risk of accident due to leakage/explosion of chemicals which directly affect health of working staff. • Risk associated with fire due to storage of fuel and Alcohol. Ifaccident arises, factory staff gets trapped in the fire.	• PPEs will be provided tooperators/ workers to avoid the occupational health hazards. • Firefighting facility asper norms.

			All safety measures will be undertaken to avoid accidents

11.7.1 Impact Assessment

Overall impacts from various activities on different environmental parameters are negligible if EMP properly implemented. Hence, no adverse negative impacts are predicted and project is ecofriendly.

12.8 ENVIRONMENTAL MANAGEMENT PLAN (EMP)

12.8.1 CONSTRUCTION PHASE

Environment management plan will be adopted properly to mitigate the adverse impact as below,

- Loss of vegetation during excavation will not be major; moreover 33% of totalland is allotted for greenbelt development.
- During the transportation, trucks will be covered to avoid dust dispersion in the air.

- Dust emission from construction machineries as well as vehicles on the roadwill be minimized by regular water spraying of for suppression.
- Regular maintenance of vehicles/ machineries and use of vehicles with PUCcertificates to avoid the vehicular pollution.
- construction machineries/ equipment's and vehicles will be turned off,when not in use. from the vehicular movement and operation of equipment's/ machineries will be managed by restricting the same during night time.
- Personal Protective Equipment's like ear muffs or ear plugs will be provided to workers who will have exposure to high noise.

12.8.2 OPERATION PHASE

12.8.2.1 Air emissions

- **Flue gas emissions**

Particulate matter (PM), SO_2 & NOx are main pollutants being/to be emitted from stacks attached with steam Boilers of capacity 20 TPH. Two D.G sets of capacity 500 kVA each will be used in case of power failure. Air pollution equipment's like Electrostatic precipitator (ESP) and dust collectors will be installed. Stack height will be 62 m.

- ***PROCESS EMISSIONS***

Fermentation and Distillation are the main source of process emissions. CO_2 and VOC's will be generated during the process. The CO_2 will be scrubbed in water. VOC emissions are very minor as distillation process in closed.

12.8.2.2 WASTE WATER GENERATION

Factory will be adopting Wet Land Technology practice hence, discharge of effluent outside the factory will not be permitted. Domestic effluent will be discharged to soak pit via septic tank. Waste water will be generated from process and steam condensate, boiler and cooling tower blow down and water treatment plant, will be treated in ETP called Condensate polishing unit and reused in process.

12.8.2.3 SOLID WASTE GENERATION

Solid wastes are generated from the Fermentation (Yeast sludge), distillation, Effluent treatment Plant (ETP Sludge), from DG sets and Ash.

Sludge dewatering unit will be installed for instead of sludge drying bed to avoid Odor. Yeast

sludge will be used as manure

The other solid wastes expected from the unit will be containers, empty drums which will be used for packing product, and/ or returned to the product seller or sold to authorizedbuyers. For avoiding any kind of fire incident leakages inside the factory premises, the safetymeasures have to be undertaken. Probable solid waste generation quantity are given in Table 11.5

TABLE 11.5: SOLID WASTE GENERATION QUANTITIES AND DISPOSAL

S.no	Type of Waste	Quantity	Hazardous Category if any
1.	Yeast sludge	28.5 Ton/Day	No Hazardous
2.	ETP sludge	5 Ton/Day	No Hazardous
3.	Ash	5 Ton/ Day	No Hazardous
4.	Domestic waste	Negligible	No Hazardous

12.8.2.4 Occupational health and safety

Occupation health hazard during the operation will be minimizing by providing PPE's. Moreover, all safety precautions will be taken to reduce the accidents during operation.

Firefighting program will be prepared and equipment's for the same will be placed properly. Workers will be trained and will be made aware with all operational hazards occurred during the operation.

12.8.2.5 GREENBELT DEVELOPMENT

Greenbelt will be developed in 2.0 acres of total plot area, which is 10 % of total land of Plant equipment's. Details of trees and shrubs to be planted are given in Chapter X. Localand

native trees will preferably plant. Broad leaves trees will be planted around the industrial area. Avenue plantation will be done along the road sides.

12.9 POST PROJECT ENVIRONMENTAL MONITORING PROGRAM

Post project monitoring helps to identify the adverse environmental impacts of the proposed project. It also recognizes the efficiency of the pollution control equipment's which are placed for pollution abatement. Environmental monitoring program prepared for proposed project is given in Table 11.6.

TABLE 11.6: POST PROJECT ENVIRONMENTAL MONITORING SCHEDULE

S.NO	Particulate	Parameters	Number of Locations	Frequency
1.	Ambient air quality	PM_{10}, $PM_{2.5}$, SO_2, NOx, CO, etc.	Ambient air quality at minimum 3-5 locations. 1 location within the plant premises, 1 location in up wind, 1 location in downwind direction and 1 location in cross wind direction.	Monthly

2.	Stack gas	PM, SO_2 and NOx	Number of stacks	Monthly
3.	Work place	$PM_{2.5}$, SO_2, NOx, VOCs,CO_2	Process emission in workplace area/plants (for each area/plant minimum 2 locations and 1 location outside plant area near vent)	Monthly
4.	Waste water	pH, EC, SS, TDS, O&G, Ammoniacal Nitrogen,COD, BOD, Chloride, Sulphide etc.	Wastewater from all sources. Inlet & outlet of ETP Process condensatetreatment plant Inlet and outlet	Monthly
5	Surface water and ground water	pH, Salinity, Conductivity, TDS, Turbidity, DO, BOD Phosphate, titrates, Sulphates, Chlorides, Total Coliforms (TC) & *E.coli*	-5 location Ground as well as Surface water Ground water preferably Near to storage lagoon	Half yearly
6.	Solid waste	Ash	• Process dust generated sludge and ash. Before used as manure if used manure	Monthly

7.	Noise	Equivalent noise level - dB (A) at min. Noise Levels measurement at high noise generating places as well as sensitive receptors in the vicinity	5 locations At all source and outside the Plant area.	Monthly
8.	Green belt	Number of plantation (units), number of survived plants/ trees, number of poor plant/ trees.	In and around the plant site	Monthly
9.	Soil	Texture, pH, electrical conductivity, cation exchange capacity, alkali metals, Sodium Absorption Ratio (SAR), permeability, porosity.	2-3 Near Solid/ hazardous waste storage. At least five locations from Greenbelt and area where manure of biological waste is applied.	Quarterly
10.	Occupational health	Health and fitness checkup of employees getting exposed to various hazards and all	All worker	Yearly / twice ayear

		other staff		

12.10 ADDITIONAL STUDY

Additional studies have been included in chapter VII are as below,

- Risk Assessment in which risks arising from
  - Storage and Handling of Alcohol, Molasses.
  - Operation of DG sets, Boiler, Storage and Handling of hazardous chemicals
- Disaster Management Plan
- Occupational Health and Safety Management System

12.11 PROJECT BENEFITS

Project contributes many direct and indirect benefits to the local people in terms of financial, social welfare and other tangible benefits and these are,

- Direct and indirect employment generation for local community of surrounding area during construction phase and operation phase. Around 70- 100 No. skilled manpower will be required during the project execution.
- Major part of these labors will be mainly from local villagers who are expected to engage themselves both in agriculture and project activities. This will enhance their income and lead to overall economic growth of the area.

12.12 CONCLUSION

- Proposed project does not attract rehabilitation and resettlement of people, since the proposed site in open and vacant.
- Proposed project does not anticipate any adverse impacts on environment.
- Production process is environmentally safe
- Air emissions through stack will be controlled by EPA Punjab.
- Loss of vegetation and habitat will not be attributed.
- Workplace/ operation hazards, which will be minimized by providing personal

protective equipment's, safety precautions, emergency plan & disaster management plan.

Consequently, impacts on air, water, land and ecological environments are insignificant and the socio-economic benefits are predominantly positive.

Thus, overall project features, process, potential of pollution, pollution prevention measures and environmental management plan proposed by proponent illustrates that proposed project will not have any considerable impacts on environment as well as on socio-economic & ecological conditions of the project area. Therefore, proposed project is environmentally safe.

INDEX

10.4.10.1.1	Introduction
10.4.10.1.1.1	Location
10.4.10.1.1.2	Geomorphology
10.4.10.1.1.3	Geology
10.4.10.1.1.4	Rain Fall and Land Use

2) Methodology

a) Surface Study

b) Subsurface Study

1. INTRODUCTION:

The work of Hydrogeological survey with detailed Geophysical investigations was carried out at the proposed distillery site at Chak No. 106/1-L, Tehsil Khanpur District Rahim yar khan., Punjab province with an objective to understand the geological and geohydrological conditions of the area surrounding the proposed distillery site. Geological formations were recorded by studying the outcrops in the nearby area and observations of road cuttings and dug wells.

a) LOCATION:

Project is located at Chak No. 106/1-L, Tehsil Khanpur District Rahim yar khan

Map of Rahimyar Khan District



PROJECT SITE PCITURES OF PROPOSED DISTILLERY :





CHAK NO. 106/1-L, TEHSIL KHANPUR DISTRICT RAHIM YAR KHAN



CHAK NO. 106/1-L, TEHSIL KHANPUR DISTRICT RAHIM YAR KHAN



CHAK NO. 106/1-L, TEHSIL KHANPUR DISTRICT RAHIM YAR KHAN



CHAK NO. 106/1-L, TEHSIL KHANPUR DISTRICT RAHIM YAR KHAN



CHAK NO. 106/1-L, TEHSIL KHANPUR DISTRICT RAHIM YAR KHAN

b) GEOMORPHOLGY:

The area is mostly characterized by a flat topography and sand pits. The major river in the region is the river Indus which is the tributary of main River of Pakistan. The area of the proposed distillery site is slightly elevated as compared to the surroundings, because of waste of Distillery to be used for Wet Land System nearby.

c) GEOLOGY:

Surface water:

The run-off during monsoon period contributes to the surface water. There is no perennial stream or river in the surrounding villages. These villages get water from open wells and bore wells which get recharged in rainy season and nearby irrigation canal system.

Ground Water:

The proposed power plant will be located in the area which is being fed by an elaborateirrigation canal system, with the result that ground water aquifer is being regularly replenished. Shortage of ground water is not expected. A hydro-geological report in thisregard is included in this EIA report

Topography and Geography:

Pakistan lying in the northwestern part of the Southern Asian Subcontinent, occupies the western end of the Indo-Gangetic Plains. The Indo-Gangetic Plains isa large and fertile plain encompassing the most populous parts of Pakistan, most of northern and eastern Pakistan, parts

of southern Nepal and virtually all of

Bangladesh. The region is named after the Indus and the Ganges, the twin river systems that drain it.

The Indo-Gangetic belt is the world's most extensive expanse of uninterrupted alluvium formed by the deposition of silt by the numerous rivers. The plains areflat and mostly treeless, making it conducive for irrigation through canals. The area is also rich in ground water sources.

The soils are mostly black cotton soils having different types such as shallow black soil to deep black soil. Red soil mixed with black can be seen at some places.Along the banks of river Vedganga alluvial soil is present. Soil has varied thickness in the region ranging from 4 m. to 9 m.

d) RAINFALL AND TEMPERATURE:

Temperature:

Mean monthly temperature during July = 30 – 35 0C

Mean monthly temperature during January = 10 – 15 0C

i- Hottest Month: May to August

M. Min. = 29.0 o C

M. Max. = 46.1 o

Cii- Coldest

month:

M. Min. = 4.7^{o} C

M. Max. = 20.00C

Rainfall:

Rainfall (July to December) = 100 - 150 mm

Rainfall (December to March) = 50 - 80 mm

Mean Annual Rain fall = 80-120 mm

As far as the land use is concerned out of the 260000 Hectors of the total available land in the Sadiqabad Tehsil, 50000 Hectors is forest land, 50000 Hectors is uncultivable land and 160000 is fallow land.

Around the proposed area the land is mostly cultivable due to various lift irrigation schemes that lift water from Lakhi Minor coming from Punjnad canal. Major crops include sugarcane, wheat, Cotton, Lemon orchards, Mango orchards etc.

The climate of the is semi-arid type with temperature ranging from 27 to 48 degree Celsius in summer to 10 to 30 degrees in the winter season.

SOIL:

Soils form a major part of environment. Their fertility and other special characteristics have an important relationship with the environment. Climate has great influence on the formation of soils; therefore, study of these factors is of importance. Soil is thedynamic layer in which many complex physical, chemical and biological activities are taking place. Soil scientists restrict the word soil or solum to the surface materials which over the ages have adopted the distinctive layers or horizon. Soils are made up of solids, liquids and gases.The solid part of the soil is made up of both inorganic and organics. While weathering of rocks make inorganic particles, the organic solids consist of living and decayed plants.

In order to classify the entire soils in Pakistan, the Soil Survey of Pakistan has divided the country into nine ecological zones.

As regards their age, they are much younger than the “Bar” areas and have been deposited only during sub-recent times. It is this age difference which is responsible for weaker developmentin these soils. Because of illuviation or eluviation of clay, calcic horizon, vertical characteristic and features are absent in the soils of this area. The soils are developed to only moderate depths. Orchic epipedon and cambic horizon are found in the soils. In local language these soils are called “Bangar” Soils.

WET LAND TECHNOLOGY

A **constructed wetland** (**CW**) is an artificial Wetland to treat the waste of plantproduced after Effluent Treatment Plant. It may also be designed for land reclamation after mining, or as a mitigation step for natural areas lost to land development.

Similarly, to natural wetlands, constructed wetlands also act as a biofilter and/or can remove a range of pollutants (such as organic matter, nutrients, pathogens, heavy metals heavy the water. Constructed wetlands are a sanitation technology that have not been designed specifically for pathogen removal, but instead, have been designed to remove other water quality constituents such as suspended solids, organic matter and nutrients (nitrogen and phosphorus). All types of pathogens (i.e., bacteria, viruses, protozoan and helminths) are expected to be removed to some extent in a constructed wetland. Subsurface wetland provides greater pathogen removal than surface wetlands.

There are two main types of constructed wetlands: subsurface flow and surface flow constructed wetlands. The planted vegetation plays an important role in contaminant removal. The filter bed, consisting usually of sand and gravel, has an equally important role to play. Someconstructed wetlands may also serve as a habitat for native and migratory wildlife, although that is not their main purpose. Subsurface flow constructed wetlands are designed to have either horizontal flow or vertical flow of water through the gravel and sand bed. Vertical flow systems have a smaller space requirement than horizontal flow systems.

SETUP FOR WET LAND SYSTEM.

We acquired 200 acres or land for this purpose for which we utilize this land for wet land system the waste water coming from Effluent Treatment Plant of is kept on the lagoons developed for

Wet Land, that water will used for the adding in the lagoons, the treeswill be cultivated like Naeem, Concarpus,Safeda, Jaman, Gava,Talhi, etc.

PICTURES OF EXISTING LAND AVAILABLE FOR WET LAND




Z

PICTURES OF TO BE DEVELOPED LAND FOR WET LAND





PICTURES OF TO BE DEVELOPED LAND FOR WET LAND



CHAK NO. 106/1-L, TEHSIL KHANPUR DISTRICT RAHIM YAR KHAN



PICTURES OF TO BE DEVELOPED LAND FOR WET LAND









CHAK NO. 106/1-L, TEHSIL KHANPUR DISTRICT RAHIM YAR KHAN

EXISTING A WETLAND IN PAKISTAN



Terminology

Many terms are used to denote constructed wetlands, such as reed beds, soil infiltration beds, treatment wetlands, engineered wetlands, man-made or artificial wetlands. A biofilter hassome similarities with a constructed wetland, but is usually without plants.

The term of constructed wetlands can also be used to describe restored and re cultivated landthat was destroyed in the past through draining and converting into farmland, or mining.

OVER VIEW

CHAK NO. 106/1-L, TEHSIL KHANPUR DISTRICT RAHIM YAR KHAN

A constructed wetland is an engineered sequence of water bodies designed to filter and treat waterborne pollutants found in sewage, industrial effluent or storm water runoff.

Constructed wetlands are used for wastewater treatment or for greywater treatment. They can be used after a septic tank for primary treatment (or other types of systems) in order to separate the solids from the liquid effluent. Some constructed wetland designs however do not use upfront primary treatment.

Vegetation in a wetland provides a substrate (roots, stems, and leaves) upon which microorganisms can grow as they break down organic materials. This community of microorganisms is known as the periphyton. The periphyton and natural chemical processes areresponsible for approximately 90 percent of pollutant removal and waste breakdown. The plants remove about seven to ten percent of pollutants, and act as a carbon source for the microbes when they decay. Different species of aquatic plants have different rates of heavy metal uptake, a consideration for plant selection in a constructed wetland used for water treatment. Constructed wetlands are of two basic types: subsurface flow and surface flow wetlands.

Constructed wetlands are one example of nature -based solutions and of phytoremediation.

Many regulatory agencies list treatment wetlands as one of their recommended "best management practices" for controlling urban runoff.

REMOVAL OF CONTAMINANTS

Physical, chemical, and biological processes combine in wetlands to remove contaminants from wastewater. An understanding of these processes is fundamental not only to designing wetland systems but to understanding the fate of chemicals once they enter the wetland.

Theoretically, wastewater treatment within a constructed wetland occurs as it passes through the wetland medium and the plant rhizosphere. A thin film around each root hair is aerobic dueto the leakage of oxygen from the rhizomes, roots, and rootlets. Aerobic and anaerobic micro- organisms

facilitate decomposition of organic matter. Microbial nitrification and subsequent denitrification releases nitrogen as gas to the atmosphere. Phosphorus is coprecipitated with iron, aluminum, and calcium compounds located in the root-bed medium. Suspended solids filter out as they settle in the water columnin surface flow wetlands or are physically filtered out by the medium within subsurface flow wetlands. Harmful bacteria and viruses are reduced by filtration and adsorption by biofilms on the gravel or sand media in subsurface flow and vertical flow systems.

Nitrogen removal

The dominant forms of nitrogen in wetlands that are of importance to wastewater treatment include organic nitrogen, ammonia, ammonium, nitrate and nitrite. Total nitrogen refers to all nitrogen species. Wastewater nitrogen removal is important because of ammonia's toxicity to fish if discharged into watercourses. Excessive nitrates in drinking water is thought to cause methemoglobinemia in infants, which decreases the blood's oxygen transport ability. Moreover, excess input of N from point and non-point sources to surface water promotes eutrophication in rivers, lakes, estuaries, and coastal oceans which causes several problems inaquatic ecosystems e.g. toxic algal blooms, oxygen depletion in water, fish mortality, loss of aquatic biodiversity.

Ammonia removal occurs in constructed wetlands – if they are designed to achieve biological nutrient removal – in a similar ways as in sewage treatment plants, except that no external, energy-intensive addition of air (oxygen) is needed.[3] It is a two-step process, consisting of nitrification followed by denitrification. The nitrogen cycle is completed as follows: ammonia in the wastewater is converted to ammonium ions; the aerobic bacterium *Nitrosomonas* sp. oxidizes ammonium to nitrite; the bacterium *Nitrobacter* sp. then converts nitrite to nitrate. Under anaerobic conditions, nitrate is reduced to relatively harmless nitrogen gas that entersthe

atmosphere.

Nitrification

Nitrification is the biological conversion of organic and inorganic nitrogenous compounds from a reduced state to a more oxidized state, based on the action of two different bacteria types. Nitrification is strictly an aerobic process in which the end product is nitrate (NO^{-})Theprocess of nitrification oxidizes ammonium (from the wastewater) to nitrite ($NO^{-}$and then nitrite is oxidized to nitrate (NO^{-})

Denitrification

Denitrification is the biochemical reduction of oxidized nitrogen anions, nitrate and nitrite to produce the gaseous products nitric oxide (NO), nitrous oxide (N_2O) and nitrogen gas (N_2), with concomitant oxidation of organic matter. The end product, N_2, and to a lesser extent the intermediary by product, N_2O, are gases that re-enter the atmosphere.Ammonia removal from mine water. Constructed wetlands have been used to remove ammonia and other nitrogenous compounds from contaminated mine water, including cyanide and nitrate.

Phosphorus removal

Phosphorus occurs naturally in both organic and inorganic forms. The analytical measure of biologically available orthophosphates is referred to as soluble reactive phosphorus (SR-P). Dissolved organic phosphorus and insoluble forms of organic and inorganic phosphorus are generally not biologically available until transformed into soluble inorganic forms.

In freshwater aquatic ecosystems phosphorus is typically the major limiting nutrient. Under undisturbed natural conditions, phosphorus is in short supply. The natural scarcity of phosphorus is demonstrated by the explosive growth of algae in water receiving heavy discharges of

phosphorus-rich wastes. Because phosphorus does not have an atmospheric component, unlike nitrogen, the phosphorus cycle can be characterized as closed. The removal and storage of phosphorus from wastewater can only occur within the constructed wetland itself. Phosphorus may be sequestered within a wetland system by:

1. The binding of phosphorus in organic matter as a result of incorporation into living biomass,
2. Precipitation of insoluble phosphates with ferric iron, calcium, and aluminum found in wetland soils.

Biomass plants incorporation

Aquatic vegetation may play an important role in phosphorus removal and, if harvested, extendthe life of a system by postponing phosphorus saturation of the sediments. Plants create a unique environment at the biofilm's attachment surface. Certain plants transport oxygen whichis released at the biofilm/root interface, adding oxygen to the wetland system. Plants also increase soil or other root-bed medium hydraulic conductivity. As roots and rhizomes grow, they are thought to disturb and loosen the medium, increasing its porosity, which may allow more effective fluid movement in the rhizosphere. When roots decay they leave behind ports and channels known as macropores which are effective in channeling water through the soil.

Metals removal

Constructed wetlands have been used extensively for the removal of dissolved metals and metalloids. Although these contaminants are prevalent in mine drainage, they are alsofound in stormwater, landfill leachate and other for which treatment wetlands

Mine water—Acid drainage removal

Constructed wetlands can also be used for treatment of acid mine drainage .

Pathogen removal

Constructed wetlands are a sanitation technology that have not typically been designed for pathogen removal, but instead, have been designed to remove other water quality constituentssuch as suspended solids, organic matter (BOD/COD) and nutrients (nitrogen and phosphorus). All types of pathogens are expected to be removed in a constructed wetland; however, greater pathogen removal is expected to occur in a subsurface wetland. In a free water surface flow wetland one can expect 1 to 2 log10 reduction of pathogens; however, bacteria and virus removal may be less than 1 log10 reduction in systems that are heavily planted with vegetation. This is because constructed wetlands typically include vegetation which assists inremoving other pollutants such as nitrogen and phosphorus. Therefore, the importance of sunlight exposure in removing viruses and bacteria is minimized in these systems.

Removal in a properly designed and operated free water surface flow wetland is reported to be less than 1 to 2 log10 for bacteria, less than 1 to 2 log10 for viruses, 1 to 2 log10 for protozoa: and 1 to 2 log10 for helminths. In subsurface flow wetlands, the expected removal of pathogensis reported to be 1 to 3 log10 for bacteria, 1 to 2 log10 for viruses, 2 log10 for protozoa, and 2 log10 for helminths.

The log10 removal efficiencies reported here can also be understood in terms of the commonway of reporting removal efficiencies as percentages: 1 log10 removal is equivalent to a removal efficiency of 90%; 2 log10 = 99%; 3 log10 = 99.9%; 4 log10 = 99.99% and so on.

Types and design considerations

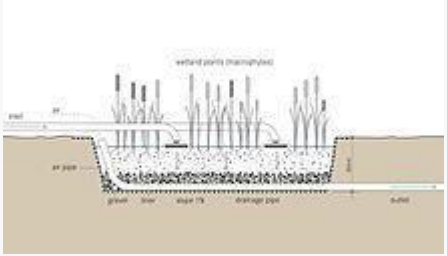
The main three broad types of constructed wetlands include:

- Subsurface flow constructed wetland - this wetland can be either with vertical flow (the effluent moves vertically, from the planted layer down through the substrate and out) or with horizontal flow (the effluent moves horizontally, parallel to the surface)
- Surface flow constructed wetland (this wetland has horizontal flow)
- Floating treatment wetland

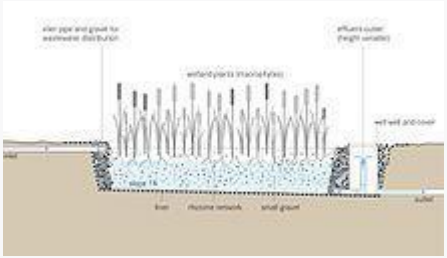
The former types are placed in a basin with a substrate to provide a surface area upon which large amounts of waste degrading biofilms form, while the latter relies on a flooded treatmentbasin upon which aquatic plants are held in flotation till, they develop a thick mat of roots andrhizomes upon which biofilms form. In most cases, the bottom is lined with either a

polymer geo membrane, concrete or clay (when there is appropriate clay type) in order to protect the water table and surrounding grounds. The substrate can be either gravel—generallylimestone or pumice/volcanic rock, depending on local availability, sand or a mixture of various sizes of media (for vertical flow constructed wetlands).

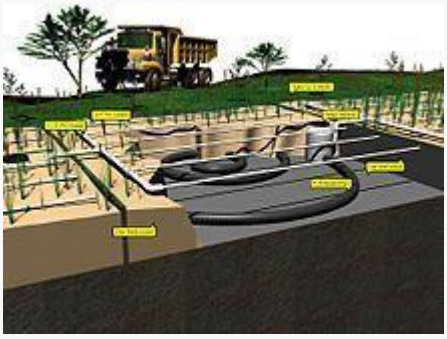
Subsurface flow



Schematic of a vertical subsurface flow constructed wetland: Effluent flows through pipes on the subsurface of the ground through the root zone to the ground.



Schematic of the Horizontal Subsurface Flow Constructed Wetland: Effluent flows horizontally through the bed.



Vertical flow type of constructed wetlands (subsurface flow)

In subsurface flow constructed wetlands the flow of wastewater occurs between the roots ofthe plants and there is no water surfacing (it is kept below gravel). As a result, the system is more efficient, does not attract mosquitoes, is less odorous and less sensitive to winter conditions. Also, less area is needed to purify water. A downside to the system is the intakes,which can clog or bio clog easily, although some larger sized gravel will often solve this problem.

Subsurface flow wetlands can be further classified as horizontal flow or vertical flow constructed wetlands. In the vertical flow constructed wetland, the effluent moves vertically from the planted layer down through the substrate and out (requiring air pumps to aerate thebed). In the horizontal flow constructed wetland the effluent moves horizontally via gravity, parallel to the surface, with no surface water thus avoiding mosquito breeding. Vertical flow constructed wetlands are considered to be more efficient with less area required compared tohorizontal flow constructed wetlands. However, they need to be interval-loaded and their design requires more know-how while horizontal flow constructed wetlands can receive wastewater continuously and are easier to build.

Due to the increased efficiency a vertical flow subsurface constructed wetland requires only about 3 square meters (32 sq. ft) of space per person equivalent, down to 1.5 square meters inhot climates.

The "French System" combines primary and secondary treatment of raw wastewater. The effluent passes various filter beds whose grain size is getting progressively smaller (from gravelto sand).

Applications

Subsurface flow wetlands can treat a variety of different wastewaters, such as household wastewater, agricultural, paper mill wastewater, mining runoff, tannery or meat processing wastes, storm water.

The quality of the effluent is determined by the design and should be customized for theintended reuse application (like irrigation or toilet flushing) or the disposal method.

Design considerations

Depending on the type of constructed wetlands, the wastewater passes through a gravel and more rarely sand medium on which plants are rooted.[1] A gravel medium (generally limestone orvolcanic rock lava stone) can be used as well (the use of lava stone will allow for a surface reduction of about 20% over limestone) is mainly deployed in horizontal flow systems though itdoes not work as efficiently as sand (but sand will clog more readily).

Constructed subsurface flow wetlands are meant as secondary treatment systems which meansthat the effluent needs to first pass a primary treatment which effectively removes solids. Such a primary treatment can consist of sand and grit removal, grease trap, compost filter, septic tank, Imhoff tank, anaerobic baffled reactor or up flow (UASB) reactor. The following treatmentis based on different biological and physical processes like filtration, adsorption or nitrification.

Most important is the biological filtration through a biofilm of aerobic or facultative bacteria. Coarse sand in the filter bed provides a surface for microbial growth and supports the adsorption and filtration processes. For those microorganisms the oxygen supply needs to besufficient. Especially in warm and dry climates the effects of evapotranspiration and precipitation are significant. In cases of water loss, a vertical flow constructed wetland is preferable to a horizontal because of an unsaturated upper layer and a shorter retention time, although vertical flow systems are more dependent on an external energy source. Evapotranspiration (asis rainfall) is taken into account in designing a horizontal flow system.

The effluent can have a yellowish or brownish color if domestic wastewater or blackwater is treated. Treated grey water usually does not tend to have a color. Concerning pathogen levels, treated grey water meets the standards of pathogen levels for safe discharge to surface water.[1] Treated domestic wastewater might need a tertiary treatment, depending on the intended reuse application.

Plantings of reed beds are popular in European constructed subsurface flow wetlands, althoughat least twenty other plant species are usable. Many fast growing timer plants can be used, as well for example as Musa spp., Juncus spp., cattails (*Typha* spp.) and sedges.

Operation and maintenance

Overloading peaks should not cause performance problems while continuous overloading leadto a loss of treatment capacity through too much suspended solids, sludge or fats.

Subsurface flow wetlands require the following maintenance tasks: regular checking of the pretreatment process, of pumps when they are used, of influent loads and distribution on thefilter bed.

Comparisons with other types

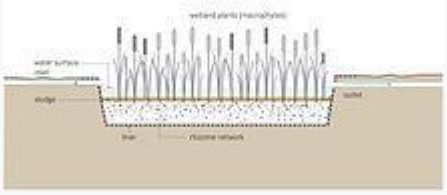
Subsurface wetlands are less hospitable to mosquitoes compared to surface flow wetlands, as there is no water exposed to the surface. Mosquitos can be a problem in surface flow constructed wetlands. Subsurface flow systems have the advantage of requiring less land areafor water treatment than surface flow. However, surface flow wetlands can be more suitable for wildlife habitat.

For urban applications the area requirement of a subsurface flow constructed wetland might be a limiting factor compared to conventional municipal wastewater treatment plants. High rate aerobic treatment processes like activated sludge plants, trickling filters, rotating discs, submerged aerated filters or membrane bioreactor plants require less space. The advantage of subsurface flow constructed wetlands compared to those technologies is their operational robustness which is particularly important in developing countries. The fact that constructed wetlands do not produce secondary sludge (sewage sludge) is another advantage as there is no need for sewage sludge treatment. However, primary sludge from primary settling tanks does get produced and needs to be removed and treated.

Costs

The costs of subsurface flow constructed wetlands mainly depend on the costs of sand withwhich the bed has to be filled. Another factor is the cost of land.

Surface flow



Schematic of a free-water surface constructed wetland: It aims to replicate the naturally occurring processes, where particles settle, pathogens are destroyed, and organisms and plants utilize the nutrients.

Surface flow wetlands, also known as free water surface constructed wetlands, can be used for tertiary treatment or polishing of effluent from wastewater treatment plants. They are alsosuitable to treat storm water drainage.

Surface flow constructed wetlands always have horizontal flow of wastewater across the rootsof the plants, rather than vertical flow. They require a relatively large area to purify water compared to subsurface flow constructed wetlands and may have increased smell and lower performance in winter.

Surface flow wetlands have a similar appearance to ponds for wastewater treatment (such as"waste stabilization ponds") but are in the technical literature not classified as ponds.

Pathogens are destroyed by natural decay, predation from higher organisms, sedimentation and

UV irradiation since the water is exposed to direct sunlight. The soil layer below the wateris anaerobic but the roots of the plants release oxygen around them, this allows complex biological and chemical reactions.

Surface flow wetlands can be supported by a wide variety of soil types including bay mud and other silty clays.

Plants such as Water Hyacinth (*Eichhornia crassipes*) and *Pontederia* spp. are used worldwide (although Typha and Phragmites are highly invasive).

However, surface flow constructed wetlands may encourage mosquito breeding. They may also have high algae production that lowers the effluent quality and due to open water surface mosquitos and odors, it is more difficult to integrate them in an urban neighborhood.

Hybrid systems

A combination of different types of constructed wetlands is possible to use the specificadvantages of each system.



Newly planted constructed wetland



Same constructed wetland, two years later

Others

Integrated constructed wetland

An integrated constructed wetland (ICW) is an unlined free surface flow constructed wetland with emergent vegetated areas and local soil material. Its objectives are not only to treat wastewater from farmyards and other wastewater sources, but also to integrate the wetland infrastructure into the landscape and enhancing its biological diversity.

Integrated constructed wetland facilitates may be more robust treatment systems compared to other constructed wetlands. This is due to the greater biological complexity and generally relatively larger land area use and associated longer hydraulic residence time of integrated

constructed wetland compared to conventional constructed wetlands.

Integrated constructed wetlands are used in Pakistan, Ireland, the UK and the United States since about 2007. Farm constructed wetlands, which are a subtype of integrated constructed wetlands, are promoted by the Scottish Environment Protection Agency andthe Northern Ireland Environment Agency since 2008.

Plants and other organisms

Plants



Newly planted constructed wetland for blackwater treatment (Lima, Peru)



The large roots of this uprooted plant growing in a *constructed wetland* indicate a healthy plant (Lima, Peru)

Typhas and Phragmites are the main species used in constructed wetland due to their effectiveness, even though they can be invasive outside their native range.

In North America, cattails (*Typha latifolia*) are common in constructed wetlands because of their widespread abundance, ability to grow at different water depths, ease of transport and transplantation, and broad tolerance of water composition (including pH, salinity, dissolved oxygen and contaminant concentrations). Elsewhere, Common Reed (*Phragmites australis*) are common (both in black water treatment but also in grey water treatment systems to purify wastewater).

Plants are usually indigenous in that location for ecological reasons and optimum workings.

Animals



A hybrid system using Flow forms in a treatment pond, in Norway.

Locally grown non-predatory fish can be added to surface flow constructed wetlands to eliminate or

reduce pests, such as mosquitos.

Storm water wetlands provide habitat for amphibians but the pollutants they accumulate canaffect the survival of larval stages, potentially making them function as "ecological traps".

Costs

Since constructed wetlands are self-sustaining their lifetime costs are significantly lower than those of conventional treatment systems. Often their capital costs are also lower compared to conventional treatment systems. They do take up significant space, and are therefore not preferred where real estate costs are high.