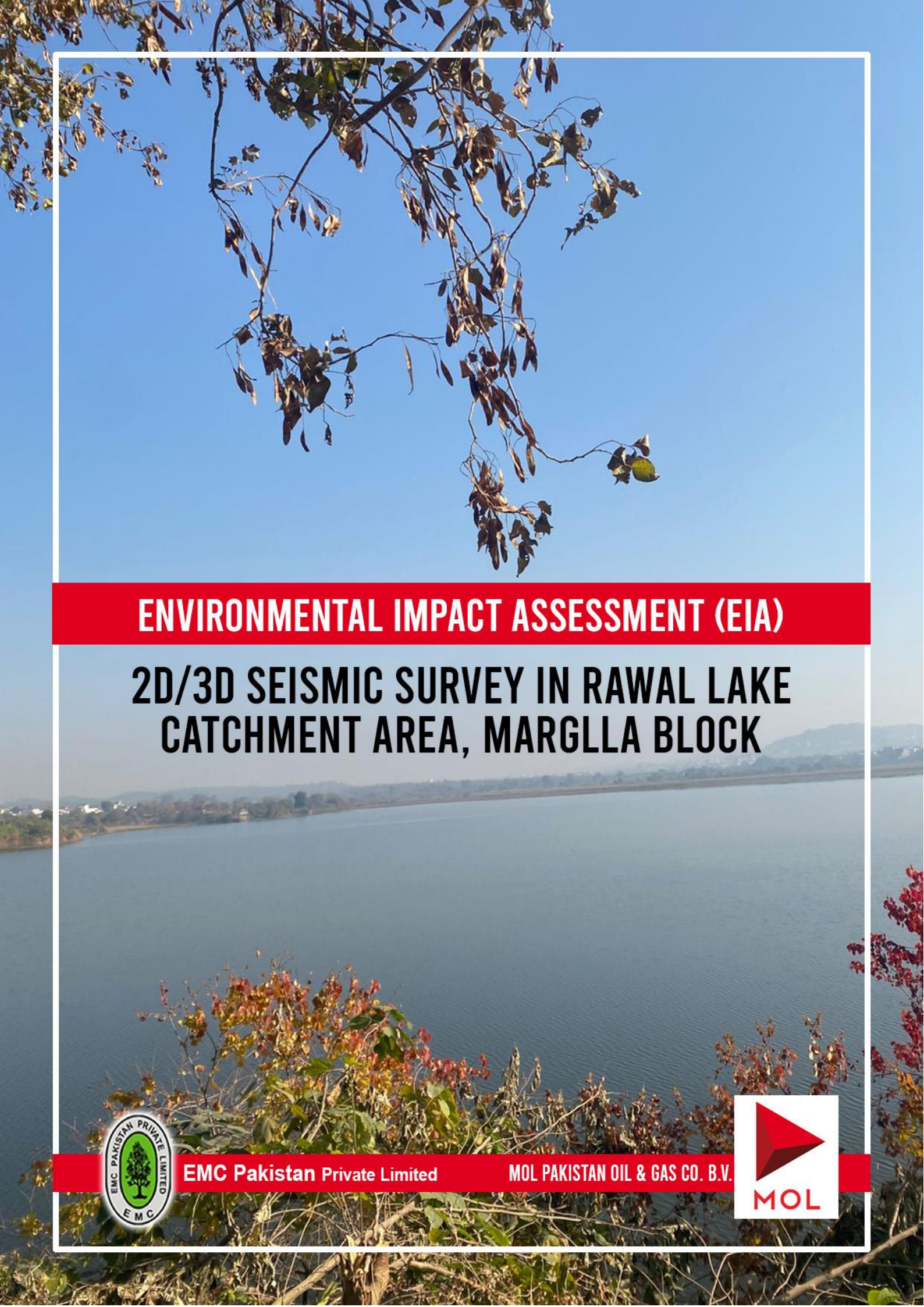

ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

2D/3D SEISMIC SURVEY IN RAWAL LAKE CATCHMENT AREA, MARGLLA BLOCK

EMC Pakistan Private Limited

MOL PAKISTAN OIL & GAS CO. B.V.

DOCUMENT ISSUE & REVISION RECORD

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ABBREVIATIONS

Acronym	Title
API	American Petroleum Institute
BOD	Biochemical Oxygen Demand
CBD	Convention on Biological Diversity
CCA	Climate Change Act
CO	Carbon Monoxide
COD	Chemical Oxygen Demand
dBA	Decibels on the A-weighted scale
EHS	Environmental, Health and Safety
EIA	Environmental Impact Assessment
EMC	EMC Pakistan Pvt. Ltd.
EMP	Environmental Management Plan
EPA	Environmental Protection Agency
ERP	Emergency Response Plan
IEE	Initial Environmental Examination
IFC	International Finance Corporation
IUCN	International Union for Conservation of Nature
MPL	Maximum Permissible Levels
MHNP	Margalla Hills National Park
NCS	National Conservation Strategy
NEAP	National Environmental Action Plan
NEQS	National Environmental Quality Standards
NGO	Non-governmental Organization
NO_2	Nitrogen Dioxide
NO_X	Nitrogen Oxides
OGRA	Oil and Gas Regulatory Authority
PEPA	Pakistan Environmental Protection Agency
$PM_{2.5}$	Particulate Matter≤2.5 microns
PM_{10}	Particulate Matter ≤10 microns
PPE	Personal Protective Equipment
PPEPCA	Pakistan Petroleum Exploration and Production Companies Association
PVC	Polyvinyl Chloride
TDS	Total Dissolved Solids
UNDP	United Nations Development Program
VOC	Volatile Organic Compounds
WHO	World Health Organization

Executive Summary

This EIA report presents the assessment of the potential environmental impacts of the proposed two-dimensional (2D) and three dimensional (3D) geophysical seismic survey in the Rawal Lake Catchment area located in the Margalla Block (the 'Project'). The project plan comprises 4.38 km of 2D seismic data acquisition and 27.2 Sq. km of 3D seismic data acquisition in the Block.

Seismic surveys are the primary tool utilized during the exploration of hydrocarbons in both onshore and offshore areas. A seismic survey is conducted by creating an energy wave commonly referred to as a 'seismic wave' on the surface of the ground along a predetermined line, using an energy source. This wave travels into and through the earth strata, where it is reflected and refracted by various subsurface formations, and returns to the surface where receivers called geophones are used to detect the waves and recorded for analysis. In this case, the seismic waves were induced by vibrating truck-mounted heavy plates on the ground. The specialized trucks are known as "Vibroseis". By analyzing the time, it takes for the seismic waves to reflect off subsurface formations and return to the surface, formations can be mapped and potential oil or gas deposits identified.

The project area falls in Zone III, designated as a protected area, heavily overlapping with the Margalla Hills National Park. Land uses in the area includes recreational, residential (planned and unplanned societies), civil infrastructure. The Lake View Park has been established for recreation and public amusement. There are planned and unplanned residential areas to the NW and Eastern side of the Lake including Bani Gala, Malpur, Mohri, Pakistan colony, and other small localities.

The common land uses in the project area include water storage (Rawal dam), recreational area (Lake View Park), residential (planned and unplanned societies), and agriculture.

Rawal Lake is part of the MHNP, a designated protected area. It is situated in a valley formed by the surrounding Margalla Hills, which are part of the lesser Himalayan foothills. These hills rise sharply around the lake, creating a natural catchment area for rainwater and seasonal streams that feed into the reservoir. To the south and southwest of the lake, the land gradually transitions into relatively flat plains, forming part of the Islamabad urban and peri-urban areas. The general slope of the terrain is from the north and northeast toward the southwest, allowing water from the hills to drain into Rawal Lake.

Several small streams and nullahs originate in the surrounding hills, contributing to the lake's water inflow. The northern and eastern sides of the lake are dominated by hilly and undulating terrain, whereas the southern and western sides are comparatively flatter. The combination of hills, valleys, and plains in the lake's catchment area plays a significant role in the topography and hydrology of Rawal Lake.

The flora of the project area is mix of scrub vegetation, shrubs, and trees, and limited agriculture. Agriculture in the vicinity is mostly small-scale and rainfed, supplemented by water from local streams and the lake itself in some areas. Forest cover is concentrated in the Margalla Hills, providing an important green buffer that supports biodiversity, stabilizes slopes, and maintains the hydrology of the lake. The catchment's natural scrubland, forested hills, and urban interfaces together define the land cover distribution around Rawal Lake.

Rawal Lake receives inflows mainly from the Korang River and several seasonal streams or nullahs, including Bani Gala, Satrameel, and other streams which carry surface runoff from the Margalla foothills and surrounding catchments, particularly during the monsoon season.

The project area has a semi-arid to sub-humid continental climate characterized by extreme temperatures, with hot summers (up to 40°C) and cold, mild winters (dropping to 5°C). The area receives significant monsoon rainfall from July to September and light winter rain from western disturbances, largely supporting rain-fed ("barani")

agriculture. Generally, there are two significant yet variable rainfall periods, the summer monsoon, and winter precipitation from December to March, which is crucial for the agricultural season.

Socio-economic survey of the project area and consultation with locals, highlighted some important concerns of the stakeholders including local communities who emphasized on protection of local infrastructure, water resources, green spaces and vegetation. Some respondents belonging to lower middle class also expected to receive employment opportunities in the form of unskilled labor.

Environmental Impact Assessment study has been conducted by EMC Pakistan Pvt. Ltd. in fulfillment of the requirements laid down in Pakistan Environmental Protection Act, 1997. The Pak EPA (Review of IEE and EIA) Regulations, 2000, categorize oil and gas exploration projects in Schedule I (Oil and gas extraction projects including exploration, production, gathering systems, separation and storage) thus requiring an IEE. However, EIA study has been conducted upon the directions of Pak EPA communicated vide EPA letter bearing reference number F. No. 2(1)/2025-EIA-MOLG-Dir (EIA/Mont)/01 dated December 8th, 2025. The proposed project activities will commence after obtaining approval from EPA.

The main objective of EIA study is to assess the potential environmental impacts of the proposed activity and devise suitable mitigation measures to limit the potential negative environmental impacts (if any).

A detailed assessment of project activities was carried out in the EIA study which involved identification of all major and minor impacts from the proposed exploration activities. Mitigation measures have been suggested side by side to manage the impacts that arise. The efficacy of mitigation measures is further enhanced by provision of EMP which provides a comprehensive action plan for implementation of the mitigation measures and monitoring plan.

Scale of impact of exploration activities is mostly small which can be further controlled by implementing the mitigation measures as suggested in the EMP.

Overall assessment of the environmental impacts of the project activities finds that:

- Rawal Lake is a sensitive ecosystem and requires careful planning and execution of project activities to protect the sanctity of the lake. Particular emphasize may be made on waste management, spill prevention and control and avoiding damages to the shoreline and banks, drainage channels and local properties.
- Protection of green cover and vegetation in the area is important and project planning must address this in its layout and designs. 2D and 3D seismic survey designs offer significant flexibility in layout, which enables the execution of exploration activities while protecting green cover and sensitive environments. Modern survey techniques, including "green seismic" technology, are specifically designed to minimize surface impact in forested or environmentally sensitive areas.
- Noise and vibration associated with data acquisition can impact local wildlife, hence planning and project timing is important. The survey schedules need to factor in the breeding, and nesting windows of the local wildlife.
- Land and water contamination from project activities is possible during fuel and chemical handling activities including storage. This is avoidable through careful implementation and monitoring.
- The impact on project area communities is possible during movement and transportation activities. Planning and scheduling of these activities in a sensitive manner can address this issue and prevent undesirable impacts.

The project planning and design needs to ensure that following environmental sensitivities are taken care of:

1. Local water sources
2. Communities
3. Vegetation and green cover
4. Local wildlife and biodiversity

5. Drainage pattern

The seismic survey will be conducted using Vibroseis and/or dynamite charges. The seismic acquisition methodology has been designed to minimize disruption to local flora and fauna as well as the local communities. Low Impact Seismic technologies will include: the use of Vibroseis as acoustic energy sources; line-cutting with mulchers to minimize line width and accelerate re-growth of vegetation; and use of bulldozers to open up new or improve existing access roads.

For effective management of environmental issues. An Environmental Management Plan has been developed for the project. The EMP identifies the specific measures that will be adopted to ensure that the environmental mitigation plans are implemented and also continued compliance with the regulatory requirements and the EIA are achieved. The project would utilize Green Seismic Technology, which is an eco-friendly approach to oil and gas exploration that uses wireless equipment to reduce environmental impact in sensitive, forested, or hard-to-reach areas. It reduces the need for heavy vehicles and clearing access lanes, significantly reducing deforestation. To prevent tree cutting, use of curvilinear, flexible profiles to bypass trees may be considered.

Based on the findings of the environmental assessment, it is reasonable to suggest that the environmental impacts from the proposed seismic survey activities can be managed through EMP and good industry practices such that the impacts would remain within acceptable limits. The Study therefore recommends that the EIA Report may be approved with the provision that the suggested mitigation measures will be adopted and the Environmental Management Plan will be followed in letter and spirit.

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Annexure:

1.0 Introduction

This Environmental Impact Assessment (EIA) was carried out for the 2D/3D Seismic survey activities in the Rawal Lake Catchment Area, Margalla Block. MOL Pakistan Oil & Gas Company B.V. (herein after referred as MOL Pakistan), plans to conduct the seismic survey in the Margalla Block, falling within geographical jurisdiction of Islamabad.

The EIA study has been carried out for the assessment of the exploration activities on existing physical, ecological and socioeconomic environment of project area. The main rationale of EIA study is to make sure that:

- Any major undesirable impacts on environment (physical, ecological and socioeconomic) during Exploration Surveying are identified;
- Negative impacts (if any) are correctly addressed and satisfactory mitigation measures are suggested for inclusion in the proposed activities of the project;
- Environmental Management Plan (EMP) is provided for sustainable development and operation of the project;
- Report is submitted to Federal Environmental Protection Agency (Pak EPA) and Environmental Approval is obtained under section 12 of the Pakistan Environmental Protection Act, 1997.

Accordingly, this EIA report has identified the potential environmental issues associated with the project activities and mitigation measures are recommended for management of project related impacts.

The requirements for conducting environmental assessment are indicated in Pakistan Environmental Protection Act 1997 (PEPA 1997). In compliance with provisions of this Act and the Pak EPA Advise, this EIA study was conducted for the project.

1.1 Project Overview

The project comprises 2D and 3D Seismic Survey for oil and gas exploration in the Margalla Block. The 2D and 3D are specialized techniques which support in mapping of major structural features (faults, folds), and providing foundational geological insights leading to reservoir characterization, optimizing well placement, identifying subtle features, and increasing drilling success.

The project will build upon the knowledge base of previous seismic survey activities carried out in the past which included 2D seismic surveys in Margalla Block in 2016. The findings of these previous surveys will be dovetailed with the new seismic survey plans to gather subsurface geological and formations data. The scope of proposed plan is to collect 4.38 km of 2D seismic data and 27.2 Sq. km of 3D seismic data from the Margalla Block.

1.2 Project Area

The area where the project activities and project components will be located, where the project activities are expected to take place, and where the proposed activities' environmental impact is expected to occur, has been referred to as the 'project area' in the report. The EIA covers the activities that are proposed to be undertaken in the environmentally sensitive areas of the Margalla and Margalla North blocks, namely the Rawal Lake along with its Catchment area falling in the Margalla Block within the jurisdiction of Islamabad.

Rawal Lake has a total surface area of about 8.8 km^2 with a maximum depth of 31m. The lake is recharged by inflows from various major and minor tributaries some of which have become redundant with the passage of time and due to change in land uses. The approximate catchment area of the lake is about 268 km^2[1]. Some major tributaries recharging the lake include Korang River (KR), Shahdara stream (SS), Barakahu stream (BS), Nurpur stream (NS), Ratahutar stream (RS), Jinnah stream (JS), and other streams.

1.3 The Proponent

MOL Pakistan, an oil and gas company owned by the MOL Group that is known worldwide for mega business ventures in different investment fields, launched its operations in Pakistan in 1999 in the exploration and production sector and has, ever since, made a number of oil and gas discoveries.

MOL Pakistan has working interests in two operated Tal & Margalla and one partner operated Karak Block which is operated by MPCL. MOL has made eleven discoveries in operated and four discoveries in partners operated blocks.

MOL Pakistan is always on the look for opportunities in Exploration and Production (E & P) sector in Pakistan through involvement in Exploration Blocks and acquisition of state owned upstream/downstream opportunities available for privatization. MOL Pakistan sincerely believes that its E & P skill inventory gathered over the period of time can positively contribute towards the self-sustainability of Pakistan's energy needs.

1.4 Scope of EIA

The EIA report covers the 2D and 3D seismic survey activities in the Rawal Lake and its Catchment area falling in the Margalla Block. Detailed description of project and associated activities is given in Section 2.

1.5 Project Categorization

The Pakistan Environmental Protection Agency (Review of IEE and EIA) Regulations, 2000 provide categorization of projects for EIA and IEE based on the expected nature and severity of environmental impacts. Projects will potentially significant and adverse impacts have been listed in Schedule II and the projects with small scale; less adverse impacts have been listed in Schedule I. Projects falling in environmentally sensitive areas are listed in Schedule II as well. For projects not listed in the schedules, EPA can issue directives for EIA or IEE based on the review of nature and potential environmental impacts of the projects.

According to the categorization given in Schedules I and II of the Pakistan Environmental Protection Agency (Review of IEE and EIA) Regulations, 2000, the proposed project falls in Schedule II **Category I: All projects in Environmentally Sensitive Areas.**

Accordingly, this EIA study was carried out in light of the advice of Pak EPA received vide EPA letter number F. No. 2(1)/2025-EIA-MOLG-Dir (EIA/Mont)/01 dated December 8th, 2025.

1.6 EIA Methodology

An overview of the methodology adopted for the EIA study is given below:

[1] AFTAB N. Haphazard colonies polluting Rawal Lake, Daily Times Monday, March 01. 2010

1.6.1 Understanding the Proposed Project

This step involved collecting information from MOL Pakistan on the proposed project activities and understanding the activities to identify potential impacts from them.

1.6.2 Review of Legislation and Guidelines

National legislation, international agreements, environmental guidelines and best industry practices were reviewed to set environmental standards. MOL Pakistan will be required to conform/adhere during the project activities.

1.6.3 Secondary Data Collection

All available published and unpublished information pertaining to the background environment was obtained and reviewed. It included previous environmental studies and environmental baselines conducted for exploration activities in project area. All data sources were reviewed to collect information relevant to physical, biological and socio-economic environment within project area.

1.6.4 Field Data Collection

Site visits were conducted periodically during the EIA study. During the site visit, primary information on the physical, biological and socio-economic background conditions of the project area were collected. Environmental conditions of project area were monitored through environmental monitoring of ambient air and water samples were collected to assess water quality of the project area.

Figure 1.1: Surveys and monitoring for field data collection

1.6.5 Baseline Studies

The environmental profile of the project area was established through secondary data as well as primary data (field surveys). The information was collected and compiled on environmentally important areas (ambient air quality, surface and groundwater resources, infrastructure, terrestrial

and aquatic ecology, local communities, agriculture, public services and sites of archeological or cultural importance etc.).

1.6.6 Impact Identification and Assessment

Potential impacts which may arise from proposed activities were identified. These include effects on physical, biological, socio-economic, archaeological and cultural environment. Impacts were identified in particular on the wildlife reserve and assessed on the basis of field data collected from project area, secondary data, expert's opinion, and monitoring results of previous oil and gas exploration projects in Pakistan.

1.6.7 Recommendations to Mitigate Impacts

Keeping in view the baseline data collected and impacts identified; mitigation measures have been recommended to eliminate, minimize or compensate for the potential environmental and social impacts on the project zone of influence. Mitigation measures recommended here are based on past experience, best industrial practices, legislative requirements and professional judgment.

1.6.8 Environmental Management Plan (EMP)

Environmental management plan (EMP) was developed for effective implementation of the recommended mitigation measures. EMP includes controls to minimize the identified impacts, and monitoring program to monitor residual impacts, if any, during the operation. The EMP has laid down procedures to be followed during the exploration survey and has identified roles and responsibilities for all concerned personnel during the operation, including post project reporting.

1.6.9 Documentation, Review and Conclusion

Findings of the EIA study were compiled in the form of this EIA report. The data collected during the study was compiled into sections. Supporting information has been provided as annexures.

1.7 Organization of this Report

The EIA report has been structured on the standard format, prescribed by the Federal EPA. The Report has been presented in the following sections:

Section 1: Provides an introduction and overview of the Project and IEE process

Section 2: Describes the proposed project and its associated activities in detail

Section 3: Gives an overview of national & international policies and legislation along with guidelines relevant to the project

Section 4: Provides description of the microenvironment and macro-environment of the Project area; explaining its physical & biological environment, as well as socio-economic conditions

Section 5: It includes screening of potential environmental and socioeconomic impacts arising from the proposed project and incorporates mitigation measures. General and project specific guidelines are used to assess the environmental impacts at various phases of the Project

Section 6: Presents a comprehensive Environmental Management Plan (EMP) and Monitoring Program for the project

Section 7: Summarizes the report and presents its conclusion

The main text of the report is supported by a series of Annexures which provide supplementary information including respective sections of prominent national laws and guidelines.

2.0 PROJECT DESCRIPTION

2.1 Introduction

A detailed description of the project activities is presented in this section including key activities and ancillary or associated activities.

2.2 Margalla Block

The Margalla Block (No.3272-20) spans across the Islamabad Capital Territory and extends into the provinces of Punjab and Khyber Pakhtunkhwa, Pakistan. The total area of the Block is 1,847.18 square kilometers. MOL Pakistan is the operator with other JV partners including Pakistan Oilfields Limited (POL) and Mari Petroleum Company Limited (MPCL). The block was granted to MOL Pakistan on November 08, 2006. So far two wells have been drilled in the block, Margala-1 in 2010 and Tarnol-1 in 2022.

2.3 Project Rationale & Objectives

The objective of the proposed seismic survey is to identify and delineate potential prospects, if any, in sufficient detail to be able to, at a later and different stage, test one or more by drilling. MOL Pakistan has been collecting 2D seismic data since 2008 until 2019 in different areas of Margalla Block. The current project will be collecting 2D as well as 3D seismic data from the Margalla Block which will also re-validate the previous the data collected using 2D technique. The plan is to collect 4.38 km of 2D seismic data and 27.2 Sq. km of 3D seismic data from the Margalla Block. The data will be used to formulate future drilling plans to determine the presence of recoverable hydrocarbons.

2.4 Project Location

The project activities will be conducted in the Rawal Lake and its Catchment Area selected over 27.2 km^2. The area being part of the MHNP is an ecologically significant area and holds biodiversity conservation value. The activity location is shown in Figure 2.1. The seismic survey operation will be constrained along the seismic survey lines and to the base and fly camps, as well as to the access roads to these areas.

2.5 Project Activities

The project involves following major and associated activities:

- 2D Seismic Survey Program
    - Line permitting
    - Line survey and preparation
    - Data acquisition
- 3D Seismic Survey Program
    - Grid design/layout
    - Permitting
    - Site preparation and equipment layout
    - Data acquisition
- Utilities, supplies and logistics
- Data processing and interpretation
- Line restoration

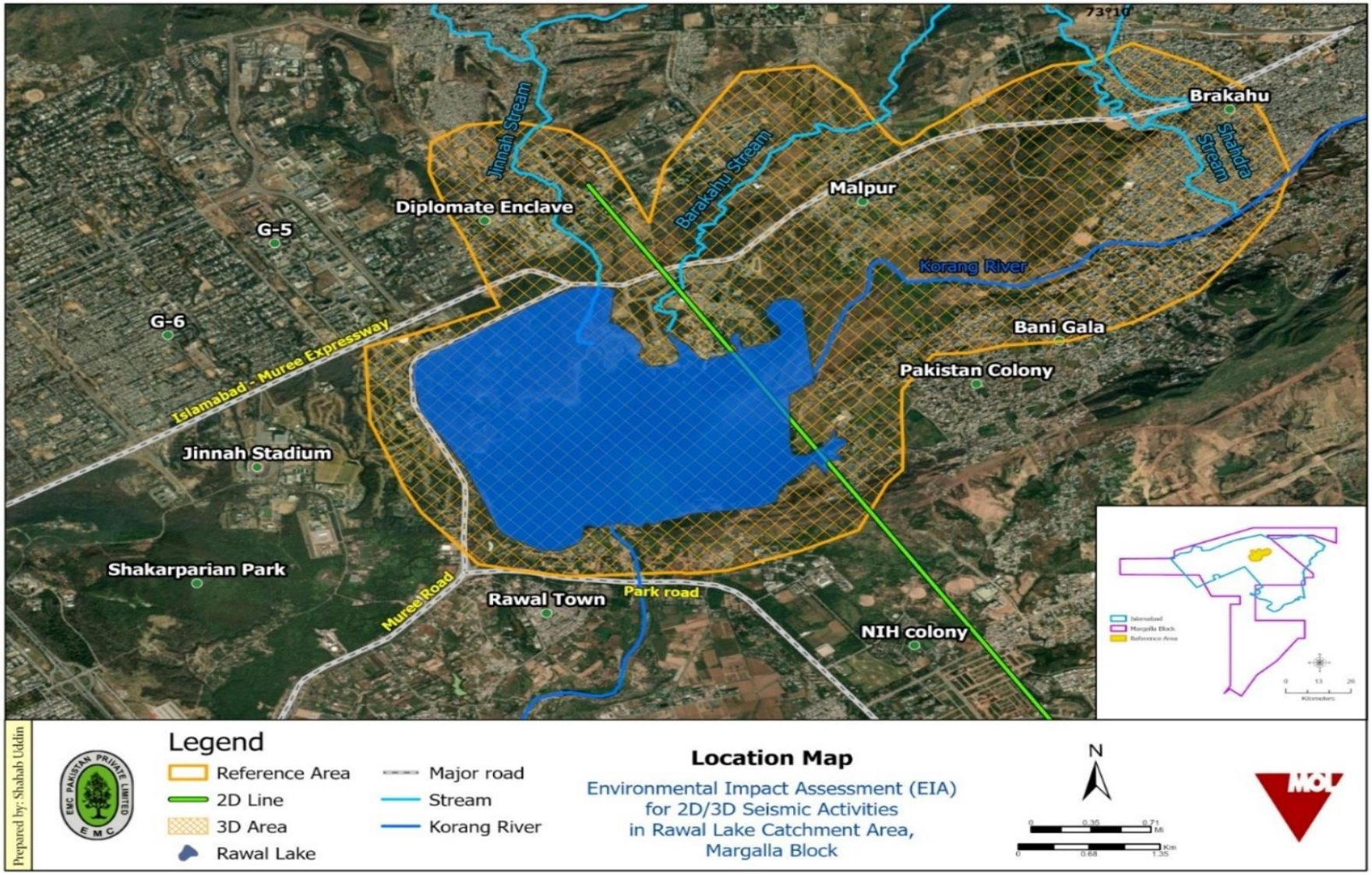

Figure 2.1: Location map of project area

2.6 Project Schedule

The field mobilization for the project is expected to take off from second quarter of 2026. The entire operations will take about 10-12 months. The tentative schedule of activities is given below:

Table 2.1: Activity Timeline (Tentative)

S #	Activity	Duration
1	Land Permitting /acquisition	2-3 months
2	Site preparation works	2 weeks
3	Mobilization	2 weeks
4	Data acquisition	10-12 months
5	Demobilization	1 week

2.7 Seismic Survey Program

Seismic surveys are a primary tool utilized during the exploration of hydrocarbons over land and water. A seismic survey is conducted by creating an energy wave commonly referred to as a 'seismic wave' on the surface of the ground/ over water along a predetermined line, using an energy source. This wave travels into and through the earth strata, where it is reflected and refracted by various subsurface formations, and returns to the surface where receivers called geophones are used to detect the waves and convey them to a recorder for analysis. Seismic waves can be induced by the following methods: small explosive charges, primarily dynamite, set off in shallow holes known as 'shot holes'; or by large 'Vibroseis' trucks equipped with heavy plates that vibrate on the ground or air guns for water-based surveys. By analyzing the time, it takes for the seismic waves to reflect off subsurface formations and return to the surface (Figure 2.2), formations can be mapped and potential oil or gas deposits identified.

2D surveys are acquired by laying the energy sources in linear pattern while 3D surveys are acquired by laying out energy source points (Vibroseis or dynamite charges) and receiver points (geophones) in a grid over the area to be surveyed in 3D design. The receiver points - to record the reflected vibrations from the source points - are laid down in parallel lines (receiver lines), and the source points are laid out in parallel lines that are approximately perpendicular to the receiver lines. The spacing of the source and receiver points is determined by the design and objectives of the survey.

3D seismic surveys are generally conducted in a similar way to 2D seismic surveys but with the variation of setting up six or eight geophone cables side by side at the same time at a distance in most cases of about 400 meters apart. Several "shots" from calculated positions along and between the receiver lines are taken, before the cables are moved up and the process repeated.

3D seismic surveys must be conducted over a large area in order to provide sufficient data for accurate interpretation of the subsurface geology. These surveys can be conducted at different times and cover different but adjacent areas. The complicated structures causing sideswipes can only be imaged properly using 3D reflection techniques in which a 3D volume (x,y,z) of crust is sampled and monitored using a planar, rather than a linear array of shots and receivers. The data collected can later be combined into a single data set for processing and analysis, provided there is sufficient overlap of the areas covered by the surveys.

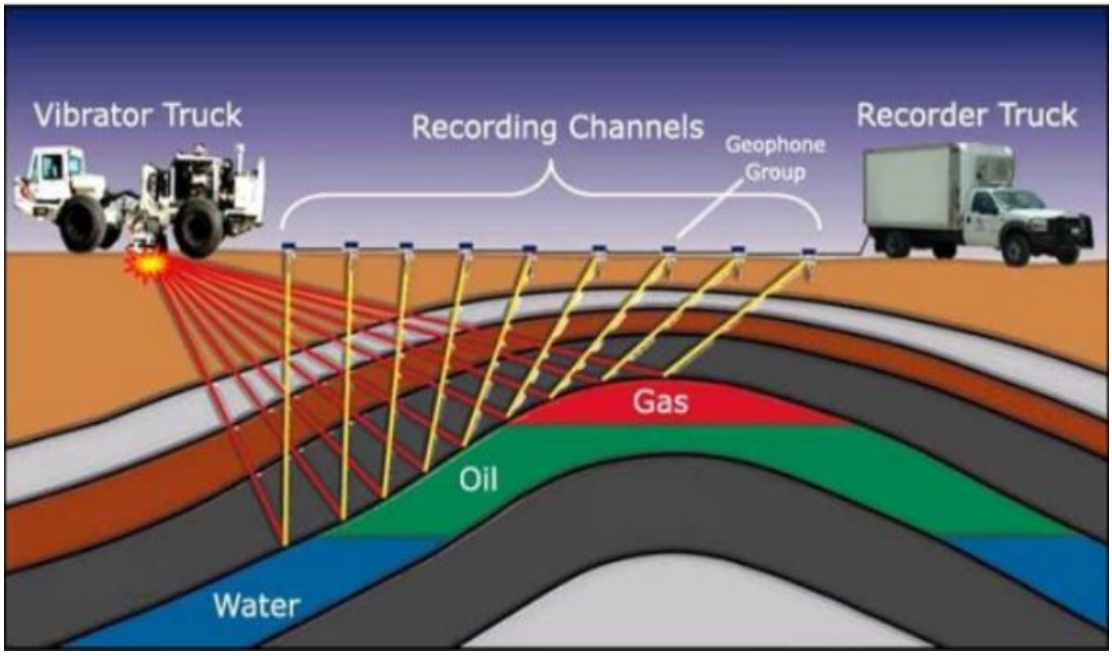

Figure 2.2: Onshore Seismology Using a Vibrator Truck as a Seismic Energy Source[2]

3D seismic surveys are complicated by the fact that a typical survey contains orders of magnitude more data to process. The end result, however, is a data cube that can be sliced to produce synthetic profiles in any arbitrary direction through the data, horizontal slices at arbitrary depths (time slices); horizon slices showing reflectivity variations in map plan for picked marker horizons, and 3D tomographic images that can be viewed from any perspective.

2.8 Survey Scheme

2.8.1 Line Permitting

Before commencement of work, a permitting team headed by a chief permit man will arrive in the area. The aim is to approach the communities and landowners for temporary land permitting for project works. The team will facilitate the activities such as liaising with local landowners and authorities to inform them of the operation and make necessary arrangements. The permitting team will identify the ownership of the land areas over which the seismic operation will be undertaken. In consultation with the district administration and following agreed rates, compensation will be given to the landowners. During the seismic survey the chief permit man will be the focal point for communication between local inhabitants and seismic survey personnel.

2.8.2 Line Survey and Preparation

The seismic survey will be conducted using standard onshore seismic survey operations and procedures.

For 2D technique, the seismic lines will be marked on the ground by survey teams, each team comprising of 4 to 5 people. The survey teams will use a global positioning system (GPS) to mark shot points on the seismic lines often at 25-50 m interval with whitewashed stones or wooden pegs. Seismic lines lying in the plain areas will be cleared to a width of 3 m and a depth of a few inches with a bulldozer. This will allow the movement of Vibroseis trucks over the cleared strip of land along the line. Clearing of trees and dense patches of vegetation will be avoided to the extent

[2] Source: Adapted from http://www.cougarlandservices.net/landowner

possible. Seismic lines lying in cultivated land will not be cleared, and alternate technique (up-hole/shothole) will be used for data collection.

For 3D, process begins by defining the survey area, designing the grid (often 25 x 25 m or 12.5 x 25 m cells), and determining the layout of receiver lines and source lines to ensure proper coverage of the target formation. On the selected land, number of geophones are placed, along with seismic sources, with receiver lines often perpendicular or diagonal to source lines.

2.8.3 Data Acquisition

Two types of techniques, Vibroseis and shothole/pop shots will be utilized for data acquisition depending on the landform, site accessibility, land use, and topography. Vibroseis is often preferred, most common, and dominant method for land seismic data acquisition, particularly for 3D surveys, due to its efficiency, low environmental impact, safety, and operational flexibility. While shot holes (dynamite) are alternate options for areas where heavy Vibroseis trucks cannot operate due to accessibility, topography or geological concerns.

Data acquisition over the lake surface will be passive and limited to surface only. There will be no in water source generation and only receiver cables (hydrophones) will be spread on the lake surface for 2D/3D activity. Source points will be placed on the nearest approachable land surface in the lake vicinity as planned. Approx 4-5 LKM 2D line consisting of these receiver cables will be overlain while approx. 27 sq km 3D survey will fall into this area. This approach caters to the sensitivity of the Rawal Lake and allows for protection of the aquatic ecology of the Lake.

The Explosive shooting procedure is attached as Annex-I which will be adopted during shothole method.

2.8.4 Recording

There are two types of Geophones (sensitive motion detectors or microphones), wireless (nodes) and conventional geophones connected with cables. Wireless geophones are remotely connected with the recording truck without any cables with a minimum human footprint. This is a latest technology which is specifically designed to record data in urbanized and remote areas. Additionally, this reduces the human imprint on the surrounding environment, since it involves lesser human resource and effort. Second type of Geophones are conventional Geophones which are connected with the cable. A cable is laid to join all geophones (buried just below the ground) and connect with the recording truck that has the main electronic hardware used to record the data coming from sub-surface. Approximately 70–80 laborers will be employed for lying and retrieving of cables. It is important to note that the primary source of recording instrument is wireless Geophones (nodes) in Margalla seismic campaign.

2.8.5 Demobilization and Site Restoration

Restoration is done through green teams and later inspected by contractor HSE team and finally by client HSE team. Restoration will include removal of all cables, geophones, station units, flags, stakes and wastes from the lines. For reference purposes a photographic record of the sites prior to set-up will be taken. The following activities will be carried out for site restoration:

- Demobilization of all equipment and machinery
- Disposal of any waste material remaining at the time of completion of the operation
- Dismantling and removal of fence or barriers surrounding the camp area; and

- General restoration of the site area including landscaping and restoration of drainage where required.

2.8.6 Data Analysis

After completion of field activities, the collected data is analyzed by a team of experts. The process includes various activities e.g. converting raw field data into desired data format, removing noise (e.g., machinery, wind) and applying filters, and other activities like stacking and migration.

2.9 Data Acquisition Techniques

2.9.1 Up-holes/Pop shots

Up-holes have different categories, pop shots (shallow drill holes) and deep holes (1.5m to 100m at max). 'Up-hole shooting' allows estimation of the thickness and seismic velocity of the weathered zone as well as the sub-weathering velocity. These data are then used in computing time corrections to a nominal seismic datum, which is a fundamental step in computer processing of seismic field data. Up-hole shooting involves successive detonation of a series of charges at varying depths inside the drill hole and recording of the 'up-hole time' with a surface geophone placed near the up-hole.

After completion of drilling, each shot hole will be loaded with approximately 2-6 kg per shot hole. Expected total number of shot holes and the total charge size is subject to seismic designing which is under progress. Explosives will be handled by a loading crew who will be specially trained in the handling, storage, transportation, charging, firing and safety of dynamite. The charges will be carefully inserted into each hole before the cylindrical PVC casing is removed. Each hole will then be backfilled with sand/mud.

For detonation, TOVEX Gel based manufactured by Biafo shall be deployed, which is widely used in surface and underground mining, quarrying, and construction for rock breaking. Tovex is a water-gel, mining-grade explosive designed as a safer, more stable alternative to nitroglycerin-based dynamites. Composed mainly of ammonium nitrate and methylammonium nitrate, it is used extensively in mining for its high-performance shattering and heaving capabilities. Unlike dynamite, Tovex is generally more resistant to shock, friction, and fire, making it safer to transport and handle. Tovex has largely displaced traditional dynamite due to its high detonation velocity. Its jelly-like consistency provides excellent water resistance, thus making it suitable for wet conditions.

Up-hole drilling is a relatively simple process and no drill casing is used. The drilling fluids used in up-hole drilling consist of soil, ground sandstone and locally sourced groundwater as a wet mix. Apart from soil, ground sandstone and groundwater, no chemicals will be added to the drilling fluid. Once recordings have been made, the majority of the cuttings will be returned to the hole. The cuttings present no risk to the environment in toxicity terms. Excess cuttings at each up-hole, if any, are placed on top of the up-hole and will integrate into the soil over time.

Up-holes will be drilled with the help of truck mounted drilling rigs. These holes will be drilled to a depth of up to 100m and will be 150mm in diameter. To ensure stability of the borehole, a water-based bentonite mud will be circulated through the hole. It is estimated that for each hole approximately 4,000 to 8,000 litres of water will be required for the preparation of the bentonite mud. The mud will be prepared in an earthen pit near the hole. A similar pit will be used to store the used mud. After drying the pits along with their contents (bentonite mud and cuttings) will be backfilled. Data from up-holes will be collected either by a hammer source at the surface and a

string of geophones suspended inside the hole or by using detonators inside the hole to receiver at the surface.

Approximately 70 labors divided into six teams including front crew, back crew, shooting crew, recording crew and green crew will carry out shooting, recording and restoration along the seismic lines. These teams will operate several days behind the drilling team.

The front cable crew will layout the cables and plant geophones along the seismic line. The cables and geophones will be symmetrically laid out 3-4 km along the seismic line on either side of a shot point. The geophones connected together in groups of 24 or more will be planted along the line at intervals of 1 to 5 meter. Each string of geophones will be connected to a cable, which will be connected to a station unit. The station units will be connected to a recording unit through the same cable. The points along which cables and geophones will be laid are termed receiver array.

The shooting crew will be responsible for the detonation of charges. Once the cables and geophones have been symmetrically laid out along the line, the charge is detonated by a crew comprising of 4 members. At the surface the sound of the detonation will be no more than a muffled thud. The process is repeated along the line; cables and geophones being removed from the back of the line and placed at the front of the line as the shooting crew headways.

The recording crew will monitor the ground electronics equipment and recording of the seismic data. The back cable crew will be responsible for picking up the cables, geophones and station units. The green crew will follow the back cable crew and remove any wastes from the seismic lines and restore the shot holes as close to their original condition as possible.

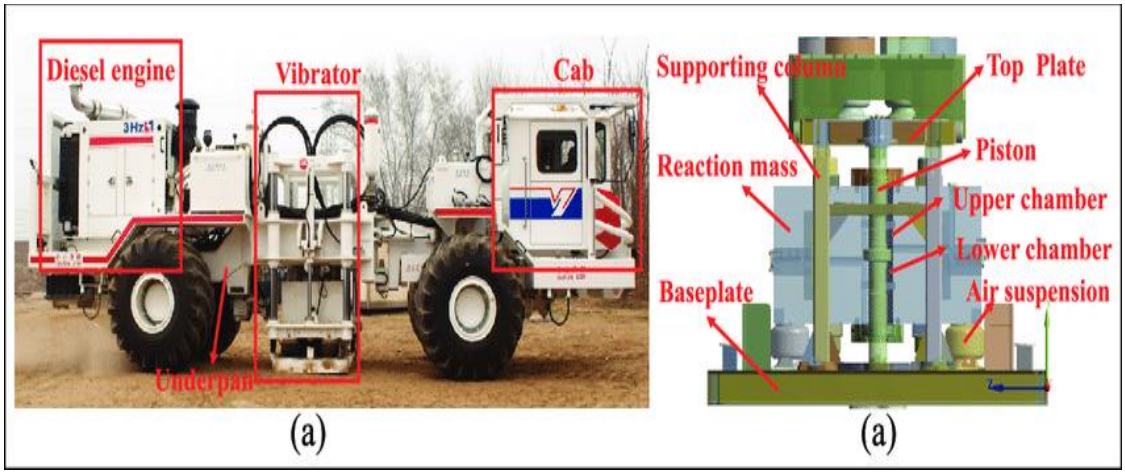

Figure 2.3: Data Acquisition Equipment/Recorder

2.9.2 Vibroseis

This technique will make use of vibrators as an energy source. Vibrator consists of a heavy mass attached to a steel plate mounted on a truck. Truck will lower the steel plate to rest on the ground by means of hydraulic jacks. Steel plate will be made to vibrate, creating energy waves that will travel downwards into the earth's surface. Reflected waves will be received.

Arrangement of cables, geophones and station units will be similar to the arrangement adopted for dynamite. A series of 4 vibrators will follow each other along the line. All 4 vibrators will stop at a point called Vibroseis point, and produce energy waves in the manner described above. With this technique approximately 5-8 km of line can be recorded each day.

2.10 Equipment, Vehicles and Instruments

The equipment to be used during a typical seismic survey program and quantity has been mentioned below:

- GPS receivers
- Survey data processing system
- Differential GPS
- Data loggers
- Energy Source
- Dozers (for line clearing)
- Vibrator trucks (energy source)
- Hand-held pneumatic drills with compressors
- Telemetry recording system
- Recording truck
- Cable station units
- Telemetry cables
- Digital grade geophones
- Wireless geophones
- Geophone strings and nodes
- Portable recording system
- Manual energy source
- Down-hole detectors

Wireless Geophones

Geophone with cable

Hydrophone

Vibrator truck

Figure 2.4: Seismic survey equipment

2.11 Access and mobility

Access to seismic lines will mostly be through existing available tracks. As 4WD vehicles will be used by the project, these tracks can be used without any improvement. Short reaches of new tracks may have to be prepared in rural areas where there is no existing access, however, the preparation of new tracks will be minimized. Project related traffic will consist of vehicles transporting equipment and personnel from campsites to work areas and camp supplies. For seismic surveys, the logistics support generally consists of fuel storage tanker, which generally holds around 8,000 liters of diesel, a water truck and a few light vehicles for food supply.

2.12 Staffing and Supplies

2.12.1 Camps, Staffing and Supplies

Considering the sensitive nature of project area, campsites will not be established in the project area (due to protected areas). Base camp and fly camp will be situated outside the protected area in a land having minimum environmental and social issues.

For explosives storage, a bulk stock of dynamite will be transported to the project area. This will be stored in a purpose-built explosive storage area called Magazine camp which is setup as per international safety standards, located at a safe distance from communities and the seismic camps.

2.12.2 Utilities

Water requirement will be for domestic purpose and for up hole drilling whereas, use of jack robs drilling and Vibroseis operation will not require water.

- Domestic water: Approximately 140,000 liters/day (at the rate of 200 liters per capita per day)
- Mud preparation: 4,000-8,000 liters/up hole

Water will be sourced from existing commercial hydrants at market rates. Water consumption and conservation as per EMP will be managed.

Electricity requirement will be met through self-generation using diesel generators. Two generators of 450kVA power will be utilized for this purpose. Multiple gensets of different capacities will be used as per requirements. Tentative plan is given below.

2.13 Project Alternatives

2.13.1 Business as Usual/No Project Alternative

Seismic surveys for geophysical investigation are necessary to determine the presence of an oil or gas reservoir in the area. Given the benefits to the economy of Pakistan in case of a significant gas discovery, the no project option is not considered a desirable option. Success in exploring and developing another reservoir will increase the local production of hydrocarbon in the country and reducing dependence on imported fuel. This is particularly important since the proposed operation is unlikely to lead to large-scale environmental impacts that may in turn lead to the loss of valuable or irreplaceable ecological resources.

The ‘No-Project’ option, if taken, will prevent the country from exploring the potential to significantly increase its hydrocarbon production especially natural gas. The proposed exploration activities offer a chance to move Pakistan’s energy balance towards the positive side and decrease the demand and supply gap in the country. The ‘No-Project’ option will also prevent creation of

new employment opportunities and infrastructural development in the project area which would result once the project is implemented.

2.13.2 Alternative Project Location and Alignment of Survey Lines

Many national and multinational companies, in addition to public sector organizations, are actively engaged in oil and gas exploration activities in different concession areas and exploration sites in Pakistan. The site for oil and gas exploration is chosen after extensive geological and land surveying, and not every concession area necessarily shows promise.

2.13.3 Technology Options for Data Acquisition

There are two techniques conventionally available for collection of seismic data, Vibroseis and up-holes/shotholes. Selection of the technique depends on many factors including local terrain, land use type, accessibility etc. Vibroseis is generally suitable for terrain with gentle slopes, salt plains and flat sandy areas while shotholes/up-holes is suitable in areas where there is accessibility issues, rough terrain and land use constraints e.g. cultivated land, built-up area, dense vegetation required for land clearing to support truck movement. Up-holes may also be drilled at selected locations within the area of the seismic exploration.

Up-hole/shothole (also known as dynamite method) was extensively used for seismic data collection before the introduction of Vibroseis in the industry. Multiple features of dynamite technique make it a preferred choice for collection of seismic data including low cost and high reliability of the data collected. The only cost involved is the cost associated with the labor required for excavation of up-holes/shot holes for placing the dynamite. The only significant drawback with dynamite is that it cannot be used in populated areas.

Vibroseis technique was introduced in 1961 after which the use of a vibrator as a seismic source has become widespread. The vibrator is a surface source, and emits seismic waves by forcing vibrations of the vibrator baseplate which is kept in tight contact with the earth through a pull-down weight.

2.13.4 Options for Project Schedule

The timing of the operation can be changed on finding of significant impacts associated with the timing of the operation e.g. disturbance to wildlife species during their breeding season and crops harvesting season. The proponent will carefully schedule the project activities with the ultimate objective to create least possible disturbance to the environment and the communities.

3.0 LEGISLATIVE & ADMINISTRATIVE FRAMEWORK

3.1 Introduction

This section provides synopsis of policies, legislation, and guidelines that may have relevance to the project. The proponent of this project will comprehensively follow the relevant and applicable regulatory requirements as described in the national and international guidelines. Relevant guidelines have been incorporated in the mitigation measures and the Environmental Management Plan (EMP) which has been formulated for better environmental management during project implementation.

Being the frontline O&G Company with operations in over 30 countries, MOL Group implements its operations strictly in line with its Health Safety and Environmental Policy. Areas including environmental protection and conservation, process and community safety lie at the core of this policy. MOL Group is committed to ensuring that its technologies, workplace practices, products, and services do not represent hazards to health and put the least possible load on environment. MOL Group, in order to implement its HSE policy, continuously updates its quality-based HSE management system.

3.2 Administrative and Institutional Setup for Environmental Management

Environmental issues are governed by three levels of the government viz. Federal, Provincial and Local Government. After the 18th amendment, the subject of environment is now under the exclusive domain of the provincial government. The main consequences of this change are as follows:

i) The Ministry of Environment at the federal level have been abolished. Its functions related to the national environmental management haves been transferred to the provinces. The international obligations in the context of environment will be managed by various ministries and departments of the federal government,

ii) The Pakistan Environmental Protection Act 1997 (PEPA 1997) is technically no longer applicable to the provinces and is applicable only in the Islamabad Capital Territory. The provinces have enacted their own Environmental Protection Act for enforcement within province.

The Pakistan environmental protection council is the top body formed under the Pakistan Environmental Protection Act, 1997. The council's mandate includes the implementation of the Pakistan Environmental Protection Act, 1997 as well as establishing national policies related to environment and ensuring they've been implemented, approving National Environmental Quality Standards while offering direction on renewable, biodiversity and non-renewable conservation, considering the yearly report on the national environment on top of stopping individuals from contravening the 1997 Pakistan Environmental Protection Act.

The Pakistan Environmental Protection Agency existence is founded within the Pakistan Environmental Protection Council and has a Director General heading it. The Director General is given the authority to establish the advisory committees as required to help him carry out his duties. Section six of the Act, 1997 details the function while the power is clearly put in Section Seven.

The proposed project lies in within the ICT and hence the laws and policies applicable within ICT shall apply to the project.

3.2.1 Role of CDA and MCI

The Capital Development Authority (CDA) has the responsibility for the overall planning, provision and supervision of public health services, covering adequate sanitation and garbage disposal within the territorial limits of the Islamabad Capital Territory (ICT). It also has the responsibility for the coordination of public health services with other relevant agencies. This includes collection, transportation and safe disposal of liquid and solid waste collected from residential areas, commercial areas, open spaces etc.

The CDA operations are governed generally by the provisions of the Islamabad Capital Territory Municipal Bye Laws, 1968 as amended from time to time; and specifically, by the Islamabad Regulations 1979 (Upkeep of Cleanliness) as amended from time to time.

CDA is the custodian of the Rawal Lake and responsible body for its environmental management and protection.

Protecting the Rawal Lake had been a decades-long struggle between urbanization and regulatory enforcement. From time to time, various actions were taken to protect the water quality and sanctity of Rawal Lake. Below is a summary of these measures:

- In 1992, the Islamabad Zoning Regulations were enacted which categorized the area into zone III, thus explicitly forbidding construction in the area.
- In 1995, a task force was appointed by the Pakistan Environment Protection Council to control Lake pollution, which recommended the construction of two sewage treatment plants (STPs) in Noor Pur Shahan and Bani Gala.
- In 1997, The **Pakistan Environmental Protection Act** was passed, requiring all construction projects in the area to submit an Environmental Impact Assessment (EIA) before beginning.
- In 2004, the **Rawal Lake Catchments Monitoring Committee (RLCMC)** was formed under the Ministry of Interior. In its first year, it imposed a **complete ban on motorized boats** to prevent oil contamination.
- In 2010, the Supreme Court took Suo motu notice of the pollution, ordering the CDA to stop raw sewage from Bari Imam and Bani Gala from entering the lake. Later in 2012, the SC closed its initial *suo motu* case by directing federal and Punjab environmental agencies to ensure the water was kept free of contamination.
- In 2013, a **Rawal Lake Monitoring Committee** was formally notified during SC proceedings, including members from CDA, ICT, and WASA.
- In 2017, the **Islamabad High Court (IHC)** banned all construction activity in Bani Gala and directed the CDA to enforce its bylaws strictly.
- In 2018, following a massive fish kill incident, a new **Joint Monitoring Committee** was notified, which comprised of members from ICT Administration, Punjab-EPA, Pak-EPA, PCSIR, PCRWR, and Small Dam Organization Punjab and WASA Rawalpindi. The Supreme Court ordered the government to install **four water treatment plants** immediately. The purpose of the committee formulation was to conduct the water quality monitoring and analysis of the Lake and preparation of joint report. For this purpose, the committee conducts water sampling analysis of Rawal Lake from time to time.

3.3 National Environmental Policies and Plans

3.3.1 National Environmental Policy, 2005

The National Environmental Policy (NEP) was approved by the Pakistan Environmental Protection Council (PEPC) in its 10th meeting on 27th December, 2004 under the chairmanship of the Prime Minister of Pakistan and thereafter approved by the Cabinet on 29th June 2005. NEP is the primary policy of Government of Pakistan that addresses the environmental issues of the country. The broad goal of NEP is, "To protect, conserve and restore Pakistan's environment in order to improve the life quality of the citizens through sustainable development". The NEP identifies a set of sectoral and cross-sectoral guidelines to achieve its goal of sustainable development.

3.3.2 National Environmental Action Plan

The GoP and United Nations Development Program (UNDP) have jointly initiated an umbrella support Program called the NEAP-Support Program that was signed in October 2001 and implemented in 2002. The development objective supported by NEAP-Support Program is environmental sustainability and poverty reduction in the context of economic growth. The objectives of new policy have total 171 guidelines on sectoral and cross sectoral issues. The objectives of new policy include assurance of sustainable development and safeguard of natural wealth of country. The following are the approved Sectoral Guidelines:

- Water Supply and Management
- Air Quality and Noise
- Waste Management
- Forestry
- Biodiversity and Protected Areas
- Climate Change and Ozone Depletion
- Energy Efficiency and Renewable
- Agriculture and Livestock
- Multilateral Environmental Agreements

3.3.3 National Water Policy

The National Water Policy (NWP) approved in 2018 emphasizes on water management through conservation and provides guidelines for effective planning to manage existing water resources. Pakistan's critical water situation demands an appropriate water conservation strategy that may help in optimizing water usage; reducing wastage of this precious resource and satisfy all users and demands equitably. The NWP states "Efficiency and conservation will be promoted at all levels". Accordingly, water conservation needs to be a central part of all process of planning, development and management of water resources. Management of water resources is vital during the project execution to conserve water resources. The objectives of the National Water Policy (2018) are focused on a set of principles that aim to promote the greater national interest and welfare of the people of Pakistan. In addition, the National Water Policy (NWP) has also identified strategic priorities of critical importance to the water, energy and food security of Pakistan, including, storage, conservation and efficiency, leveraging technology, renewable energy, integrated water resource management, comprehensive regulatory framework, and planning principles.

3.3.4 National Water Conservation Strategy

The National Water Conservation Strategy provides specific plans to achieve the goals set by the NWP, focusing on implementation, efficiency, and demand-supply balance, in Pakistan.

The National Water Conservation Strategy closely aligns with UN Sustainable Development Goals 2015 agreed by countries as Agenda 2030 for sustainable development such as; Goal 6 (clean water and sanitation), Goal 10 (reducing inequalities), Goal 11 (sustainable cities and communities), Goal 12 (responsible production and consumption), Goal 13 (climate action), Goal 14 (life below water), Goal 15 (life on land), Goal 16 (peace, justice, strong institutions) and Goal 17 (partnerships). This indicates worth of water conservation and its impact on multiple dimensions of sustainable development.

3.3.5 The Biodiversity Action Plan, 2000

Pakistan is a signatory to the Convention on Biological Diversity, and hence obligated to develop a national strategy for the conservation of biodiversity. The Government of Pakistan constituted a Biodiversity Working Group, under the auspices of the Ministry of Environment, to develop a Biodiversity Action Plan for the country, which was completed after an extensive consultative exercise. The plan, which has been designed to complement the NCS and the proposed provincial conservation strategies, identifies the causes of biodiversity loss in Pakistan and suggests a series of proposals for action to conserve biodiversity in the country.

The Pakistan Environmental Protection Council (PEPC) has approved the action plan and steering committees at federal and provincial levels have been formed to implement it. Developing the Biodiversity Action Plan for Pakistan, 2000 has been the most significant direct steps towards addressing the biodiversity loss.

3.3.6 National Climate Change Policy, Updated 2021

The National Climate Change Policy (NCCP) of Pakistan, first approved in 2012 and updated in 2021, serves as a comprehensive framework to address the challenges posed by climate change in the country. Recognizing Pakistan's high vulnerability to climate change impacts, the policy primarily focuses on climate-resilient development and adaptation, while also addressing mitigation efforts to the extent possible. The policy goal is to mainstream climate change considerations into the economically and socially vulnerable sectors and steer Pakistan towards climate-resilient development. The updated policy (2021) also emphasizes a transition towards climate-compatible development. The Policy also indicates that the government aims to decarbonize the economy, aiming for 60% clean energy by 2030, which affects the expansion and operational approvals for fossil fuel projects.

Acknowledging the climate change vulnerabilities and its responsibilities as a prominent O&G operator, MOL implements its HSE policy which focuses on environmental conservation and activities that contribute to climate change adaptation and resilience e.g. afforestation/reforestation, flaring reduction, and methane leak detection etc. The prime objective is to integrate sustainability into its core operations and strengthen climate resilience in Pakistan.

3.4 National Environmental Legislations

3.4.1 Pakistan Environmental Protection Act, 1997

The Pakistan Environmental Protection Act, 1997 (PEPA) is the fundamental legislation pertaining to environmental management in Pakistan. It is broadly applicable to air, water, soil, marine and noise pollution, as well as to the handling of hazardous waste. It empowers the government to formulate regulations for protecting the environment. Penalties have been prescribed for those contravening the provisions of the Act. In addition, the EPAs have been empowered to conduct

inquiries into possible breaches of environmental law either upon the registration of a complaint or on their own accord. Some key provisions of the Act include:

- Prohibition of emission or discharge of noise, waste, air, or effluent that flout the NEQS.
- Filing with EPA, a report on environmental assessment as per the area's sensitivity or indicating where the projects impact would be on the environment.
- Prohibition of waste disposal in on highways, public land or local council administered or owned land, unless it is according to the Act, 1997.
- Prohibition on import of lethal waste as described in the Act, 1997.

After the 18th Amendment, the PEPA, 1997 has limited application to projects falling in the ICT jurisdiction and those located offshore beyond the provincial maritime jurisdiction.

3.4.2 Pakistan Penal Code, 1860

Section XIV of PPC deals with the offences affecting the public health, safety, convenience, decency and morals. Person may be guilty of public nuisance if his act or omission causes common injury, danger or annoyance to the public or results in spread of infection of diseases dangerous to life. The section also deals with environmental pollution.

Provisions under this Act relating to environment are no longer being enforced after promulgation of the environmental Protection Act, 1997. However, pollution offences can still be tried under the Pakistan Penal Code, 1860.

3.4.3 Hazardous Substances Rules, 2003

The Hazardous Substances Rules, 2003 call for the safe handling, storage, transportation, use, and disposal of hazardous substances to prevent adverse impacts on human health and the environment. Explosives used during the project, including dynamite and detonators for seismic activities, fall within the definition of hazardous substances due to their reactive, flammable, and potentially toxic nature. Under these Rules, the project proponent is required to ensure that explosive materials are stored in approved, clearly marked, and secure magazines located away from public access, water bodies, and environmentally sensitive areas. The Rules also require the preparation and implementation of safety procedures, emergency response plans, and training of personnel involved in handling explosives. During usage, explosives must be handled by trained and authorized staff, with measures in place to prevent accidental detonation, spillage, or environmental contamination. Compliance with the Hazardous Substances Rules, 2003 is therefore essential to minimize risks to workers, the public, and the surrounding environment during seismic activities involving explosive materials.

3.4.4 The Explosives Substances Act, 1908

This Act prevents the unlawful manufacture, possession, use, sale, transport, and import of explosive substances. The Act defines explosive substances broadly and prescribes strict penalties, including imprisonment and fines, for acts intended to endanger life, cause serious damage to property, or disrupt public safety. It empowers law-enforcement agencies to investigate, search, and prosecute offences related to explosives and places the burden of proof on the accused in certain cases. The Act is primarily aimed at safeguarding public security and maintaining law and order by regulating and controlling activities involving explosive materials.

Use of dynamite during the seismic activities requires its careful possession, transport, storage, and detonation as per the law. The law also requires to obtain authorization from the competent

authorities, to ensure that explosives are handled only by licensed personnel, and used strictly for approved purposes.

3.4.5 Antiquities Act, 1975

The Antiquities Act of 1976 ensures the protection of cultural resources in Pakistan. The Act is designed to protect antiquities from destruction, theft, negligence, unlawful excavation, trade, and export. Antiquities have been defined in the Act as ancient products of human activity, historical sites, or sites of anthropological, military or scientific interest, and empowers the Government of Pakistan to prohibit excavation in any area that may contain such articles of archaeological significance.

This act is designed to protect these antiquities from destruction, theft, negligence, unlawful excavation, trade, and export. The law prohibits new construction in the proximity of a protected antiquity and empowers the Government of Pakistan to prohibit excavation in any area that may contain articles of archaeological significance. Under this act, the project proponent is obligated to:

- Ensure that no activity is undertaken in the proximity (i.e. on, or within a distance of two hundred feet of a protected immovable antiquity, or with an approval from the concerned department
- Report to the Department of Archaeology, Government of Pakistan, any archaeological discovery made during the course of the project.

3.4.6 The Forest Act 1927

The Forest Act, 1927 empowers the Government to declare any forest area reserved or protected. The act also empowers the government to prohibit the clearing of forests for cultivation, grazing, hunting, removing forest produce, quarrying, felling, and lopping. Other offences punishable under the Act include land clearing, kindling, keeping or carrying fire, tree cutting, damage to plantation, quarries, construction of building or other structure, removal of soil or damage to the soil, water, natural vegetation (shrubs, herbs and plants), fish, wild animals and wild birds etc. in a forest.

The Rawal Lake being part of the MHNP requires careful execution of project as per the provisions of the forest act including any ground works and data collection activities that can affect soil and subsoil, flora, fauna and local ecosystems.

3.4.7 Pakistan Climate Change Act, 2017

Federal Cabinet of Government of Pakistan approved the Pakistan Climate Change Act 2016 in November. It was enacted in 2017 after it was passed by the National Assembly. Consequent to the Act, three relevant institutions have been setup namely Pakistan Climate Change Council, Pakistan Climate Change Authority, and Pakistan Climate Change Fund.

The Act is the primary federal legislation designed to address environmental threats through adaptation and mitigation strategies, extending across the country. The Act calls to integrate the necessary climate change considerations into long-term planning, specifically in sectors like water, agriculture, and forestry. The Act also calls for reducing current and future emissions and enhancing potential sinks for greenhouse gases via the climate change authority whose function will be to work in collaboration with relevant Government Agencies and nongovernmental organizations and (after the conduct of relevant research and studies), set targets and coordinate actions for the reduction of greenhouse gas emissions and development of carbon markets.

The Act requires that project activities are planned and executed in a manner that contribute to reduction and mitigation of GHG emissions by adopting latest technologies.

3.5 Laws and Regulations applicable in ICT

3.5.1 Islamabad Nature Conservation and Wildlife Management Act, 2024

The law was enacted on August 27, 2024 and addresses the management of Margalla Hills National Park and restructures the Islamabad Wildlife Board (IWMB) to improve its function. The Act aims at protecting, preserving, and managing biodiversity within the Islamabad Capital Territory (ICT). The Act elevates the IWMB from a consultative body to a properly empowered regulatory authority. It enables the board to generate its own revenue, enforce stricter penalties for environmental violations, and protect biodiversity within the ICT. It imposes strict fines and penalties for illegal activities including illegal hunting, habitat destruction, and illegal wildlife trade, prohibits keeping wild animals and exotic species as pets in the capital.

The law prohibits activities that harm wildlife or their habitats, such as hunting, killing, capturing, or injuring protected species, damaging or removing vegetation, altering land use through clearing, excavation or development, and introducing invasive species without authorization. These prohibitions are intended to safeguard ecological balance, maintain habitat integrity, and ensure the long-term sustainability of natural areas within the Territory, including legally designated protected areas.

All activities of project need to be aligned with the requirements of the Act including site preparation, data collection, restoration and waste management Seismic operations, particularly those involving ground disturbance, vehicular movement, drilling, use of explosives, or clearing of vegetation could potentially contravene prohibitions in the Act if they lead to habitat disturbance, wildlife disruption, or land alteration in protected zones unless expressly authorized by the Board. Therefore, the current IEE must assess the potential impacts of seismic activities on these protected areas, demonstrate compliance with the Act's requirements, and include mitigation measures and approvals to ensure that project implementation does not violate the Act's conservation objectives or prohibited activity clauses.

3.5.2 Islamabad Capital Territory Local Government Act, 2015

This Act is expedient to establish an elected local government system to devolve political, administrative and financial responsibility and authority to the elected representatives of the local governments; to promote good governance, effective delivery of services and transparent decision making through institutionalized participation of the people at local level; and, to deal with ancillary matters.

3.5.3 Islamabad Capital Territory (Zoning) Regulation, 2005

For administration and land use characterization, through this regulation, the Islamabad Capital territory has been divided into following five zones:

Zone-1: This zone constitutes sectors up to the existing alignment of the G.T. road from the point of intersection of G.T. road with Shah rah-e-Kashmir to the point of the Nicolson Monument inclusive of sector H-14, H-15, H-16, H-17, I-14, I-15, I-16, I- 17.

Zone -2: The zone consists of an area bounded by G.T. road in the north &north east, north of Shah rah-e-Kashmir and Capital limits in the west, comprising residential sectors G-15 (part), G-16, G-17, F-15 (part), F-16, F-17, E-15 (part), E-16, E-17, D-16, D-17, C-17, AND B-17.

Zone -3: Margalla Hills National Park as notified under section 21 of the Islamabad Wildlife (Protection, Preservation, and Conservation& Management) Ordinance 1979, other protected

ranges, forest areas and un- acquired land falling between the Margalla Hills & north of Murree Road shall constitute this zone.

Zone-4: This zone comprises Islamabad Park and rural periphery wedged between Murree Road towards north and Lehtrar road towards south and extending beyond Simly road up to the ICT limits in the north east. This zone excludes the part of Margalla Hills National Park and Rawal Lake.

Zone-5: This zone comprises areas falling south of Islamabad Park and extending up to outer limits of ICT towards south, south west and south east.

The Margalla Block spans a large part of ICT comprising most or all portion of the five zones except zone 5, of which a relatively small portion falls in Margalla Block.

3.6 Laws, Regulations, Policies on Oil and Gas Exploration and Production

3.6.1 Petroleum Exploration and Production Policy, 2012

The purpose of this Petroleum Exploration and Production policy, 2012 is to establish the policies procedures, tax and pricing regime in respect of petroleum exploration and production (E&P) sector. The principal objectives of this Policy are:

- To accelerate E&P activities in Pakistan with a view to achieve maximum self – sufficiency in energy by increasing oil and gas production.
- To promote direct foreign investment in Pakistan by increasing the competitiveness of its terms of investment in the upstream sector.
- To promote the involvement of Pakistani oil and gas companies in the country's upstream investment opportunities.
- To train the Pakistani professionals in E&P sector to international standards and create favorable conditions for their retaining within the country.
- To promote increased E&P activity in the onshore frontier areas by providing globally competitive incentives.
- To enable a more proactive management of resources though establishment of a strengthened Directorate General of Petroleum Concessions (DGPC) and providing the necessary control and procedures to enhance the effective management of Pakistan's petroleum reserves.
- To ensure the energy secure of the country by enhancing domestic exploration.
- To decrease reliance on imported energy by providing additional incentives to exploration and production companies for enhancing indigenous production.
- To undertake exploitation of oil and gas resources in a socially, economically and environmentally sustainable and responsible manner.

3.6.2 The Pakistan Onshore Petroleum (Exploration & Production) Rules, 2013

These rules contain provisions related to reconnaissance surveys; license for petroleum exploration, lease for petroleum development and production; accounts, records, inspection, reports; and, miscellaneous matters. The rules allow any company incorporated inside or outside Pakistan to apply for reconnaissance permit, exploration license or a development and production lease. The manner in which application may be made has also been prescribed i.e. in writing, mentioning principal place of business of applicant, furnishing of guarantee and deposit of fees etc. The petroleum right, if not exercised within three months, shall lapse. Every permit, license or lease shall

be subject to terms and conditions mentioned in these rules included in second schedule and any other conditions which Government may deem fit to insert.

The rules require the lease or license holder shall maintain safety in operations including non-interference with navigation, fisheries and agriculture. All reasonable precautions shall be taken to prevent pollution or accumulation of trash and to prevent damage to the environment and surroundings. Pakistani goods and services should be used subject to their quality, employment and training of Pakistani personnel to develop the capability should be ensured. Indemnity and force majeure have also been provided.

3.7 National Environmental Assessment Guidelines

3.7.1 Pakistan Environmental Assessment Procedures

EPA has prepared a set of guidelines for conducting environmental and social assessments. The guidelines derive from much of the existing work done by international donor agencies and NGOs. The package of regulations, of which the environmental and social guidelines form a part, includes the PEPA 1997 and the NEQS. The package of regulations prepared by PEPA with relevance to this IEE includes:

- Policy and Procedures for Filing, Review and Approval of Environmental Assessments;
- Guidelines for the Preparation and Review of Environmental Reports;
- Sectoral Guidelines for Environmental Reports-Oil and Gas Exploration and Production
- Guidelines for Public Consultation

3.7.2 Policy and procedures for filing, review and approval of environmental assessments

These guidelines define the policy context and the administrative procedures that will govern the environmental assessment process, from the project pre-feasibility stage, to the approval of the environmental report. According to the procedures laid out in the policy guidelines, IEE's or EIA's are to be filed with the EPA of the province where the project is to be implemented. The PEPA has, however, been given the right to review any environmental report at any time and the power to revoke the decision of the provincial EPA, if it deems this to be necessary. Projects have been classified in the policy guidelines by expected degree of adverse environmental impacts.

3.7.3 Guidelines for the preparation and review of environmental reports

It requires proponents to prepare terms of reference for the environmental assessment reports. It requires that all studies should contain baseline data on the area and must contain an assessment of the potential environmental impacts and the recommended mitigation measures.

3.7.4 Guidelines for public consultation

These guidelines are intended to provide assistance throughout the environmental assessment of project by involving the public which can lead to better and more acceptable decision-making. Public involvement, undertaken in a positive manner and supported by a real desire to use the information gained to improve the proposal, will lead to better outcomes, and lay the basis for ongoing positive relationships between the participants.

3.7.5 Pakistan EPA (Review of IEE/EIA) Regulations 2000

The IEE/EIA Regulations 2000 provide the necessary details on the preparation, submission, and review of the IEE and the EIA. Categorization of projects for IEE and EIA is one of the main

components of the IEE/ EIA Regulations 2000. Projects have been classified on the basis of expected degree of adverse environmental impact. Project types listed in Schedule II of the regulations are designated as potentially seriously damaging to the environment and require an EIA, whereas those listed in Schedule I as having potentially less adverse effects and require an IEE. But all projects located in environmentally sensitive areas would require an EIA (section 22). In accordance of the IEE-EIA Regulations 2000 the proposed project falls in Schedule II requiring an EIA due to sensitive location.

3.7.6 National Environmental Quality Standards (NEQS)

The NEQS are uniform standards applicable to all kind of industrial and municipal effluents. Different Parameters are set showing permissible levels of pollutants in liquid effluents and gaseous emissions. These were first promulgated in 1993 and were last revised in 2000. To enforce NEQS, Government has been empowered to levy a pollution charge. For liquid effluents, there are 32 parameters showing permissible level of pollutants before its discharge into sea, inland water & sewage. And, for gaseous emissions, there are 16 parameters.

3.7.7 Sectoral Guidelines for Environmental Reports – Oil and Gas Exploration and Production

These guidelines identify and explain issues that should be addressed for a proposal involving exploration for or production of oil and gas. It is important to focus on key issues for specific proposals. The matters identified in this guideline should provide guidance for the preparation and assessment of most exploration and production proposals. It is intended that Companies involved in Oil and Gas Exploration and Production will self-regulate and undertake monitoring to meet or exceed the provisions of the Package and these sectorial guidelines; the Responsible Authority reserves the right to spot check field operations from time to time.

3.7.8 Guidelines for Operational Health, Safety and Environmental Management, 1996

These guidelines are the outcome of a study commissioned by the Directorate General Petroleum Blocks, Ministry of Petroleum and Natural Resources, Government of Pakistan. The guidelines list down the relevant laws related to the operational health, safety and environmental management and also recommends environmental controls and management practices to be adopted in Oil & Gas exploration projects. These guidelines are extensive and fully supportive of the Environmental Protection Act of 1997.

3.7.9 PPEPCA guidelines for Upstream Oil and Gas Exploration

These guidelines have been prepared to assist the industry and the practitioners in meeting these challenges. The need for the development of these guidelines was felt by the industry few years back when the industry sectoral guidelines prepared by the Federal EPA were found to be insufficient. The present new guidelines are based on previous work by international industry associations, donor agencies, non-government organizations, and statutory bodies and national experiences. The guidelines have been divided into 4 parts for clarity and ease of use.

3.8 International Treaties and Guidelines

3.8.1 The Convention on Biological Diversity

The Convention on Biological Diversity was adopted during the Earth Summit of 1992 at Rio de Janeiro. The Convention requires parties to develop national plans for the conservation and

sustainable use of biodiversity, and to integrate these plans into national development programs and policies. Parties are also required to identify components of biodiversity that are important for conservation, and to develop systems to monitor the use of such components with a view to promoting their sustainable use.

3.8.2 Ramsar Convention

Ramsar Convention on Wetlands (1971) is the principal international treaty for the conservation and wise use of wetlands. Pakistan has been a Contracting Party since 1976 and is therefore obligated to promote the wise use of all wetlands within its territory, irrespective of whether they are formally designated as Ramsar Sites. The Convention requires integration of wetland conservation into national planning, prevention of degradation of wetland ecological character, and adoption of precautionary and ecosystem-based management approaches.

While Rawal Lake is not designated as a Ramsar Wetland of International Importance, it qualifies as a significant freshwater wetland and water reservoir. Due to its importance as water resource and support for local ecosystem, the Ramsar Convention's principles and obligations remain applicable as an international best-practice to seek guidance on planning, environmental management of activities in and around the lake. The articles 3.1, 3.2 and 4.1 provide guidance for management of project activities which are summarized below:

- Activities must avoid degradation of ecological character
- Baseline should assess the ecosystem, environmental quality (water, air, noise etc.) and provide benchmark for monitoring
- Maintenance of buffer zones
- Ensuring pollution prevention

3.8.3 IUCN Red List

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

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

3.8.4 World Bank Guidelines on Environment

The principal World Bank publications that contain environmental guidelines are listed below.

- Environmental Assessment-Operational Policy 4.01. Washington, DC, USA. World Bank 1999.
- Environmental Assessment Sourcebook, Volume I: Policies, Procedures, and Cross-Sectoral Issues. World Bank Technical Paper Number 139, Environment Department, the World Bank, 1991,

- Environmental Assessment Sourcebook, Volume III: Guidelines for Environmental Assessment of Energy and Industry Projects. World Bank Technical Paper No. 154, Environment Department, the World Bank, 1991.
- Pollution Prevention and Abatement Handbook: Towards Cleaner Production, Environment Department, the World Bank, United Nations Industrial Development Organization and the United Nations Environment Program, 1998.

The first two publications listed here provide general guidelines for the conduct of an IEE/EIA, and address the IEE/EIA practitioners themselves as well as project designers. While the Sourcebook in particular has been designed for the Bank projects, and is especially relevant for the impact assessment of large-scale infrastructure projects. It contains enormous information which is useful to environmentalists and project proponents. The Sourcebook dealing with the assessment of industry and energy projects is more specific. The Pollution Hand book provides general waste management policies with specific techniques for the prevention of air and water pollution. Project guidelines are presented for major pollutants as well as typical emissions from various industrial sectors.

3.8.5 IFC EHS guidelines for Onshore Oil and Gas Development

The Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP). These industry sector EHS guidelines are designed to be used together with the General EHS Guidelines document, which provides guidance to users on common EHS issues potentially applicable to all industry sectors. For complex projects, use of multiple industry-sector guidelines may be necessary. The EHS Guidelines contain the performance levels and measures that are generally considered to be achievable in new facilities by existing technology at reasonable costs. Application of the EHS Guidelines to existing facilities may involve the establishment of site-specific targets, with an appropriate timetable for achieving them.

The EHS Guidelines for Onshore Oil and Gas Development include information relevant to seismic surveys, exploration and production drilling, development and production activities, transport activities including flow lines and pipelines, other facilities including pump stations, metering stations, pigging stations, compressor stations and storage facilities, ancillary and support operations, and decommissioning. For onshore oil and gas facilities located near the coast (e.g., coastal terminals marine supply bases, loading/offloading terminals).

3.8.6 IAGC Environmental Manual for Geophysical Operations

This environmental manual has been produced for seismic surveys. These include the sections on access roads, base camps, hazardous materials, and operations in desert and semi-arid climatic conditions.

The manual provides comprehensive, industry-standard guidelines for conducting land and marine seismic surveys in an environmentally responsible manner. It focuses on minimizing impacts through proactive planning, site-specific mitigation strategies for sensitive habitats (arctic, rainforests, wetlands), and regulatory compliance. It also provides specific, actionable techniques to minimize impact, including proper handling of waste, minimizing vegetation clearing on land, and reducing sound impacts on marine life.

Reference has been made to the guidelines provided in the manual as well as other relevant guidelines while devising mitigation strategies for the potential impacts from the seismic survey activities.

4.0 ENVIRONMENTAL & SOCIAL BASELINE

4.1. General

This section provides a detailed environmental and social baseline profile of the project area where the proposed project will be undertaken. The information presented in this section covers:

- Physical Environment
- Ecological Environment
- Socioeconomic Environment

Information for the above areas has been collected from both primary and secondary sources. Secondary data includes maps prepared by the Geological survey of Pakistan, Soil survey of Pakistan, published literature; Census Reports etc. Primary data was collected through field surveys, onsite environmental monitoring and discussions with the MOL team regarding site activities.

The baseline information of the project area is required for identification and assessment of potential social and environmental impacts associated with the implementation of the project. On the basis of baseline information, the project interventions would be addressed and mitigation measures proposed. The baseline information also helps to indicate the specific issues to be monitored during project execution as well as during operational phase.

4.2. Methodology for baseline data collection

Data used to compile this section was obtained from previous environmental reports[3], published literature and field survey. Published literature was used in describing all aspects of the environment, more extensively for some aspects than for others. It was used extensively for the sections on soil, climate, water resources, wildlife, vegetation and air quality. A list of references appears at the end of this report.

Information on geomorphology, drainage, water resources, settlement locations, agricultural land and access roads was also obtained from the online mapping services, Atlas of Pakistan and Geological Survey of Pakistan 1:200,000 geological maps of the area.

Field surveys were conducted to collect primary data for this study. A team consisting of environmentalists, and biologists, visited the project area to collect the data. Surveys were held as per following schedule:

- Physical Environment Survey: 8th Dec, 2025.
- Ecological survey: 13th till 23rd Jan, 2026 (in phases)
- Social survey: 9th Jan, 2026

4.3. Project Area

The area where the project components will be located, where the project activities are expected to take place and where the proposed activities' environmental impact is expected to occur, has been referred to as the 'project area'. The project area thus comprises the Rawal Lake and its catchment area selected over 27.8 square kilometers. For features like geology, and seismicity, the entire area of Federal capital has been taken as reference area.

[3] IEE for Drilling of Tarnol-1 exploratory well in Margalla Block, 2021, IEE for 2D Seismic Survey in Margalla Block, 2016, EIA of 2D Seismic Survey in Sensitive Areas of Margalla and Margalla North Blocks, 2008, 2D Seismic Survey in Non-Sensitive Areas of Margalla and Margalla North Blocks, 2008

4.4. Physical Environment

4.4.1. Geology

The Rawal Lake area lies within the geological setting of the Margalla Hills, which form part of the Lesser Himalayan fold-and-thrust belt. The region is characterized by folded and faulted sedimentary rock sequences ranging in age from the Jurassic to the Eocene. These rocks are well exposed in the surrounding Margalla Hills and extend into the Rawal Lake catchment area.

The geology of the Rawal Lake area is dominated by limestone, shale, marl, and sandstone formations. Prominent lithological units include the Jurassic–Cretaceous limestone and shale sequences, overlain by Paleocene to Eocene sedimentary rocks. The limestone formations are extensively jointed and fractured, giving rise to rugged topography and playing an important role in groundwater recharge and surface runoff patterns feeding the lake.

Structurally, the area is affected by major folds and thrust faults associated with the Himalayan orogeny. The regional strike of the rock formations is generally east–west to northeast–southwest, which coincides with the alignment of the Margalla Hills. Anticlinal and synclinal folds are common, and the strata are often steeply dipping due to compressional tectonics. Several local faults and fracture zones influence slope stability and drainage patterns within the Rawal Lake catchment.

Quaternary alluvial deposits are present along the lower reaches of streams and in the valley floors surrounding the lake. These deposits consist of unconsolidated sand, silt, gravel, and clay, derived from the weathering and erosion of the surrounding hills. The alluvium supports limited agriculture and settlement and forms an important component of the Rawal Lake watershed.

4.4.2. Topography

Rawal Lake is situated in a valley formed by the surrounding Margalla Hills, which are part of the lesser Himalayan foothills. These hills rise sharply around the lake, creating a natural catchment area for rainwater and seasonal streams that feed into the reservoir. The Margalla Hills in this region are characterized by rugged terrain with rocky outcrops and moderate forest cover, including shrubs and scattered trees. To the south and southwest of the lake, the land gradually transitions into relatively flat plains, forming part of the Islamabad urban and peri-urban areas. The general slope of the terrain is from the north and northeast toward the southwest, allowing streams to drain into the Rawal Lake.

Several small streams and nullahs originate in the surrounding hills, contributing to the lake's water inflow. The northern and eastern sides of the lake are dominated by hilly and undulating terrain, whereas the southern and western sides are comparatively flatter. The combination of hills, valleys, and plains in the lake's catchment area plays a significant role in the topography and hydrology of Rawal Lake.

4.4.3. Seismic Vulnerability

Islamabad is on the south margin and leading edge of the Hazara fault zone. All the faults, except those to the south of Rawalpindi, are part of this fault zone. This zone consists of an arc of thrusted and folded rocks about 25 km wide and 150 km long that is convex to the south and extends west-southwestward away from the Himalayan syntaxis. More than 20 individual thrust sheets have been identified across the 25-km-wide zone north of Islamabad, but only 5 major thrusts lie within the area. In the Islamabad area, some of the thrust faults are slightly oblique to the front of the Margalla Hills; hence, they project west-southwestward beneath the cover of the piedmont fold belt. The extensions of these faults are prominent north of Fateh Jang, 25 km west of Rawalpindi, where they form the south margin of the Kala Chitta Range, which is an echelon extension of the structural pattern of the Margalla Hills.

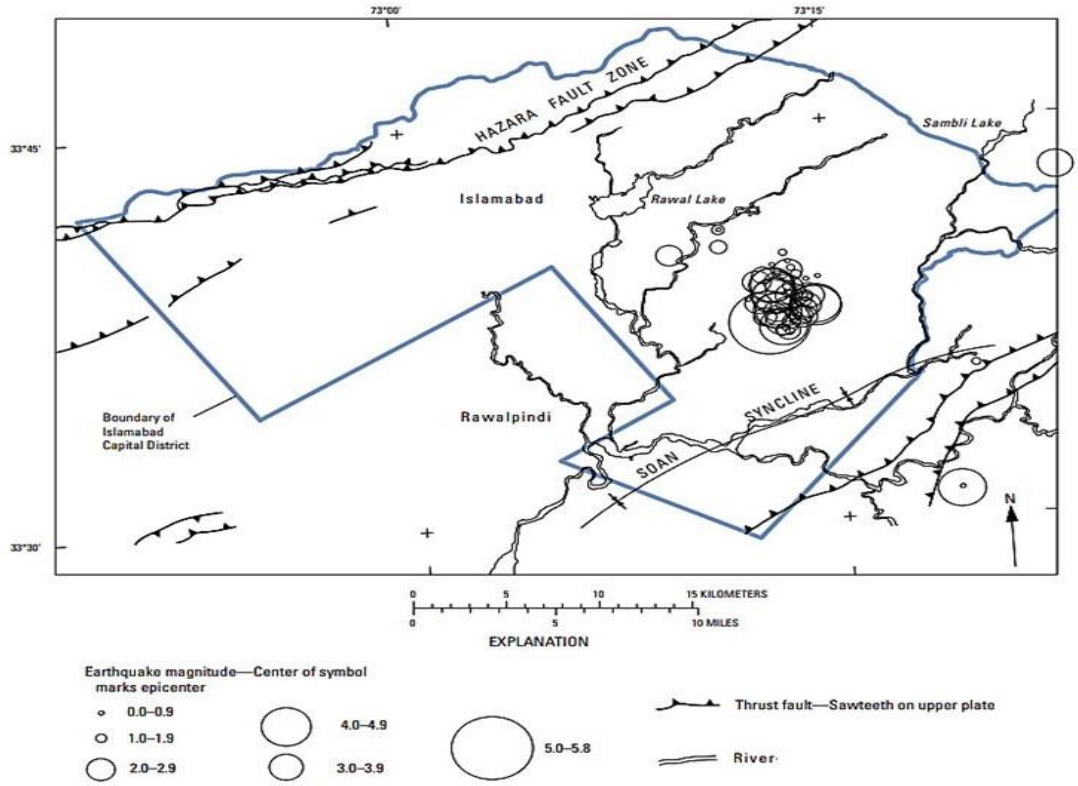

Figure: 4.1: Potentially active faults in the Islamabad-Rawalpindi area. (Centers of circles are epicenters, and radii of circles are proportional to magnitude, Source: Geological survey of Pakistan)

The thrust and fold structure of the Margalla Hills immediately north of Islamabad is complex. The Margalla Hills consist of at least five principal thrust sheets that repeat the pre-Miocene marine section. The structurally lowest sheet dips generally northward at about 30°, and the higher thrust sheets dip progressively more steeply, so that the northernmost and structurally highest are overturned and dip southward at about 85°. The thrusts have most commonly broken through the beds within or just beneath the Samana Suk Formation, although almost all pre-Miocene units are cut at some place in the study area. Higher in the section, thrusts are common at the base of the Margalla Hill Limestone (probably within the shale of the Patala Formation) and within the overlying Chorgali Formation.

Piedmont Fold Belt

The faults and folds in the piedmont fold belt south of the mountain front probably have high potential activity, although definitive exposures are sparse and discontinuous. The Pleistocene Lei Conglomerate, overlying the sandstone of the Murree Formation (lower Miocene), is folded in the broad anticline at Shakar Parian Park in Islamabad. The Lei Conglomerate also is tilted 80° southward along a thrust fault in the Kuldana Formation (lower Eocene) north of Golra, about 17 km northwest of Rawalpindi. The fault at Golra may be an eastward projection of the southward overthrusting of the mountain front along the south face of the Kala Chitta Range, a major range that begins about 25 km west of Rawalpindi and extends westward south of the Margalla Hills. Major faults bounding the Khalri Murat Range, about 15 km south of the Kala Chitta Range, may also extend northeastward toward Rawalpindi, concealed beneath Quaternary eolian and alluvial deposits.

Seismic Hazard Level

The Islamabad-Rawalpindi area lies in a tectonically active zone, where faulting, folding, and earthquakes have been recurrent in the recent geologic past. According to Building Codes for Pakistan, the project area falls in Zone 2B which corresponds to peak ground acceleration of 0.16 to 0.24g. Studies by National Engineering Services of Pakistan (NESPAK) indicated that a realistic seismic factor.

4.4.4. Soil

The soils in the project area are generally well-drained but are prone to erosion, especially on exposed slopes with sparse vegetation cover. This erosive nature contributes to sediment inflow into Rawal Lake during monsoon rainfall. The soils are closely linked to the underlying limestone and shale formations of the Margalla Hills. The dominant soil types are shallow, stony, and calcareous in nature, developed mainly from weathered limestone and marl. These soils are generally classified as Lithosols, particularly on the hill slopes surrounding the lake, where soil depth is limited due to steep gradients and active erosion. In relatively flat and sheltered areas, such as valley floors and gentle slopes, deeper loamy and silty soils are present. These soils have developed from weathered shale and alluvial deposits and are moderately fertile, supporting limited agriculture and vegetation. Along stream courses and near the lake margins, recent alluvial soils consisting of sand, silt, and clay are found.

4.4.5. Climate

Islamabad is located on the northern edge of the Potohar Plateau and exhibits weather patterns characteristic of the Plateau, a semi-arid to sub-humid continental climate characterized by extreme temperatures, with hot summers (up to 40°C) and cold, mild winters (dropping to 5°C). The area receives significant monsoon rainfall from July to September and light winter rain from western disturbances, largely supporting rain-fed ("barani") agriculture. Generally, there are two significant yet variable rainfall periods, the summer monsoon, and winter precipitation from December to March, which is crucial for the agricultural season. Data from Islamabad Meteorological Station is representative of the climate of the project area.

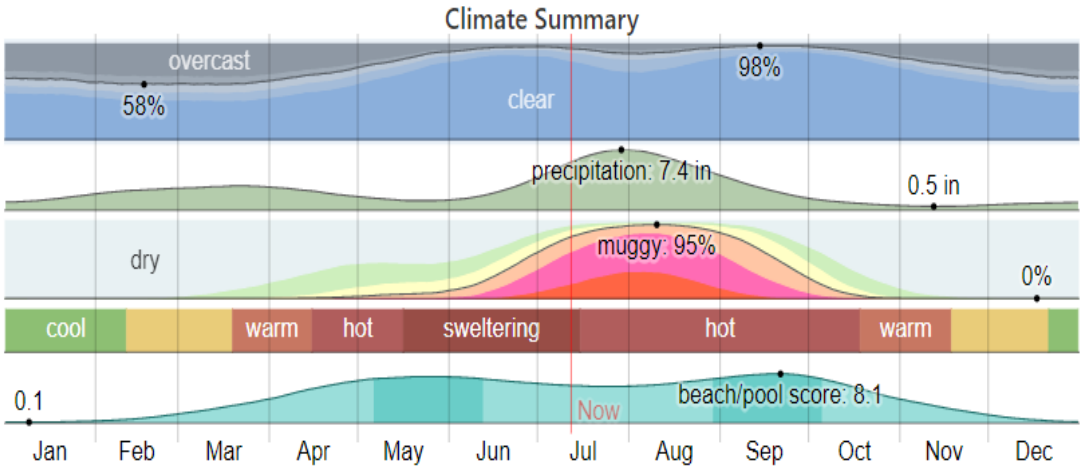

Figure 4.2: Climate Summary of Islamabad [4]

4.4.5.1. Temperature

The hot season lasts for 3.0 months, from May 5 to August 5, with an average daily high temperature above 92°F. The hottest day of the year is June 12, with an average high of 100°F and low of 75°F. The

[4] https://www.worldweatheronline.com

cool season lasts for 2.9 months, from December 4 to March 1, with an average daily high temperature below 69°F. The coldest day of the year is January 9, with an average low of 38°F and high of 62°F.

4.4.5.2. Rainfall

To show variation within the months and not just the monthly totals, we show the rainfall accumulated over a sliding 31-day period centered around each day of the year. Islamabad experiences extreme seasonal variation in monthly rainfall. The rainy period of the year lasts for 12 months, from November 20 to November 7, with a sliding 31-day rainfall of at least 0.5 inches.

4.4.5.3. Wind speed and direction

The wind experienced at any given location is highly dependent on local topography and other factors, and instantaneous wind speed and direction vary more widely than hourly averages. The average hourly wind speed in Islamabad experiences mild seasonal variation over the course of the year. The predominant average hourly wind direction in Islamabad varies throughout the year. The wind is most often from the west for 2.1 months, from April 22 to June 26, with a peak percentage of 35% on June 11.

4.4.6. Land use and Land Cover

The area around Rawal Lake also includes urban and semi-urban settlements, particularly toward the south and southwest, which are part of Islamabad city. Agriculture in the vicinity is mostly small-scale and rainfed, supplemented by water from local streams and the lake itself in some areas. Forest cover is concentrated in the Margalla Hills, providing an important green buffer that supports biodiversity, stabilizes slopes, and maintains the hydrology of the lake. The catchment's natural scrubland, forested hills, and urban interfaces together define the land cover distribution around Rawal Lake. The detailed land-use statistics for Islamabad Capital Territory is presented in Table 4.1 below.

Table 4.1: Land Use / Land Cover Distribution (2019–2022)[5]

	2019		2020		2021		2022	
Classes	**Area (Ha)**	**%**	**Area (Ha)**	**%**	**Area (Ha)**	**%**	**Area (Ha)**	**%**
Water	964.09	0.98	1,019.82	1.03	877.00	0.89	888.14	0.90
Vegetation	42,290.09	42.98	43,255.69	43.97	38,318.14	38.95	35,131.98	35.71
Built-up Area	44,014.19	44.74	46,032.40	46.79	48,097.09	48.89	51,162.04	52.00
Bare Ground	134.93	0.13	114.54	0.11	132.29	0.13	29.97	0.03
Rangeland	10,971.78	11.15	7,952.63	8.08	10,950.56	11.13	11,162.69	11.34
Total	98,375.08	100	98,375.08	100	98,375.08	100	98,375.08	100

Source: *Impact of Urbanization on Land Use Land Cover and Urban Climate, Using Spatio-Temporal Techniques: A Case Study of Islamabad, Pakistan, May18, 2024.*

[5] https://journal.50sea.com/index.php/IJIST/article/view/836/1415

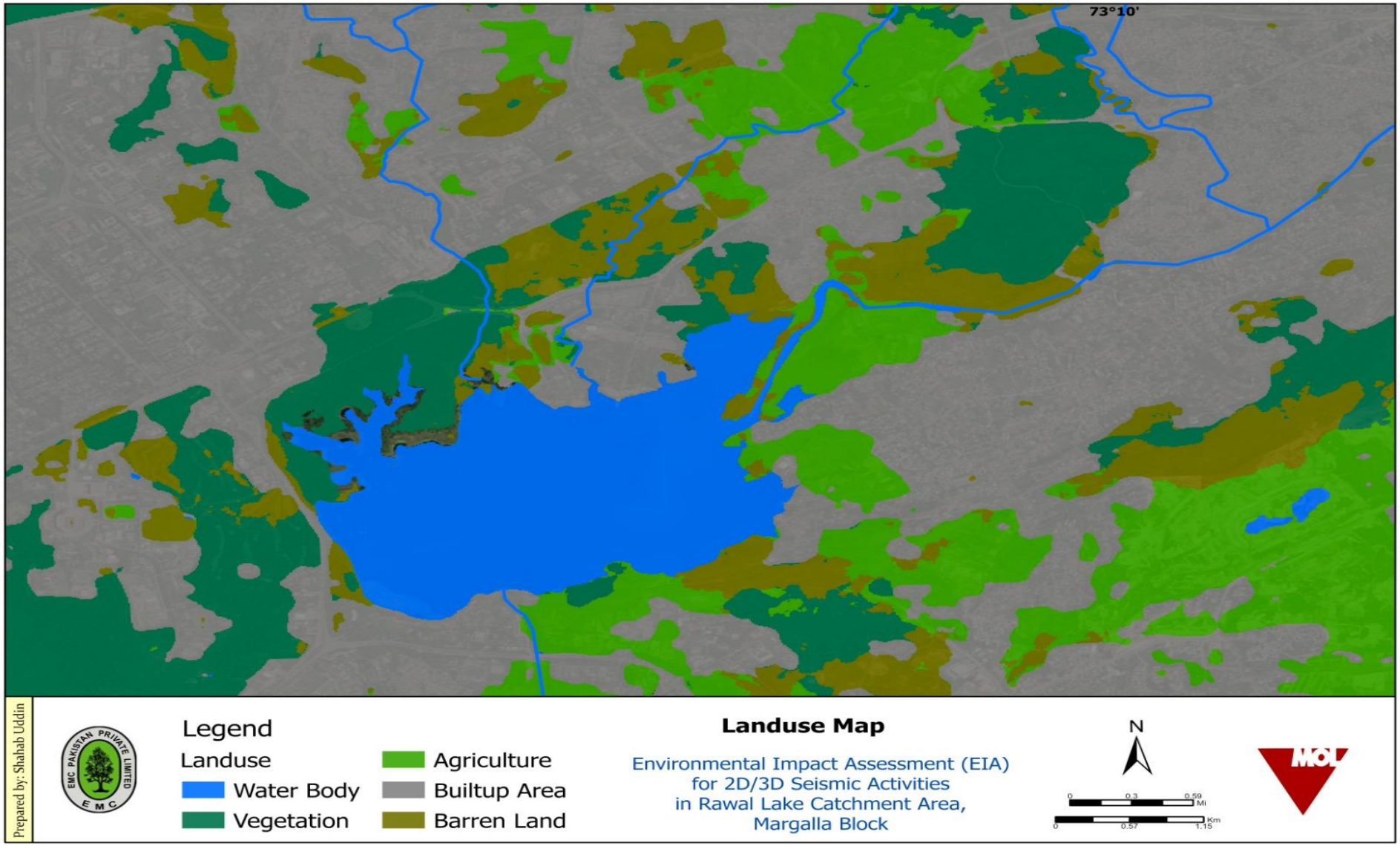

Figure 4.3: Land Use map of project area

4.4.7. Hydrology

The project area has a network comprising river and streams, groundwater basin, small and medium tributaries/drainage channel that drain into the Rawal Lake. Rawal Lake is the principal surface water body in the area and serves as a major drinking water reservoir for Islamabad and Rawalpindi, in addition to supporting fisheries, recreation, and local micro-habitats. The lake receives inflows mainly from the Korang River and several seasonal streams or nullahs, including Bani Gala, Satrameel, and other streams which carry surface runoff from the Margalla foothills and surrounding catchments, particularly during the monsoon season. The surface hydrology map is shown in Figure 4.4.

Besides Korang River, which originates in the Murree Hills area, and a major feeding channel of Rawal Lake, the Lake also receives water from rainfall which is carried to it by various streams that act as stormwater drainage channels. In Bani Gala and Rawal Town, there are several such small to medium drainage channels and perennial stormwater drains. These channels convey monsoon runoff from surrounding hills and urban areas toward Rawal Lake. The streams and channels play a vital role in stormwater management and groundwater recharge; they are also vulnerable to pollution from untreated domestic wastewater and urban runoff. Water, during its passage through this river, streams, and surface carries various dissolved and suspended impurities into the Rawal Lake. Over the years, most of the catchment areas have been turned into human settlements. The untreated waste discharged into the lake from illegal human settlements and livestock pens in the catchment areas pose a threat to the quality of the water and also puts the ecology of the lake at risk. Various research studies have been conducted to assess the water quality of Rawal Lake.

Another significant surface water feature of the area is the Rawal Dam, constructed in 1962. The dam is built on the Korang River and supplies water to the city of Rawalpindi. Due to siltation, there has been depletion in the storage capacity of the dam. Historically, technical surveys were conducted in 1980 and 2000. The latest data available is in the official reports from the Rawalpindi Development Authority (RDA) and WASA which mention that the capacity had dropped to almost half from its initial design (roughly 28,000 acre-feet).

In pursuance of Rawal Lake fish kill incident which took place in July, 2017 and on the recommendation of National Assembly Standing Committee on Climate Change, the incumbent Director General Pak-EPA called upon a meeting on 9th January, 2018, of all concerned stakeholders and notified the "Rawal Lake Monitoring Committee" which comprised of members from ICT Administration, Punjab-EPA, Pak-EPA, PCSIR, PCRWR, and Small Dam Organization Punjab and WASA Rawalpindi. The purpose of the committee formulation was to conduct the water quality monitoring and analysis of the Lake and preparation of joint report. For this purpose, the member collected water samples simultaneously and analyzed independently in their respective labs.

The second source which is as important is the groundwater. Numerous groundwater wells are operating in the area. The aquifers in the area are charged by the Korang River system. The developments in the basin have led to other environmental problems as well, such as, fragmentation of aquatic habitats, impoundment, soil erosion, and water pollution due to deforestation and discharge of municipal garbage and industrial waste.

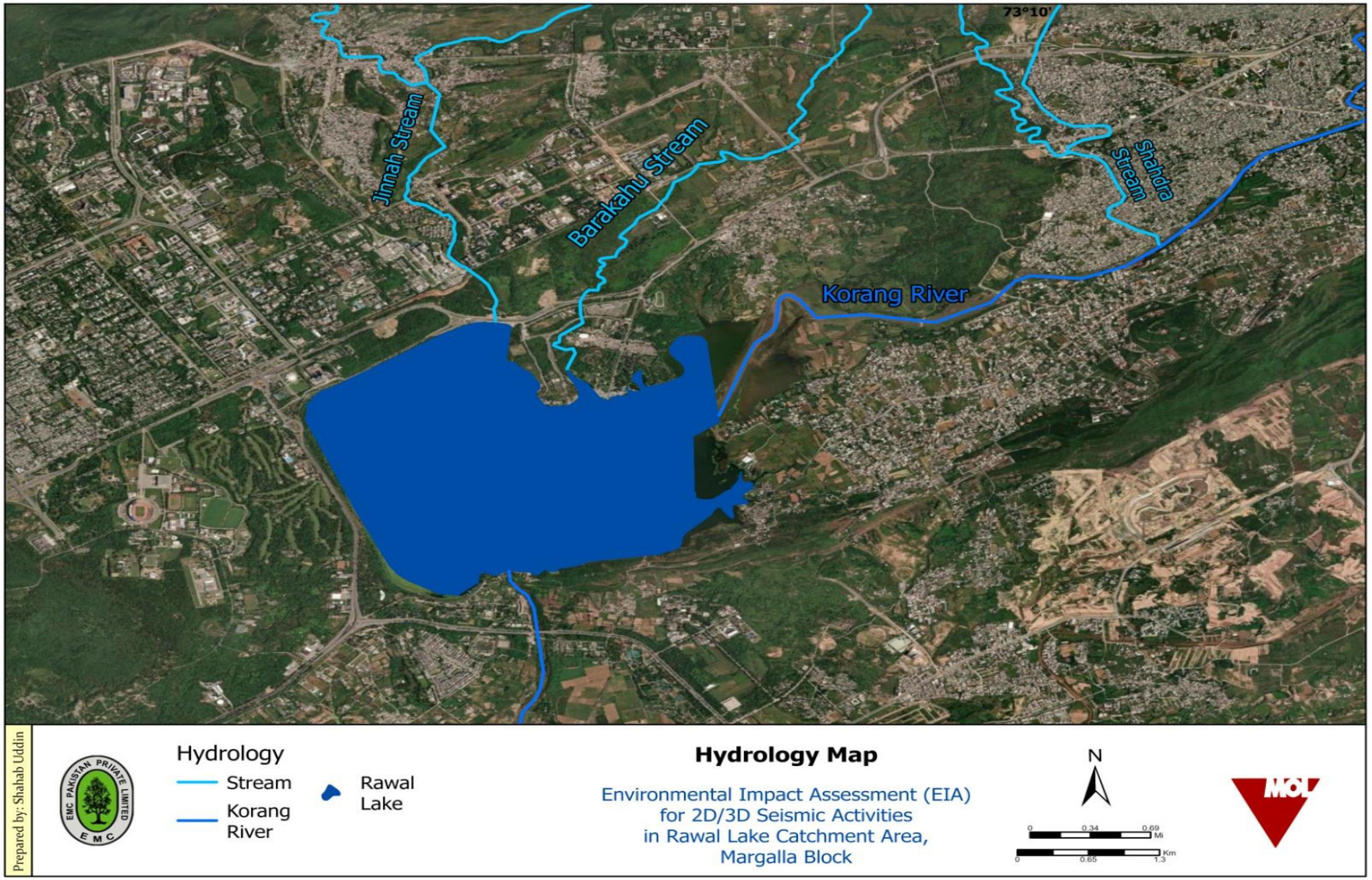

Figure 4.4: Surface Hydrology Map of project area

Groundwater in the project area occurs at variable depths, influenced by local geology, topography, and land use patterns. In the hilly and elevated areas of Bani Gala and the surrounding foothills, groundwater is generally found at greater depths, typically ranging from 150 to 250 feet. In comparatively lower-lying and built-up areas of Rawal Town, groundwater depths are relatively shallow, ranging from approximately 80 to 150 feet. Overall, groundwater quality in the area is generally fresh and suitable for domestic use, particularly in less disturbed and low-density zones. The water table of the surveyed areas are given below:

- Bani Gala 150-250 ft
- Rawal Town 80-150 ft

Rawal Lake

Bara Kahu Stream

Korang River

Shahdra Stream

Jinnah Stream (upstream of Rawal Lake)

Figure 4.5: Surface water bodies in Project area

4.4.8. Air Quality

The air quality of the project area is representative of an active urban environment which is influenced by various factors including the urban emissions from transportation, dust emissions, wood and refuse burning in some areas. Data on air quality is reported by Pak EPA on selected parameters including ozone, Carbon monoxide, Nitrogen Oxide and $PM_{2.5}$. Table 4.2 shows the average monthly concentrations of these parameters in Islamabad for year 2025 as reported by Pak EPA.

Due to open airshed, green cover, and absence of industrial activities, the overall air quality of the area is within acceptable limits for most parameters except particulate matter which is often elevated. There is localized increased concentration of SPM observed in some places due to use of dirt tracks and construction works. The study area does not have other major pollution sources like industries, construction works, or heavy flow of traffic.

Table 4.2: Ambient Air Quality of Islamabad

Parameter	O_3 (µg/m³)	CO (µg/m³)	NO_2 (µg/m³)	PM2.5 (µg/m³)
NEQS	**130 *(µg/m³)***	**5000 *(µg/m³)***	***80 (µg/m³)***	***35 (µg/m³)***
January	35	30	32	176
February	44	10	14	151
March	57	10	20	87
April	108	7	23	100
May	126	4	20	101
June	128	2	14	97
July	42	0	9	76
August	29	0	10	83
September	27	0	13	89
October	26	2	19	169
November	25	7	25	192
December	26	42	34	199

Source: Pak EPA

4.4.9. Noise

Rawal Lake, being a protected water reservoir and recreational area, exhibits relatively low ambient noise levels, largely influenced by natural background sounds, limited vehicular movement, and controlled recreational activities along the lake perimeter. In contrast, the surrounding areas, including nearby roads, recreation points, and adjoining residential areas, recorded comparatively higher noise levels. These elevated noise levels are mainly due to vehicular traffic, commercial activities, and routine urban movement. The levels of Rawal lake and adjacent areas are following in table 4.3.

Ambient noise levels were recorded from various places in the project area, was carried out in project area at 24-hour noise monitoring was also conducted in the project area. Noise levels were observed within NEQS limit. Noise monitoring results are presented below.

Table 4.3: Noise monitoring in project area

No.	Area	Location	Reading	Area Classification
1.	**Rawal Lake**	33°43'5.79"N, 73° 7'34.08"E	47.7dB	-
2.		33°42'50.51"N, 73° 8'7.63"E	50.2dB	-
3.	**Bani Gala**	33°42'12.76"N, 73° 9'34.71"E	52.4dB	Residential
4.		33°42'12.26"N, 73° 9'36.37"E	53.0dB	Residential
5.		33°42'13.33"N, 73° 9'33.75"E	59.8dB	Commercial
6.	**Rawal Town**	33°41'13.76"N, 73° 6'59.58"E	54.2dB	Residential
7.		33°41'3.13"N, 73° 7'5.42"E	60.7dB	Commercial

Table 4.4: Noise limits for different area classifications		
Category of Area	**Day time**	**Night time**
Residential area	55	45
Commercial area	65	55
Industrial area	75	65
Silence Zone	50	45
https://environment.gov.pk/SiteImage/Misc/files/Rules/SRO2010NEQSAirWaterNoise.pdf		

4.5. Biological Environment

In this section, the baseline environmental conditions pertaining to biological environment have been described on the basis of primary and the secondary data. A reconnaissance of the project area was carried out followed by desktop study regarding the ecology of project area.

A detailed ecological baseline study was carried out for the Rawal Lake area to study its ecological features, characteristics and constraints. The survey at Rawal Lake aimed to document species diversity, abundance, and habitat characterization and utilization, with particular emphasis on birds, fish, and terrestrial wildlife. The ecological surveys were conducted from 13th till 26th Jan, 2026 by team of ecologists, GIS expert and junior environmentalist.

4.5.1. Methodology for Faunal Species Survey at Rawal Lake

The methodology included the following components:

4.5.1.1. Study Area Delineation

- The lake and its surrounding terrestrial habitats were divided into representative ecological zones, including open water, shoreline, marshland, reed beds, and adjacent woodland/urban areas.
- Sampling sites were selected to cover a gradient of human disturbance, from highly urbanized zones to relatively undisturbed natural habitats.
- GPS mapping was used to mark survey points and transects for spatial consistency and future repeat surveys.

4.5.1.2. Survey Timing and Frequency

- Observations were primarily undertaken during early morning (06:00–10:00) and late afternoon (16:00–18:30), coinciding with peak wildlife activity.
- Multiple visits were scheduled for each zone to reduce the risk of missing transient or cryptic species.

4.5.1.3. Data Collection Techniques

a. Birds

- Point count and transect methods were used: fixed points were monitored for a set period (10–15 minutes), and linear transects (200–500 m) were walked while recording all birds seen or heard.
- Binoculars and telescopes were used for visual identification; field guides and bird call recordings were used to aid accurate species identification.
- Data included species, number of individuals, behaviour, feeding activity, and habitat use.

b. Aquatic Fauna (Fish and Invertebrates)

- Direct sampling was limited by lake depth, turbidity, and safety concerns.

- Secondary literature, previous studies, and official records were used to document aquatic species composition, breeding areas, and seasonal abundance patterns.
- Opportunistic field observations, such as fish sightings near the shoreline or during water level changes, were recorded where feasible.

c. Terrestrial Wildlife

- Opportunistic observations, track and sign surveys, and camera traps were employed to record mammals, reptiles, and amphibians.
- Signs included footprints, droppings, burrows, nests, and feeding evidence.
- Particular attention was given to species of conservation concern, such as the Indian Pangolin and other endangered or vulnerable species.

4.5.1.4. Threats and Disturbance Recording

- All observed human-induced and natural threats (e.g., pollution, habitat degradation, illegal hunting, or encroachment) were recorded alongside species data.
- Habitat condition assessments were made for each survey zone, including vegetation cover, shoreline stability, and water quality indicators where possible.

4.5.1.5. Data Recording and Analysis

- Data were recorded in standardized field datasheets and GPS-tagged records.
- Species richness, relative abundance, and diversity indices (Shannon-Wiener and Simpson's) were calculated to evaluate ecological health.
- Observed threats and disturbance levels were integrated with species occurrence to identify sensitive zones requiring conservation attention.

4.5.1.6. Limitations of the Faunal Species Survey

The faunal survey at Rawal Lake faced several methodological and practical constraints that may have influenced the completeness and accuracy of the data:

- **Accessibility Constraints:** Certain areas of the lake, such as steep banks, dense vegetation, and highly disturbed zones, were difficult to access, limiting observations in these microhabitats.
- **Aquatic Fauna Data:** Reliance on secondary literature and previous studies for fish and invertebrate species may not fully reflect current population dynamics or recent ecological changes.
- **Temporal Limitations:** Surveys were conducted during limited periods in the dry and wet seasons. This may not capture the full annual variation in species presence, particularly for migratory birds, transient wildlife, and species with seasonal habitat shifts.
- **Diurnal Bias:** Surveys focused on daytime periods (early morning and late afternoon), which may have resulted in underrepresentation of nocturnal or crepuscular species.
- **Human Disturbance:** Recreational and urban activities in and around the lake could have temporarily altered wildlife behaviour, potentially leading to under- or overestimation of certain species during observation periods.

These limitations are typical of short-term ecological surveys in urban-adjacent water bodies, and the findings should be interpreted in the context of these constraints.

4.5.2. Rawal Lake Ecosystem

The Rawal Lake ecosystem comprises:

- Open freshwater reservoir
- Tributary inflows and wetlands

- Riparian vegetation
- Surrounding scrub forest and parkland
- Urban greenbelt and agricultural interfaces

The ecological health of the lake is influenced by seasonal hydrology, sediment inflow, nutrient loading, and anthropogenic activities within the catchment.

4.5.3. Ecological Significance of Rawal Lake

The Rawal Lake ecosystem plays a vital role in maintaining both environmental and societal well-being:

- Protection of municipal water supply: The lake acts as a natural reservoir, ensuring a reliable source of clean water for Rawalpindi and some parts of Islamabad.[6]
- Habitat for migratory birds: It provides essential resting and feeding grounds for numerous migratory bird species, supporting regional biodiversity.
- Fish breeding and feeding grounds: The lake's aquatic environment sustains fish populations, contributing to ecological balance and local fisheries.
- Wildlife refuge within an urban landscape: Rawal Lake serves as one of the few natural habitats within Islamabad, offering shelter to various terrestrial and aquatic wildlife species.
- Recreational ecosystem services: The surrounding area supports leisure, tourism, and educational activities, enhancing human well-being and environmental awareness.
- Flood regulation and microclimate stabilization: The lake helps mitigate flood risks during heavy rainfall and moderate's local temperatures, maintaining urban climate resilience.

4.5.4. Key Conservation Concerns

The Rawal Lake ecosystem faces multiple anthropogenic and environmental pressures that threaten its biodiversity and ecological integrity:

- **Sewage and nutrient pollution:** Untreated wastewater and agricultural runoff increase nutrient loads, leading to eutrophication and deterioration of water quality.
- **Catchment urbanization:** Expansion of urban areas in the catchment alters natural hydrology, increases surface runoff, and fragments habitats.
- **Habitat disturbance:** Recreational activities, shoreline modification, and infrastructure development disrupt wildlife habitats.
- **Sedimentation:** Soil erosion from surrounding lands contributes to sediment accumulation in the lake, affecting aquatic habitats and water storage capacity.
- **Illegal fishing and hunting:** Unsustainable harvesting of fish and hunting of wildlife reduces species populations and disrupts ecological balance.
  Solid waste dumping: Improper disposal of plastics and other solid wastes contaminates the ecosystem and poses risks to aquatic and terrestrial species.

4.5.5. Sensitive Habitats/Protected areas

The project area falls in Margalla Hills National Park Extension comprising Rawal Lake.

4.5.6. Survey Findings

4.5.6.1. Floral Diversity around Rawal Lake

The Rawal Lake ecosystem supports a diverse assemblage of flora and fauna owing to the presence of freshwater habitats, riparian zones, scrub vegetation, and adjoining woodland areas that connect

[6] Determination of Water Quality of Rawal Dam, Islamabad, https://new.academiapublishing.org/journals/ajar/pdf/2016/Mar/Ayaz%20et%20al.pdf

ecologically with the Margalla Hills landscape. The reservoir and its surrounding catchment provide feeding, breeding, and refuge habitats for aquatic organisms, resident wildlife, and migratory bird species. Seasonal water level fluctuations, nutrient inputs, and human activities influence habitat distribution and species composition; however, the area continues to function as an important urban biodiversity refuge. Aquatic macrophytes are limited due to fluctuating water levels but reed vegetation occurs in shallow margins. Table 4.5 below summarizes key floral and faunal species recorded in and around Rawal Lake along with their ecological associations and conservation status according to the IUCN Red List.:

Table 4.5: Common Flora recorded in Rawal Lake area

Common Name	Scientific Name	Habitat Type	IUCN Status
Phulai (Wild Olive)	*Olea ferruginea*	Dry scrub forest	Least Concern (LC)
Kikar (Acacia)	*Vachellia nilotica*	Scrub & riparian	Least Concern (LC)
Sheesham	*Dalbergia sissoo*	Riparian belts	Least Concern (LC)
Peepal	*Ficus religiosa*	Parkland & villages	Least Concern (LC)
Banyan	*Ficus benghalensis*	Urban & parkland	Least Concern (LC)
Eucalyptus spp.	*Eucalyptus* spp.	Plantation	Not evaluated
Bermuda grass	*Cynodon dactylon*	Open areas	Least Concern (LC)
Typha (Reed)	*Typha* spp.	Wetlands	Least Concern (LC)

4.5.6.2. Faunal Species encountered during Survey

A. TERRESTRIAL FAUNA (MAMMALS)

During the faunal survey at Rawal Lake, several mammalian species were recorded through direct sightings and evidence such as tracks and signs. Notably, flying foxes (Pteropus giganteus) were observed in groups roosting on trees along the wetland edge, indicating the availability of suitable nocturnal roosting habitat and their role in seed dispersal. A single wild boar (Sus scrofa) was sighted foraging along the shoreline, reflecting the connectivity between aquatic and terrestrial habitats and the species' opportunistic feeding behaviour. Jackals (Canis aureus) were detected through tracks in two locations, highlighting the presence of adaptable carnivores that rely on cover and prey availability in the wetland and adjacent areas. Most observations were concentrated near the shoreline and wetland zones, demonstrating the importance of these habitats for mammalian fauna within the urban landscape. While the survey provides valuable baseline data, dense vegetation, human activity, and the nocturnal nature of some species may have limited detection, suggesting that actual species richness could be higher. Overall, the findings underscore the ecological value of Rawal Lake as a refuge for both common and conservation-significant mammalian species, emphasizing the need for habitat protection and ongoing monitoring.

Table 4.6a: Mammal recorded in Rawal Lake Area

Species Name	Record Type	Count	Sex	Habitat Type	Coordinates	Observation Method
Flying fox	Sighting	11	N/A	Wetland	33°41'38.59"N 73° 7'42.81"E	Line transects
Wild boar	Sighting	1	N/A	Wetland	33°41'38.59"N 73° 7'42.81"E	Point count
Jackal	Sign	1	N/A	Wetland	33°41'43.43"N 73° 7'55.83"E	Point count
Jackal	Sign	1	N/A	Wetland	33°41'43.43"N 73° 7'55.83"E	Point count

B. AVIFAUNA (BIRDS)

The avifaunal survey at Rawal Lake recorded a diverse assemblage of bird species, primarily concentrated in wetland and shoreline habitats. Observations were conducted using the point count

method between 08:00 and 11:50 hours, capturing feeding, perching, and calling behaviors. The survey documented a range of common and resident species, including Bank Myna (Acridotheres ginginianus), Jungle Myna (Acridotheres fuscus), and Common Myna (Acridotheres tristis), with counts of 6, 13, and 24 individuals respectively, predominantly engaged in feeding activity. Predatory and insectivorous species such as the Red-breasted Flycatcher (Ficedula parva) and Long-tailed Shrike (Lanius schach) were also recorded, highlighting the wetland's role as a foraging ground. Aquatic and semi-aquatic birds including the Indian Pond Heron (Ardeola grayii), Common Kingfisher (Alcedo atthis), White-throated Kingfisher (Halcyon smyrnensis), White-breasted Waterhen (Amaurornis phoenicurus), Common Moorhen (Gallinula chloropus), Common Coot (Fulica atra), and Little Cormorant (Microcarbo niger) were observed feeding or perched along the shoreline, indicating suitable wetland habitat for foraging and resting. Additionally, species such as Eurasian Wryneck (Jynx torquilla), Black-headed Gull (Chroicocephalus ridibundus), Eurasian Starling (Sturnus vulgaris), and Chestnut-tailed Starling (Sturnia malabarica) were noted calling or perched, reflecting high seasonal diversity. The presence of both resident and migratory species demonstrates the ecological importance of Rawal Lake as a critical urban wetland supporting avian biodiversity, particularly for feeding, roosting, and migratory stopover functions. While the survey provides valuable baseline data, species counts may be influenced by human disturbance, diurnal activity patterns, and observer limitations, suggesting that actual avian diversity may be higher than recorded.

Table 4.6b: Birds recorded in Rawal Lake area

Time	Species Name	Count	Sex	Age Class	Behavior	GPS Latitude
Observation Method: Point Count Habitat Type: Wetland						
8:00am	Bank myna	6	N/A	Adult	Feeding	33°43'11.94"N 73° 7'45.00"E
8:11am	Jungle myna	13	N/A	Adult	Feeding	33°43'5.74"N 73° 8'9.85"E
9:00am	Common myna	24	N/A	Adult	Feeding	33°43'5.74"N 73° 8'9.85"E
9:12am	Long tailed shrike	1	N/A	Adult	Perched	33°43'5.74"N 73° 8'9.85"E
9:17am	Eurasian wryneck	1	N/A	Adult	Calling	33°42'47.87"N 73° 8'12.42"E
9:22am	Black headed gul	15	N/A	Adult	Perched	33°42'47.87"N 73° 8'12.42"E
9:50am	Indian pond heron	1	N/A	Adult	Perched	33°42'47.87"N 73° 8'12.42"E
9:55am	Red breasted flycatcher	1	N/A	Adult	Calling	33°42'47.87"N 73° 8'12.42"E
10:20am	Common kingfisher	1	N/A	Adult	Feeding	33°42'47.87"N 73° 8'12.42"E
10:25am	White throated kingfisher	1	N/A	Adult	Feeding	33°41'43.43"N 73° 7'55.83"E
10:30am	White breasted waterhen	1	N/A	Adult	Feeding	33°41'43.43"N 73° 7'55.83"E
10;45am	Chestnut tailed starling	1	N/A	Adult	Feeding	33°41'43.43"N 73° 7'55.83"E
11:00am	Common moorhen	7	N/A	Adult	Feeding	33°41'38.59"N 73° 7'42.81"E
11:30am	Common coot	19	N/A	Adult	Feeding	33°41'38.59"N 73° 7'42.81"E
11:50am	Little cormorant	18	N/A	Adult	Feeding	33°41'38.59"N 73° 7'42.81"E

11:50am	Eurasian starling	5	N/A	Adult	Feeding	33°41'38.59"N 73° 7'42.81"E

A. AVIFAUNA DIVERSITY

Rawal Lake is an important stopover and wintering site for migratory water birds and supports resident bird populations.

i. Water Birds

Table 4.6c: Water birds recorded in Rawal Lake area			
Common Name	**Scientific Name**	**Status at Site**	**IUCN Status**
Mallard	*Anas platyrhynchos*	Winter migrant	Least Concern (LC)
Northern Shoveler	*Spatula clypeata*	Winter migrant	Least Concern (LC)
Common Teal	*Anas crecca*	Winter migrant	Least Concern (LC)
Common Coot	*Fulica atra*	Resident & migrant	Least Concern (LC)
Little Egret	*Egretta garzetta*	Resident	Least Concern (LC)
Little Cormorant	*Microcarbo niger*	Resident	Least Concern (LC)
Common Pochard	*Aythya ferina*	Winter migrant	Vulnerable (VU)

ii. Terrestrial & Park Birds

Table 4.6d: Terrestrial Birds recorded in Rawal Lake area			
Common Name	**Scientific Name**	**Habitat**	**IUCN Status**
Grey Francolin	*Francolinus pondicerianus*	Scrubland	Least Concern (LC)
Green Bee-eater	*Merops orientalis*	Open fields	Least Concern (LC)
Spotted Owlet	*Athene brama*	Woodland	Least Concern (LC)
Black Kite	*Milvus migrans*	Urban & wetlands	Least Concern (LC)
House Sparrow	*Passer domesticus*	Urban	Least Concern (LC)

B. AQUATIC FAUNA (FISH & TURTLES)

Rawal Lake supports native and introduced fish species important for ecological balance and fisheries.

Table 4.6e: Fish recorded in Rawal Lake area			
Common Name	**Scientific Name**	**Ecological Role**	**IUCN Status**
Rohu	*Labeo rohita*	Native carp; omnivore	Least Concern (LC)
Catla	*Catla catla*	Surface feeder	Least Concern (LC)
Mori	*Cirrhinus mrigala*	Bottom feeder	Least Concern (LC)
Common Carp	*Cyprinus carpio*	Introduced species	-----
Snakehead	*Channa channa*	Predatory fish	Least Concern (LC)
Tilapia	*Oreochromis mossambicus*	Introduced omnivore	-----

Table 4.6f: Turtles recorded in Rawal Lake area			
Common Name	**Scientific Name**	**Habitat**	**IUCN Status**
Indian Softshell Turtle	*Nilssonia gangetica*	Freshwater	Vulnerable (VU)
Indian Flapshell Turtle	*Lissemys punctata*	Wetlands & lakes	Least Concern (LC)
Brown Roofed Turtle	*Pangshura smithii*	Rivers & reservoirs	Near Threatened (NT)

a. Mammalian Fauna

The lake margins and adjoining greenbelt connect with Margalla Hills wildlife corridors.

Table 4.6g: Mammalian Fauna recorded in Rawal Lake area			
Common Name	**Scientific Name**	**Habitat**	**IUCN Status**
Golden Jackal	*Canis aureus*	Scrubland	Least Concern (LC)
Red Fox	*Vulpes vulpes*	Scrubland	Least Concern (LC)
Jungle Cat	*Felis chaus*	Wetlands	Least Concern (LC)
Indian Crested Porcupine	*Hystrix indica*	Scrub & farmland	Least Concern (LC)

Wild Boar	*Sus scrofa*	Wetlands & forests	Least Concern (LC)
Indian Pangolin	*Manis crassicaudata*	Forest & scrub	Endangered (EN)

b. Reptiles & Amphibians

Table 4.6h: Reptiles and Amphibians recorded in Rawal Lake Area

Common Name	Scientific Name	Habitat	IUCN Status
Indian Cobra	*Naja naja*	Scrub & farmland	Least Concern (LC)
Russell's Viper	*Daboia russelii*	Grassland	Least Concern (LC)
Common Toad	*Duttaphrynus melanostictus*	Wetlands	Least Concern (LC)
Skink species	*Eutropis* spp.	Terrestrial	Least Concern (LC)

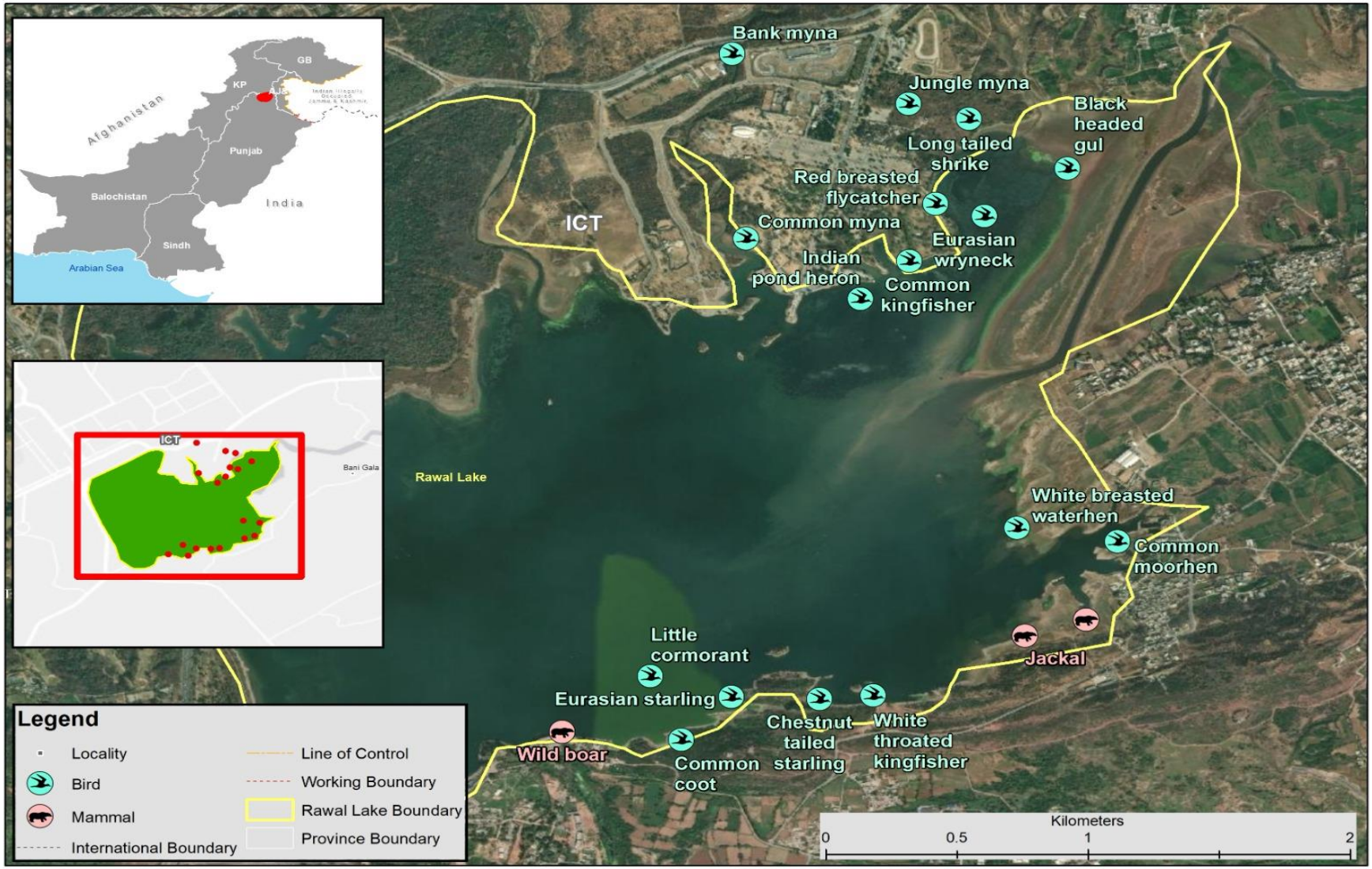

Figure 4.6: Spatial Distribution of species spotted during survey

4.6. Social Environment

Protecting people and the environment is considered a core value at MOL Pakistan. This section describes the key socio-economic and cultural features of the micro and macro environment of the project area.

Various social aspects including the history, administrative set-up, demography, infrastructure facilities, education, health, water supply and road network, cultural heritage, economic scenario etc. are described in subsequent sections.

4.6.1. District Administration

Rawal Lake and its adjoining areas fall in zone III of Islamabad as per ICT Zoning Regulations.

4.6.2. Land use features

Land uses in the area includes recreational, residential (planned and unplanned societies), and civil infrastructure comprising roads, bridges, commercial units. The Lake View Park has been established for recreation and public amusement. There are planned and unplanned residential areas to the NW and Eastern side of the Lake including Bani Gala, Malpur, Mohri, Pakistan colony, and other small localities.

4.6.3. Demography and Population

According to the 2023 Population and Housing Census of Pakistan, the total population of Islamabad Capital Territory (ICT) is 2,363,863. Of this population, about 1,108,872 people live in urban areas, while around 1,254,991 reside in rural areas. The gender distribution includes approximately 1,247,693 males and 1,115,900 females, along with a small number of transgender persons, showing a slightly higher male population. Overall, the population of ICT is spread between planned urban sectors and rural settlements, which affects the planning and provision of infrastructure, services, and development activities.[7]

4.6.4. Agriculture and Irrigation

There is almost no planned farming activity near Rawal Lake and Rawal Town because of land use restrictions. However, in rural Bani Gala and other unplanned societies in vicinity of the Lake, some small-scale farming activities are observed where locals grow crops like wheat, maize, and vegetables. These farms mostly depend on rain, and some farmers also use tube wells for irrigation.

Figure 4.7: Agricultural activities in Bani Gala

[7] https://www.citypopulation.de/en/pakistan/admin/islamabad/501__islamabad/

4.6.5. Occupation

The primary livelihoods include government and semi-government employment, such as staff working in public offices, institutions, and security services. A significant number of people are employed in education, healthcare, administration, and office-based jobs in nearby sectors of Islamabad. Others earn their livelihood through service and informal sectors, including tourism-related work, park and landscape maintenance, cleaning staff, vendors, drivers, construction workers, and small shopkeepers. Overall, the population depends largely on salaried jobs, daily wage labor, and service-oriented activities.

4.6.6. Housing

Housing conditions in Rawal Town and surrounding areas of Rawal Dam are predominantly concrete reinforced structures (locally called pakka), consisting of reinforced concrete houses and planned residential units with access to basic urban services such as electricity, water supply, sewerage, and road infrastructure. The area reflects an overall urban character with well-established housing. In Bani Gala, housing is mostly concrete in the developed and settled areas. However, some settlements located in the semi-urban and rural parts of Bani Gala have mixed structures and grey structures.

4.6.7. Movement and accessibility

The road network in and around the project area provides important connectivity between southern Islamabad, residential sectors, and recreational areas. The area is connected to central Islamabad through a mix of primary and secondary roads, allowing access to residential, commercial, and tourism-related locations.

Access to Rawal Lake is primarily through Park Road and connecting link roads. Transportation to the lake is mostly via private vehicles, taxis, and motorcycles, with traffic increasing during weekends and holidays due to recreational visitors. Public transport availability near the lake is limited, and most visitors rely on private or hired transport. Rawal Town is well connected through Park Road, Korang Road, and Islamabad Expressway, which link the area to major sectors of Islamabad, Rawalpindi, and other parts of the city. These roads are generally paved and carry moderate to heavy traffic, especially during peak hours.

Transportation in the project area is mainly road-based and depends on a mix of public, and private transport. CDA bus services (Blue and Green Lines) are also available. Rawal Town has relatively good connectivity through major roads such as Park Road, Korang Road, and Islamabad Expressway, allowing easy access to central Islamabad and Rawalpindi. Residents commonly use private cars, motorcycles, taxis, ride-hailing services (Indrive, YANGO), vans, and local buses for daily commuting.

4.6.8. Health

Primary and secondary healthcare facilities are available in the area. Rawal Town has comparatively better access to healthcare services, with basic health units, private clinics, dispensaries, and nearby hospitals available within the locality or at short distance. Residents can also easily reach major public hospitals of Islamabad, such as PIMS and Federal Government Polyclinic Hospital, for specialized and emergency medical treatment. In contrast, Bani Gala has limited healthcare facilities. The area mainly relies on small private clinics and dispensaries, which provide basic medical services only. There are no major hospitals within Bani Gala, and residents must travel to central Islamabad or Rawal Town for emergency care, diagnostics, and specialized treatment. Areas

around Rawal Lake do not have permanent healthcare facilities, and visitors or nearby residents also depend on hospitals and clinics located in central Islamabad.

4.6.9. Education

Educational facilities in the project area show clear variation between urban and semi-urban localities. Rawal Town has relatively good access to education, with a number of public and private schools and colleges providing education from primary to higher secondary levels. Students from Rawal Town can also easily commute to central Islamabad for higher education. In Bani Gala, educational facilities are limited mainly to primary, secondary, and higher secondary schools, including both government and private institutions. However, no universities or degree-awarding institutions are located within Bani Gala or its nearby areas. As a result, students seeking higher education must travel to central Islamabad on a daily basis. The Rawal Lake area itself does not host educational institutions, as it is primarily a recreational and environmental zone. Residents living around the lake also depend on schools and colleges located in central Islamabad.

4.6.10. Archeological and Cultural Sites

Rawal Lake holds strong cultural and recreational importance for Islamabad, serving as a major public leisure area and a historically significant water reservoir developed during the early planning of the capital. The lake and its surroundings are widely used for social gatherings, festivals, and outdoor recreation. Bani Gala is known for its traditional village character and long-established local communities. Although no officially protected archaeological sites are located within Bani Gala, the area reflects local cultural heritage through traditional housing patterns, community mosques, and long-standing settlement history. Rawal Town, being a developed urban area, does not host major archaeological sites.

4.6.11. Common Social Issues

The project area and nearby settlements, especially Bani Gala, face several common social and environmental issues. Most households use groundwater from borewell for drinking and daily use as there is no piped water supply. The water is often muddy and not palatable. Because of poor water quality, water-borne diseases are common, particularly during the rainy season. There are no major hospitals in Bani Gala, so residents must travel to central Islamabad for medical treatment. Likewise, no universities or higher education institutes are present in Bani Gala or nearby areas, and students travel to main Islamabad city for higher studies. Land disputes, street crimes are a serious issue in the area, including land conflicts and activities of the land grabbing mafia, which create problems for residents. Ongoing construction of new housing schemes has led to cutting of trees, causing loss of greenery, increased dust, and allergy and breathing problems among locals. The area also lacks a proper stormwater drainage system. During rainfall, rainwater flows on roads and streets, leading to waterlogging and unhygienic conditions. In addition, residents report crime issues, such as mobile snatching and theft, which are often linked to increased migration from other areas. Solid waste management is inadequate in several localities, with irregular street cleaning and waste collection.

5.0 STAKEHOLDER CONSULTATION

5.1. Introduction

This section provides an overview of the stakeholder and public consultation process adopted by the consultant team and presents the findings of the stakeholder consultation activity conducted during the EIA. Public involvement is one of the key features of environmental assessment, which ensures better and more acceptable decision-making.

5.2. Consultation Objectives

The overall objective of the consultation with stakeholders is to identify the environmental and social concerns of the stakeholders and to identify those which are not known or are unique to the project area. Stakeholder consultation presents an opportunity for mutual information-sharing and dialogue between the project proponent and stakeholders. An effective public consultation process provides concrete suggestions that can help improve project design, resolve conflicts at an early stage, identify management solutions to mitigate potentially adverse consequences and enhance positive impacts, and develop guidelines for effective monitoring and reporting of project activities throughout the project cycle. Providing the public with adequate reliable information of the planned project is of significant importance in creating public trust and acceptance. Moreover, experience reveals that unexpected project impacts on the local community generally give rise to significant issues and concerns. Such problems can be avoided if people are properly informed and consulted about the project and given the opportunity to raise their concerns.

5.3. Consultation Methodology

EMC team carried out consultations with the local residents in the vicinity (primary stakeholders) of the project and with the relevant departments (secondary stakeholders). The consultation approach included:

- Communication of project scope and objectives to the stakeholders
- Identification of values held by the residents/departments and their concerns regarding the development activities in the project area.
- Obtaining their feedback and suggestions on the proposed project activity.

Identification of stakeholders is one of the major steps for designing an effective consultation process. For this purpose, a site visit was carried out by EMC social team to identify the communities and the relevant stakeholders for consultation. Consultation meetings were conducted with the identified stakeholders residing or working in the nearby areas of project and with relevant departments by EIA team. The stakeholders were briefed about background and scope of the MOL Pakistan Bioremediation & Dumping Site project at the beginning of the meeting sessions. Queries regarding the project were responded by EIA team during the session. Concerns and suggestions of the respondents were noted down by the team and pictures of the session were taken with the consent of the stakeholders.

5.4. Identification of Stakeholders

Stakeholders are individuals, groups, or institutions that may be affected by and can significantly influence the project activities, or are integral to the achievement of the objectives of a project. Stakeholders can be divided into 2 broad categories; primary and secondary; Tables 5.1(a) and (b).

Primary stakeholders are those who have a direct interest in the project which includes residents, commercial entities and institutions falling in the project area. Secondary stakeholders include the relevant government agencies and public interest groups which may indirectly influence or be influenced by the project. The concerns and input from both primary and secondary stakeholders are important to identify the issues arising from the project and propose mitigation measures that minimize the negative project impacts and enhance the positive ones.

Table 5.1(a): Primary Stakeholders

S. No.	Stakeholder Groups	Stakeholders
1	Proponent	MOL Pakistan HSE team, Exploration Dept.
2	Settlements near the project area	• Bani Gala • Rawal Town
3	Commercial entities	• Small business such as shops, hotels

Table 5.1(b): Secondary Stakeholders

S. No.	Stakeholder Groups	Department	Name and Designation
1	Government Departments	Environmental Protection Agency, Islamabad	Mr. Khalid Mehmood, Director EIA
		Capital Development Authority (CDA), Islamabad	Mr. Akhtar Rasool (Director Environment) Mr. Idress (Deputy Director, Parks)
		Islamabad Wildlife Management Board (IWMB)	Dr. M. Saeed, AD R&D, IWMB
2	Environment practitioners and experts	NUST Islamabad	Dr. Zeshan, Professor, SEE (IESE), NUST, Islamabad Dr. Erum Aamir, Assistant Professor, SEE (IESE), NUST, Islamabad

5.5. Outcome of Consultation

5.5.1. Consultation with Government Departments and Institutions

A meeting was held with the government stakeholder department and were briefed about the project purpose and project location. The department consulted at Islamabad Capital Territory (ICT) for the feedback on the proposed activities are as under.

Table 5.2: Summary of Consultation with institutions/government departments

S#	Departments	Date:	Feedback
1.	EPA Islamabad		• The project area has conservation importance and the local ecological is sensitive. Careful management during project is critical. • Prudent monitoring plan should be implemented during the project.
2.	CDA, Islamabad	26th Jan, 2026	• After completion of project activities, plantation and landscaping shall be carried out to restore the area to conditions similar to the baseline. • Tree cutting is strictly prohibited after a suo moto notice by the Court. • Tree transplantation may be considered only if the tree trunk width is less than 12 inches and height is under 8–10 feet, subject to species-specific conditions and prior approval.

			• Waste management shall be the responsibility of the project proponent, and all waste must be managed at the proponent's own cost. • Any damage caused during project activities shall be fully restored to the original condition. • Prior approval from CDA) is mandatory for carrying out activities in protected or sensitive areas.
3.	Islamabad Wildlife Management Board (IWMB)	1st Dec, 2025	• is the custodian of protected areas in Margalla Block, with support from CDA. • Common fauna in surrounding areas (e.g., Rawal Lake) include foxes, jackals, porcupines, wild boar, waterfowl, turtles, and other species. • The area supports diverse wildlife, including around 30 mammal species; Pangolin is an endangered species. • Prior approval from IWMB is mandatory for carrying out any activities in protected areas. • Breeding seasons vary from species to species, and project activities should consider wildlife sensitivity periods. • A buffer zone of 100 meters is defined for protected areas as per the relevant Act. • Project activities should be avoided within National Park areas. • If activities are unavoidable, international environmental and wildlife protection protocols must be strictly followed.

Figure 5.1a: Consultation with Field office env directorate CDA

Figure 5.1b: Consultation with IWMB

5.5.2. Consultation with Environment Practitioners and Experts

Consultation was conducted with academic expert to gather feedback on the proposed project. A meeting was held with Prof. Dr. Zeshan and Dr. Erum Aamir, their feedbacks are presented in the below.

Name	Designation	Feedback
Dr. Zeshan	Professor, SCEE (IESE), NUST, Islamabad	• Avoid tree cutting during all project activities. • Prevent adverse impacts on biodiversity and wildlife habitats. • Islamabad already faces water scarcity; project activities should not stress community water resources. • Ensure proper storage and treatment of wastewater using separate systems for municipal and hazardous wastewater. • For municipal wastewater, use anaerobic wastewater treatment technologies. • Implement sludge processing and safe disposal for hazardous wastewater. • Minimize CO_2 and other greenhouse gas (GHG) emissions during project execution. • Promote innovative solutions such as Liquid Trees for CO_2 absorption and air quality improvement.
Dr. Erum Aamir	Assistant Professor, SCEE (IESE), NUST, Islamabad	• Ensure strong understanding of climate change concepts and actively avoid and minimize emissions during project activities. • Implement proper solid waste management, including collection, segregation, recycling, and safe dumping. • Prevent soil and dust pollution, particularly $PM_{2.5}$ and PM_{10} emissions.

		• Use biochar as a sustainable measure to reduce pollution and improve soil quality where applicable. • Install activated carbon filters for purification of smoke and exhaust emissions from all types of equipment and vehicles. • Ensure no tree cutting during any phase of the project. • Promote rainwater harvesting to address Islamabad's water scarcity. • Harvest rainwater using efficient and effective systems to reduce reliance on community water resources.

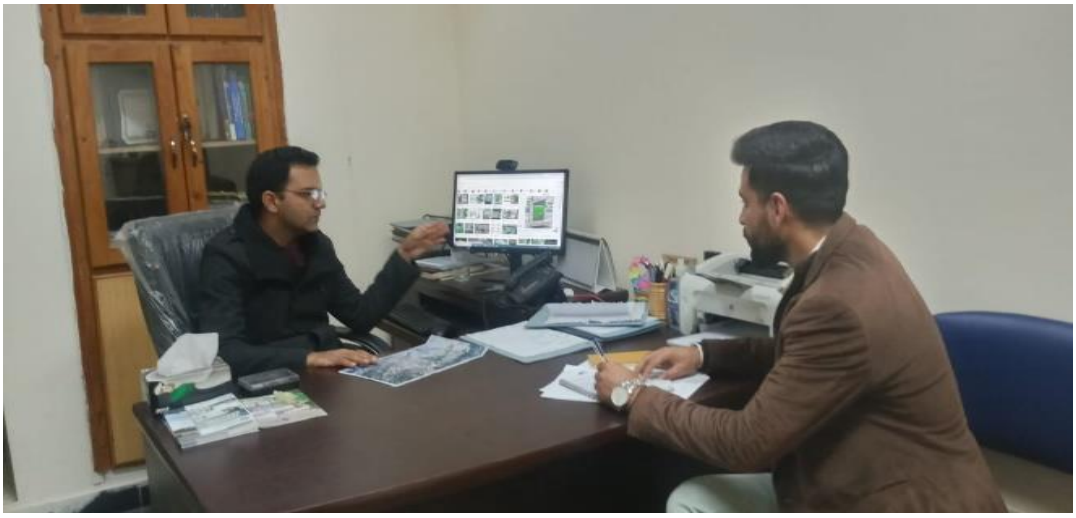

Figure 5.2a: Consultation with Professor Dr. Zeshan, SCEE (IESE), NUST, Islamabad

Figure 5.2b: Consultation with Dr. Erum Aamir, Assistant Professor, SCEE (IESE), NUST, Islamabad

5.5.3. Consultation with Communities

The communities of the Bani Gala and Rawal Town were consulted during the process to obtain their feedback on the project. The consultations were conducted on 9th January, 2026. The respondents did not share any significant concern related to the project. However, they were hopeful to receive direct or indirect benefits in the form of employment, business (materials and logistics

etc.). Some of the respondents emphasized that the project activity should minimize environmental damage, control dust and noise, and avoid loss of trees spaces.

Figure 5.3a: Consultation with locals in Bani Gala

Figure 5.3b: Consultation with locals in Rawal Town

6.0 ENVIRONMENTAL & SOCIAL RISK ASSESSMENT

6.1 Introduction

This section presents the outcome of screening process and risk assessment conducted to identify potential environmental and social impacts of project's activities followed by assessment to determine the scale and magnitude of identified impacts.

The screening process, besides identifying potential environmental impacts and the possibility of residual impacts, also outlines mitigation measures that may be adopted in order to prevent, reduce or minimize the impact. The screening process has also identified possible risks pertaining to natural environment including physical environment, fauna and flora and nearby communities apart from health safety risks.

The potential impacts related to the proposed project have been identified through professional judgment, experience, process understanding, and field observations. Impact significance has been assessed using a Risk Assessment Approach based on the severity and likelihood of the potential impact.

6.2 Methodology adopted for Risk Assessment

Oil and gas sector has its own distinctive impacts associated with the exploration activities. The sectoral guidelines on oil and gas exploration provide guidance on significant environmental impacts from exploration activities. The environmental aspects of the project were identified in relation to the present land use, effect on vegetation, physical environment and other during the project.

The methodology adopted for impact assessment comprised following steps:

1. Identification of impacts through review of guidelines, previous similar studies and field data from surveys
2. Assessment of magnitude and scale of impacts using applicable guidelines, site data (surveys) and project activities
3. Mitigation Measures through review of national and international guidelines, and best industry practices
4. Identification of residual impacts after mitigation measures and determining monitoring requirements

The major element involved in the process of environmental impact assessment is identification as it leads to other elements such as quantification and evaluation of impacts. Although, in general number of impacts can be identified while describing the project, all the impacts may not be considered significant. Hence it is necessary to identify the critical impacts that are likely to cause significant impact on various components of environment due to the project.

While identifying the impact for exploration activities in the study area, all significant project activities have been accounted for. The availability of energy resource (oil/gas) the end product has been considered for the purpose of economic benefits.

National Environmental Quality Standards (NEQS) were reviewed for determining the permissible levels of environmental parameters during project operation and classification of the site with respect to its pollution status.

6.3 Screening of potential impacts

The seismic survey activities in Rawal Lake area would require following environmental constraints to be addressed:

1. Impacts on Physical Environment (Air, Noise, Water, and land/Soil resources)
2. Impacts on Ecology (Flora, Fauna, habitats)
3. Impact on social environment (land use change, infrastructure, community health hazards, accessibility)
4. Project Benefits (Positive impacts)
5. Community Health and Safety

6.4 Impacts on Physical Environment

6.4.1 Soil Erosion

Site preparation for up-holes/shot holes, movement on dirt tracks will create ground disturbances leading to soil erosion. The probability and scale of impact is expected to remain small as most of the project area has well bound soils with green cover in the form of grasses, shrubs or other form of vegetation. In some areas, the effect can be more pronounced where there has been no previous activity of soil erosion. The activities can also affect slope stability thus increasing erosion. The overall impact will be localized and can be controlled effectively by adopting mitigation measures.

Mitigation Measures

- Seismic activity in the undulating areas will follow natural contours wherever possible. However, in areas where seismic line cutting is a requirement, the activity will be carried out in a way that would minimize disturbance to natural topography and soils.
- The width of lines cleared for seismic survey will be limited to 4m to minimize clearing of vegetation and disturbance to soil from a large area.
- Cut and fill works will be avoided to at least kept to minimum.
- Clearing of vegetation will be kept to a minimum, to the extent possible.
- Existing access roads shall be used as much as possible and new roads will be planned carefully.
- Vegetation removal for the purpose of accessibility will be avoided.
- Total land uptake by the access road will be kept to the minimum required.
- Vehicle speeds will be regulated and monitored to avoid excessive dust emissions.
- Trainings will be mandated for the drivers on use of roads, access roads and dirt tracks.
- Activities will be confined within work corridors.
- Photographs will be taken at regular intervals throughout the project activities to monitor any changes on soil and its conditions.
- Regular monitoring of project activities will be done to identify any soil erosion occurring from the project activities, especially areas close to any slopes.

6.4.2 Dust and Gaseous Emissions

The dust and gaseous emissions from the equipment and vehicles can alter the local air quality of project area. The effect will be localized and site specific and scale of impact can vary depending on the nature and intensity of activities.

6.4.2.1 Dust Emissions

Dust emissions cause the amount of particulate matter in the air to increase, and thus become a health concern. Dust clouds also reduce road visibility, creating a traffic hazard. Dust emissions due to construction and road travel can create dust clouds and increase local PM concentration.

6.4.2.2 Exhaust emissions from generators and vehicles

Two generators of 450HP will be used during the project. Emissions sources would include generators and vehicles used during seismic surveys. NEQS for diesel generators are not available and World Bank or US EPA standards are generally adopted. World Bank environmental guidelines have set a much higher limit for NOx emissions produced by engine driven power plants. The guidelines (World Bank, 1998) suggest NOx emission limits of 2,000 mg/Nm3 at 15% oxygen.

Emissions from vehicles and equipment are generally similar to those produced by diesel generators in terms of the pollutants discharged viz. SO_2, NOx, PM, etc., except that the extent will be considerably lower. Monitoring of air emissions from generators during previous exploration activities shows that the emissions remain within the National Environmental Quality Standards (NEQS). The emissions will also disperse quickly with the prevalent wind currents.

Mitigation Measures

- Dust emissions due to road travel will be minimized by regulating vehicle speeds and watering of the access track.
- Generators and other equipment and vehicles used will be maintained in a good condition to ensure that emissions are kept to a minimum level.
- Well-tuned equipment will be used to prevent avoidable emissions.
- Regular monitoring of all exhaust emissions sources will be done.

6.4.3 Noise and Vibrations

The use of heavy road construction equipment, Vibroseis acoustic energy sources, dynamite charging, and power augers for shallow drilling are potential sources of noise and vibrations that may affect the survey crew, neighboring communities and their livestock.

Noise impacts from 2D and 3D land-based seismic surveys stem from high-energy, low-frequency impulsive sounds generated to image the subsurface, primarily causing temporary disturbance to wildlife, potential behavioral changes, and, in some cases, impacting local communities. While 2D surveys are generally linear, 3D surveys involve dense, widespread, and long-lasting operations, increasing the scale of noise exposure. Measured at a distance of 15m, vehicular traffic is expected to generate 60 to 70 dB(A) of noise, and the diesel generators up to 82 dB(A). Detonation of dynamite in shot holes (20 m deep) will only be heard at the surface like a muffled thud. The length of time the seismic crew spends in any one location is short, with up to 20 to 50 km per day of acquisition possible in good weather conditions. Project activities involving land-based seismic energy sources and associated vehicular movement may generate temporary noise and low-level ground vibrations that could affect nearby sensitive receptors, including schools and healthcare

facilities within the project area. Potential impacts may include short-term disturbance to classroom activities, reduced concentration levels among students, and temporary discomfort for patients, particularly in facilities treating vulnerable groups. However, given that seismic operations are short-duration, intermittent, and conducted at controlled energy levels, the magnitude of impact is expected to be low and localized. No structural damage to buildings is anticipated, as vibration levels will remain within internationally accepted safe thresholds.

Mitigation Measures

- Built up areas such as schools, mosques will be avoided as much as is practical.
- All seismic operations will be carried out only during daylight hours.
- Ensure that Vibroseis and other vehicles have working silencers to muffle noise.
- Workers will be sensitized on hazards likely to be encountered in such a work environment, and trained accordingly.
- Local communities in the vicinity of the seismic operation areas should be sensitized about the project and its possible noise and vibration impacts before commencement, and
- Use of personal protective equipment such as ear muffs will be enforced, and setting up of buffer zones in areas of active seismic survey to keep away unauthorized personnel.
- Blasting will be avoided as much as possible during proposed project activities to provide relief to the sensitive environmental receptors of the area.
- Regular monitoring of noise near communities will be carried out.

6.4.4 Soil and water Contamination

Following activities can cause contamination of soil and water sources of project area.

1. Solid and Liquid Waste
2. Oil and chemical during handling and storage and spills

6.4.4.1 Leaks and spills

Leaks from vehicles, equipment, or storage containers at work sites and handling and transfer operations can cause contamination of soil and water. Depending on the nature and scale of spill or leaks, the impact can be medium to significant and localized. Soil contamination can occur from chemical or oil spills during chemical or fuel handling (loading and storage activities). Runoff from fuel storage area can also carry fuel content and cause soil contamination.

6.4.5 Wastes

Solid and liquid wastes that could be generated during project include domestic waste, removed vegetation, plastics, scrap, packaging, fencing sheets off cuts and plumbing accessories among others. Besides being an eyesore, the waste can also pose a health hazard if disposed of improperly. Plastic waste is of particular concern especially if ingested by livestock, and for its environmental pollution effect. Waste oils and petroleum used in vehicles and exploration machinery may spill or leak on/into the ground, hence polluting the soil or water system within the project area. This may degrade water quality and affect livestock and domestic water users in the project area. Special care will be needed at activity sites in places close to water channels that drain into the Rawal Lake. Table given below elaborates the summary of wastes generation due to proposed Seismic activity and their proposed disposal methodologies.

Parameter	Generation rate	Total Generation/day
Domestic Wastewater	160 Liters per capita per day	160 x 700 = 112,000 Liters
Domestic Solid waste	0.6kg per capita per day	0.6 x 700 = 420 kg

Improper handling of waste and effluents can cause soil and water contamination, risk to local animal life from improper disposal, and degradation of aesthetic quality.

Mitigation Measures

- Waste Management Plan will be implemented.
- At the time of restoration all pin flags, signs, and refuse from seismic lines will be removed.
- Monitoring of all waste handling, transportation and storage activities will be done on regular basis and any non-compliances will be immediately addressed.

6.4.6 Lakebed Configuration

The seismic data acquisition within the Rawal Lake will be limited to the temporary deployment of receiver cables (hydrophones) on the water surface for 2D and 3D survey. The seismic source points will not be located within the Lake but positioned on the nearest accessible land surface in the vicinity of the Lake. The hydrophone cables will be passively laid on the water surface and retrieved upon completion of recording activities. Hence, any form of lakebed disturbance or alteration to sediment structure, bed morphology is not expected to occur.

Mitigation Measures

- All activities will be done with prior communication to and coordination with relevant authorities (CDA).
- Receiver cables will remain surface-floating.
- No anchors, weights, or bed-fixed equipment will be used.
- Aquatic vegetation clusters will be avoided to prevent entanglement of cables.
- Disposal of waste within the Lake will be strictly prohibited.
- Visual monitoring of the entire activity to spot any detachment.
- All equipment and components will be logged and cross checked upon completion of activity.

6.4.7 Impact on Biological Environment

Seismic activities, particularly onshore or nearshore exploration, have the potential to affect both fauna and flora in sensitive wetland ecosystems such as Rawal Lake. The impacts can be direct or indirect, and range from temporary disturbances to longer-term habitat alterations.

6.4.8 Impact on Local Ecology

6.4.8.1 Fauna

- **Disturbance and Behavioural Changes:** Noise, vibrations, and human presence associated with seismic operations can cause temporary **displacement of wildlife**, altering feeding, roosting, and breeding behaviour. Birds, especially migratory species using the lake as a stopover, may avoid areas of high disturbance, potentially reducing their foraging efficiency.
- **Habitat Alteration:** Seismic tracks, vehicles, and temporary infrastructure can lead to trampling of vegetation and soil compaction along shoreline and wetland edges, impacting small mammals, amphibians, reptiles, and invertebrates that rely on undergrowth or wetland margins.
- **Aquatic Species:** Although Rawal Lake is a relatively small and urbanized water body, **vibrations transmitted through the substrate** could disturb fish and invertebrates, potentially disrupting

breeding or feeding patterns. Sudden changes in sedimentation from construction activities may also degrade spawning or benthic habitats.

- **Increased Human-Wildlife Conflicts:** Temporary influx of personnel and equipment may increase disturbance, causing species like wild boar or jackal to move closer to urban areas, raising potential for human-wildlife interactions.

6.4.8.2 Impact on Floral Species

- **Vegetation Damage:** Seismic surveys involving vehicle movement, trenching, or equipment placement can **trample or uproot shoreline and wetland vegetation**, reducing habitat quality for both flora and fauna. Sensitive aquatic plants in shallow areas may be particularly vulnerable.
- **Alteration of Wetland Structure:** Changes in soil compaction, sedimentation, or water flow from seismic operations can **affect plant growth**, especially in marshy or riparian zones. Loss of vegetation cover may reduce nesting and foraging habitats for birds and small mammals.
- **Indirect Impacts:** Disturbance to floral communities may also impact pollinators, invertebrates, and dependent species, leading to cascading ecological effects.

6.4.8.3 Vulnerable Species Considerations

- Rawal Lake supports **Endangered Indian Pangolin (*Manis crassicaudata*)** and several **Vulnerable migratory bird species**. These species are sensitive to noise, human presence, and habitat disruption. Seismic activities may temporarily displace them from critical foraging or roosting areas, affecting their health and reproductive success.

6.4.8.4 Temporal Nature of Impacts

- Most impacts from seismic activities are likely **short-term and localized** if operations are carefully planned. Temporary disturbances may subside once activities cease, and fauna often return to previously used habitats if disturbance is not persistent.
- Long-term impacts may occur if habitat loss or fragmentation is significant or if repeated disturbances occur during critical breeding or migratory periods.

Mitigations Measures

- Conduct seismic activities outside peak migration and breeding seasons; maintain buffer zones around roosting and feeding areas; minimize noise and human presence
- Restrict vehicle movement to designated paths; avoid sensitive habitat zones; implement wildlife monitoring during operations
- Limit heavy machinery near shallow and sensitive areas; avoid sediment runoff; monitor water quality before and after operations
- Confine operations to defined tracks; restrict equipment movement; restore any damaged vegetation post-survey
- Schedule activities to avoid critical periods; enforce strict no-disturbance zones; implement post-activity ecological monitoring
- Implementation of "No Hunting and No Trapping" policy by MOL.
- Burrows or dens will be assumed as active and will be first evacuated by using soft start approach and then cleared in a careful manner.
- Speed limits to be observed to ensure animals do not get hit by vehicles.
- Effective measures shall be taken to protect the environment and control pollution so that restoration of regional ecology is ensured at the time of demobilization

- General awareness of onsite crew will be increased regarding the biological resources.

6.4.8.5 Benthic Habitats and aquatic ecology

Hydrophones are passive receivers. The seismic data acquisition within the Lake will be limited to the temporary deployment of receiver cables (hydrophones) on the water surface for 2D and 3D survey. The seismic source points will not be located within the Lake but positioned on the nearest accessible land surface in the vicinity of the Lake. The hydrophone cables will be passively laid on the water surface and retrieved upon completion of recording activities. Hence, any form of lakebed disturbance or alteration to sediment structure, bed morphology is not expected to occur.

Given the passive and temporary nature of surface-deployed receiver cables and non-deployment of energy sources of water surface, impact on sediment integrity/benthic habitats, and aquatic ecology are not envisaged.

Mitigation Measures

- There will be no anchoring or any other form of lakebed contact to provide support to hydrophones.
- Deployment duration will be minimized; cables will be retrieved immediately after completion of recording.
- If advised by concerned authority, a buffer distance from the shoreline will be maintained to reduce transmitted energy into water.

6.5 Socio-economic issues

All development initiatives give rise to secondary impacts that affect socio-economic receptors in the project area. Socio-economic impacts vary from project to project and are not easily quantifiable. These are consequences of project activities on the human population that alter the ways in which people live, work, interact, relate to one another, organize to meet their needs and generally exist as members of society.

These also include more long-term impacts such as cultural impacts involving changes to the norms, values, and beliefs that guide and rationalize their cognition of themselves and their society. In the past socio-economic impacts of large development projects were mitigated through monetary compensation, or were altogether ignored. However, the importance of these impacts has been recognized, and it is very strongly felt that impacts on communities, cultural activities, local practices, and day-to-day activities have far reaching impacts on their psychological, emotional and social wellbeing, whereby having an effect on their quality of life. This section identifies, assesses and proposes mitigation for potential impacts of the project on key parameters, which define the wellbeing of the communities.

6.5.1 Land Acquisition

Land acquisition will not be needed for the surveys and land permitting will be sufficient. The overall scale of impact is expected to remain negligible with adequate and transparent community outreach process. Land uptake by the project will not be significant and will not have any measurable significant effect.

Mitigation Measures

- A transparent and fair land permitting process will be followed.

- A grievance redressal mechanism will be implemented to address any grievances that may arise.
- The process will be recorded, registered and monitored

6.5.2 Community Disturbance

Community disturbance is likely to become an issue during seismic work due to various field activities such as operation of field equipment which may disturb people in nearby houses due to noise from the equipment being operated. Access roads passing close to settlements will also result in disturbance and annoyance to the local population from movement of vehicles on these access tracks. The aspects leading to community disturbance are discussed below.

6.5.2.1 Mobility and transportation

The project activities may affect mobility of local women. Project personnel will be given gender sensitization briefings and will be instructed to respect local norms, the local culture, particularly in relation to the womenfolk of the area. In connection to the usage of the access track by the women of the area, they will not be restricted in any way, and will be given due right to crossing the road in pursuit of the daily chores, such as collection of fuel wood and fetching water.

Mitigation Measures

- Project vehicles and equipment will not be located randomly in the project area; the drivers will be instructed to consider the possible hindrance from parking the vehicles in such area which could create disturbance to the locals.
- Gender issues will be communicated to the project personnel before start of work

6.5.2.2 Safety and Security

The operations may affect the safety and security of the inhabitants of the areas by affecting road safety, creating conflicts between residents and the contractors, safety and security issues pertaining to the carriage of firearms on the site.

Community sensitive project planning and implementation as prescribed through the recommended mitigation measures will minimize the occurrence of any such impacts.

6.5.2.3 Disturbance from Noise and dust

Communities that are located close to the access road may be exposed to increased dust emissions and noise from seismic camps. If the mitigation measures relating to the control of dust emissions, oil or fuel spills, and project wastes are followed, no impacts will occur. Local complaints of dust emissions shall be noted and addressed immediately. Community complaints shall be duly addressed and appropriately resolved. Impact of noise will be very low to negligible since the site will be located at safe distance from communities (around 500m).

Mitigation Measures

- Communities will be kept informed about all project activities and possible disturbance in advance.
- Although all project drivers will adopt safe driving practices, special care will be taken while passing by the settlements, and will reduce speed as required.
- Any new tracks will be aligned as far away from settlements as possible, even if this results in longer routes.
- If alternative routes exist, existing tracks passing close to settlements will not be used.

6.5.2.4 Interactions with Communities/gender issues

Except for the presence of local people hired for the project, very little interaction is expected between seismic survey crews and local communities. However, the influx of outsiders may affect the mobility of local women. The seismic survey workers will not be confined to one particular area for more than a few days; the interaction will therefore be limited. Moreover, the personnel will be instructed to limit their interaction with the locals to a level which is not perceived as disturbing to them.

6.5.3 Damage to Structures

It is possible that the seismic survey may damage structures owned and used by local people. Damage could be caused if seismic lines are located too close to structures, or if the existing tracks are excessively used by the project vehicles.

Mitigation Measures

To reduce the chances of damage, a safe distance between the seismic lines and the structures will be maintained. In addition, the following mitigation measures will apply:

- If tracks used by local people are damaged, they will be restored / repaired as part of the restoration plan.
- Compensation will be paid for any structures damaged due to the seismic survey.

6.5.4 Archaeological, religious and cultural Sites

No known archaeological sites are present in project area. Religious and cultural sites include mosques, shrines, graveyards etc. Access track shall be located at appropriate distances from such sites to avoid damage to access of local communities to these sites.

All contractors hired for construction or seismic work will be instructed to notify MOL Pakistan immediately if any artifacts, or sites of archeological or cultural value, are found while working in the area, so that relevant departments can be informed.

Mitigation Measures

- All graveyards and shrines and other cultural sites in the vicinity of the project area will be identified before the survey.
- Any site that is located in any project activity or facility will be cordoned off so that they do not get accidentally damage.
- No seismic shooting will take place within a circle of ‘safe’ radius from the sites as defined in EMP. The safe radius will be determined on the basis of the quantity of explosive used.
- Communication will be established with the local spiritual leader and the communities to explain about the activities near the religious sites.
- To reduce the chances of damage, a safe distance between the seismic lines and the sites will be maintained.

6.6 Occupational Health and Safety Hazards

The potential impacts on human health and safety resulting from exploration activities could include: occupational accidents and injuries, vehicle accidents, adverse health effects from dust generation and emissions, wastes from seismic camps, exposure to weather extremes, wildlife encounters, trips and falls on uneven terrain and contact with hazardous materials (e.g. from spills)

etc. The potential for these impacts to occur would be low because of the limited range of activities and number of workers required during exploration. Communities residing near the site are also susceptible to the spread of contagious diseases from the project personnel on site.

MOL will work on specialized occupational health and safety policies for Covid-19 and it will ensure that these policies are regularly updated according to the instructions given by the National Command and Operation Centre, Government of Pakistan.

Mitigation Measures

- Conduct Job Hazard Analysis for all critical jobs.
- Develop and implement a health and safety program for workers and the public, addressing all of the safety issues identified in the assessment and all applicable safety standards.
- Consult with local planning authorities regarding traffic and traffic hazards. Address specific issues in a traffic management plan or in the health and safety program.
- Use appropriate procedures for storage and transportation of blasting equipment and explosive materials, including appropriate signage indicating their locations.
- Safe driving practices will be implemented. Special care will be taken while passing by the settlements, and speed will be reduced as required.
- If alternative routes exist, existing tracks passing close to settlements will not be used.

Table 6.1: Environmental Impacts & Characterization Matrix						
Activity & Source	**Nature of Impact**	**Duration**	**Extent**	**Likelihood**	**Severity**	**Significance**
Noise & Vibrations						
• Generators, Transportation of heavy machinery, materials, equipment & personnel. • Vibration along the road and the seismic activity area. • Vibroseis and dynamite shooting.	Direct	Short term	Local	Medium	Medium	Medium
Dust Emission						
• Dirt tracks by project related vehicles. • Drilling of deep holes. • shooting.	Direct	Short term	Local	Low	Low	Low
Air Emissions						
• Exhaust emissions produced by generators. • Exhaust fumes from vehicles and construction machinery. • shooting	Direct	Short term	Local	Medium	Low	Low
Water Abstraction						
• Water required for seismic operation and other project activities.	Direct	Short term	Local	Low	Medium	Low
Soil and Water Contamination						
• Domestic waste (sanitary and kitchen). • Oil and grease from vehicles and machinery. • Stored fuel, oil and other chemicals.	Indirect	Short term	Local	Low	Medium	Low
Impact on Birds (resident & migratory), Mammals, aquatic fauna, and flora including sensitive species						
• Access roads. • Clearing of vegetation for seismic survey.	Direct	Short term	Local	Low	Low	Medium

Criteria:

		Likelihood frequency				
		Very High (1)	**High (2)**	**Medium (3)**	**Low (4)**	**Very Low (7)**
Consequences / severity	Very high (1)	VH X VH (1)	H X VH (2)	L X VH (3)	L X VH (4)	VL X VH (7)
	High (2)	VH X H (2)	H X H (4)	M X H (6)	L X H (8)	VL X H (14)
	Medium (3)	VH X M (3)	H X M (6)	M X M (9)	L X M (12)	VL x M (21)
	Low (4)	VH X L (4)	H X L (8)	M X L (12)	L X L (16)	VL X M (28)
	Very Low (7)	VH X VL (7)	HX VL (14)	M X VL (21)	L X VL (28)	VL X VL (49)

	VERY HIGH	**HIGH**	**MEDIUM**	**LOW**	**VERY LOW**
LIKELIHOOD / PROBABILITY	• The occurrence during abnormal /unplanned event on monthly basis or • During normal activity, the aspect occurs continuously as a result of normal operating condition	• The occurrence during abnormal /unplanned event is once per quarter or • During normal activity, the aspect occurs twice a month	• The probability of occurrence during abnormal / unplanned events is once every six months or • During normal activity, the aspect occurs once a month	• The occurrence of aspect during abnormal or unplanned event with the probability of occurrence of once per year or • During normal activity, the aspect occurs once in six months	• The occurrence of aspect is only during abnormal or unplanned event with the probability of occurrence less than once per year

7.0 ENVIRONMENTAL MANAGEMENT PLAN

7.1 General

The Environmental Management Plan (EMP) is an important integration document between the various approvals, authorizations and permits issued for specific components and/ or activities of the project.

This EMP outlines the contents of exploration activity. It constitutes contract document for use in the field by the contractor(s) and their personnel as well as by the personnel of MOL Pakistan during operations.

MOL Pakistan, is responsible for implementing the EMP and ensuring that all personnel are informed about the EMP and the requirement to implement the procedures it contains. The EMP is intended as a quick reference for Project personnel and regulators to monitor compliance, and is structured to allow updates and revisions as work continues.

7.2 Objectives of Environmental Management Plan

The Environmental Impact Assessment (EIA) for the proposed project has identified potential impacts that are likely to arise during the project. The EIA has examined in detail both negative and positive impacts at each stage of the project.

For effective implementation and management of the mitigation measures an Environmental Management Plan (EMP) has been prepared. The EMP satisfies the requirement of the Pakistan Initial Environmental Examination and Environmental Impact Assessment Review Procedures, 2000.

The EMP will help MOL Pakistan, the Proponent in managing the environmental impacts of the project, enhance project benefits, and implement standards of good environmental practice. The primary objectives of the EMP are to:

- Assist the proponent in environmental management during the project by providing framework for environmental management w.r.t. project.
- Define the responsibilities of key players including project coordinators, contractors and other players.
- Provide plan for implementation of mitigation measures identified in the EIA, and providing an implementation schedule.
- Define a monitoring mechanism and identify monitoring parameters to ensure that all mitigation measures are completely and effectively implemented.
- Ensure that after completion of Project, restoration of site and rehabilitation work will be carried out
- Identify the required human and technical resources for implementation of EMP.

7.3 MOL Group HSE policy

The MOL Group is committed to ensuring that its technologies, workplace practices, products, and services do not represent hazards to health and put the least possible load on environment. The MOL Group is actively working to decreasing health, safety, and environmental (HSE) risks associated with its activities by creating safe working conditions and constantly improving its environmental performance. The MOL Group, in order to implement its HSE policy, continuously develops its quality-based HSE management system. HSE policy of MOL group is provided in Chapter 3 of this report.

7.4 Scope of EMP

This EMP provides detailed strategy to be implemented for achieving improved environmental performance in the following areas:

1. Environmental Management
2. Hazardous materials management
3. Waste Management
4. Ecological Resources
5. Community Safety
6. Operational Safety

7.5 Structure of EMP

The EMP consists of the following components:

1. Organizational Structure and Responsibilities
2. Implementation of EMP
3. Mitigation Plan
4. Environmental Monitoring Plan
5. Emergency Response and Contingency Plan
6. Waste Management Plan
7. Change Management Plan

7.6 Organizational Roles and Responsibilities

Key players for implementation of EMP will be:

- MOL Pakistan
- Contractors and subcontractors
- EPA

7.6.1 MOL Group

As project proponent, MOL Pakistan will be responsible for ensuring the implementation of the EMP. Project Manager will be responsible for the overall environmental performance of the project. He will monitor the environmental performance of the project to ensure that the project is carried out in accordance with governing legislation, MOL Pakistan's corporate policies and recommendations of this EIA. This will be done through MOL's HSE department that will manage and supervise the environmental management issues during the course of the project.

7.6.2 Contractors and subcontractors

Contractors will be responsible for implementation of, or adherence to, all provisions of the EMP and with any environmental and other codes of conduct required by MOL Pakistan. Overall responsibility for environmental performance of the operation will rest with the senior management of the contractors. Site managers of the contractors will be responsible for the effective implementation of the EMP.

7.6.3 EPA

EPA as regulatory body has the responsibility to ensure project's compliance with local environmental laws is always ensured by the proponent. Under section 18 of the Pak EPA (IEE and EIA) Review of

Regulations 2000, EPA has the powers to conduct surprise inspections or visits of the project area to observe the status of environmental compliance of the project.

7.7 Implementation of Environmental Management Plan

The EMP will be implemented during all activities of the project to meet the following requirements.

7.7.1 Planning and Design of the Proposed Operation

1. Design of the Operation

Design of the operation includes the selection of the data acquisition and exploration technique and other ancillary operations discussed in the EIA. Following approval, if any design parameter is changed the proponent will assess the environmental impacts that may arise from such change(s). If the impacts are found to be different and in excess of those mentioned in the report, MOL will develop mitigation measures to minimize these impacts and seek approval of the required change from Environmental Protection Agency.

2. Approvals

Obtaining Environmental Approval from EPA does not relieve the proponent of other obligations and hence MOL Pakistan and the contractor will obtain all relevant clearances and necessary approvals required by the government prior to commencing the survey operation.

3. Contractual Provisions

The requirements of this EIA in terms of environmental mitigation shall be made part of contractual agreement with the contractor.

7.7.2 Implementation of the Seismic Survey

1. Co-ordination with Stakeholders

MOL Pakistan will ensure that co-ordination with the project stakeholders and regulators on environmental and social matters, as required by the EMP are maintained throughout the operation.

2. Environmental Management Systems

MOL Pakistan and the contractors will ensure that the mitigation measures mentioned in the EIA are adhered to and HSE Management System are implemented during the proposed project. The contractors will abide by the relevant contractual provisions relating to the environment.

3. Monitoring

MOL Pakistan and its contractors will ensure that monitoring of the project activities is carried out according to the monitoring program given in the EMP.

4. Emergency Procedures

MOL Pakistan / seismic contractor will prepare contingency plans to deal with any emergency situation that may arise during the exploration activities e.g. fire, major oil spills, medical evacuation and communicate these to the regulatory agencies if required by these agencies.

5. Training

MOL Pakistan, its contractors and suppliers will be responsible for training of staff. MOL Pakistan and its contractors and suppliers will be responsible for providing induction to their staff members on the EIA, the EMP and their implementation provided in the EMP.

For the project, MOL Pakistan will develop training matrix to determine the nature and type of trainings and target workforce. Technical and non-technical trainings will be provided to the staff.

Toolbox talks will be carried out before the start of the work. HSE Induction is provided to all the staff. ERP is developed and emergency drills are carried out on regular basis and frequency.

6. Training programme

A recommended program of environmental training is provided below to increase awareness among project personnel for environmental risk management.

Table 7.1: Proposed Program Environmental Trainings

Staff	Contents
Drivers	➢ Road safety ➢ Road restrictions ➢ Vehicle restrictions ➢ Waste disposal ➢ Socio-economic sensitization
Survey Crew	➢ Wildlife sensitivities ➢ Communication of environmental problems to appropriate officer ➢ Waste disposal ➢ Socio-economic sensitization
Mechanics and Vehicle Repair Personnel	➢ Environmental control of vehicles and equipment ➢ Waste disposal ➢ Socio-economic sensitization
Restoration and Clean-up Team	➢ Restoration requirements ➢ Socio-economic sensitization

7. Communication and Documentation

For effective monitoring, management and documentation of the environmental performance during the operation, environmental matters will be discussed during daily meetings held on-site. Environmental concerns raised during the meetings will be mitigated after discussions between MOL Pakistan and the contractors. Any issues that require attention of MOL Pakistan higher management will be communicated to them for action. MOL Pakistan and its contractors will ensure that the communication and documentation requirements specified in the EMP are fulfilled during the project.

8. Restoration

MOL Pakistan will ensure that the restoration of the site after the end of seismic activities is carried out according to the requirements of the EIA and EMP.

7.7.3 Minimum Distances

The EIA recommends minimum distances to be maintained from environmental features including communities, water sources etc. These minimum distances are provided in Table 7.2. The contractor will ensure that these minimum distances are adhered to during the project and inspected by HSE Advisor.

Table 7.2: Minimum Distances from Environmental Features

Item	Distance
New access tracks	▪ 50m from all surface water sources ▪ 100m from cultural sites (including graveyard and shrines) ▪ 100m from settlements
Installation of new wells	▪ 500m from existing wells
Up-holes /Shotholes	▪ 50m from water wells ▪ 50m from houses ▪ 100m from drainage channels

	▪ 50m from reptile holes ▪ 50m from bird nest

7.7.4 Maintaining Contact with Local Communities

MOL Pakistan will strive to maintain contact with major stakeholders, particularly local communities, through all stages of project implementation. This is necessary to engender a sense of community in the project proponents and to ensure that the community's concerns are responded to at every stage. The purpose of such contact is to develop a relationship of trust with the local communities, keeping in mind that the exploration may lead to the development of long-term interests in the region.

MOL Pakistan will keep communities informed of work schedules and of the nature of work being undertaken. They will also take advantage of local knowledge regarding any possible sensitive sites (such as sources of water), or sites of historical or cultural interest, that are located in close proximity to seismic operations. These sites will not be disturbed during the course of the project.

7.8 Mitigation Matrix

A Mitigation Management Matrix is provided in Table 7.3. The Mitigation Management Matrix will be used as a management and monitoring tool for implementation of the mitigation measures required by the EIA. The matrix lists down the following:

- The mitigation measures recommended in the EIA;
- The person/organization directly responsible for adhering to or executing the required 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.

It is highlighted that although responsibilities for executing and monitoring mitigation measures have been delegated to different persons/organizations, MOL Pakistan will hold the primary and overall responsibility for ensuring full implementation of the EMP.

Table 7.3: Mitigation Matrix for Seismic Activities

No.	Mitigation Measures	Execution	Monitoring	Action	Timing
Soil Erosion	Clearing of vegetation will be kept to a minimum. Access tracks will weave around patches of vegetation and trees to avoid unnecessary clearing of vegetation.	SC	MOL	Monitor land clearing activities	During land clearing
	The width of lines cleared for vibroseis will be limited to 4m to minimize clearing of vegetation and disturbance to soil.	SC	MOL	Randomly check width of seismic lines	During line preparation
	The number of access routes used will be kept to a minimum and road travel will be minimized.	SC	MOL	Approve access tracks	Prior to track preparation
	Preparation of new access tracks will be minimized and use of existing routes will be preferred as much as possible. Where improvement of existing tracks or development of short lengths of new tracks is unavoidable the width of the access track will not exceed 4 m.	SC	MOL	Supervise preparation of access tracks and randomly check width of access track	Prior to and during track preparation
	Off-road travel will be strictly prohibited and observance of this will be monitored during the seismic activities	SC	MOL	Approve access track and monitor off road travel	During entire operation
	Photographs will be taken before any activity to record the conditions of work sites, roads and seismic lines at locations that are likely to undergo soil erosion. Similar photographs will be taken at intervals throughout the survey to monitor any changes and soil conditions	SC	MOL	Supervise and ensure compliance	During the entire project
Soil & Water Contamination	All fuel and oil storage areas will have a concrete pad / suitable containment underneath to prevent soil contamination in case of leaks or spills.	SC	MOL	Ensure provision of concrete pad	During camp set-up and project activities
	All fuel tanks will be properly marked to highlight their contents.	SC	MOL	Check signs	During the entire operation
	Fuel and oil storage areas will have secondary containment in the form of concrete or brick masonry bunds.	SC	MOL	Check containment volume of the bunded area	At the time of construction
	Fuels tanks will be daily checked for leaks and all such leaks will be plugged immediately.	SC	MOL	Inspect fuel tanks for leaks	During the entire operation
	The soil contaminated from minor and moderate spills will be removed and handed over to waste contractor for safe disposal.	SC	MOL	Check compliance	During the entire operation
	The soil contaminated from major spills will be removed and handed over to waste contractor for safe disposal.	SC	MOL	Monitor and supervise special treatment, if any	During the entire operation

Table 7.3: Mitigation Matrix for Seismic Activities

No.	Mitigation Measures	Execution	Monitoring	Action	Timing
	A spill prevention and contingency plan will be prepared to deal with moderate and major spills.	SC	MOL	Study and examine the plan and identify any flaws, if any before its approval	Before the commencement of project
	Used oil and vehicle related waste will be transported to local contractors for recycling.	SC	MOL	Check compliance	During the entire operation
	During fuel and oil transfer operations such as re-fueling vibroseis through a dedicated fuel vehicle, drips and spills will be avoided and drip pans will be used.	SC	MOL	Ensure provision of drips pans, provide training on safe re-fueling practices, monitor oil or fuel stains	During the entire operation
Use of Water	Local commercial hydrants having sufficient yield will be used during seismic operation	SC	MOL	Check local demand and water abstraction	During entire operation
	For all water obtained from local wells, the owner will be paid for water abstracted at the market rate and as per mutual agreement.	SC	MOL	Check compliance	During entire operation
	The quantity of water used during seismic and camp construction operation will be kept to the minimum by taking prudent water conservation measures on site.	SC	MOL	Monitor water consumption and advise water conservation measures	During the entire operation
	A complete record of water consumption during seismic and construction of camps will be maintained.	SC	MOL	Check records	During the entire operation
Ambient Air Quality	All equipment and machinery and vehicles used during seismic operations will be maintained in a good condition to ensure that emissions are kept to a minimum level	SC	MOL	Check maintenance logs	During the entire operation
	During seismic operations vehicle speeds will be regulated and monitored to minimize dust emissions	SC	MOL	Set and monitor speed limits	During the entire operation
	During seismic activities dust emissions due to road travel will be minimized by regulating vehicle speeds and watering of the access track (where required)	SC	MOL	Set and monitor speed limits. Monitor sprinkling of access track	During the entire operation
Noise	All equipment, machinery and vehicles will be maintained in a good condition to ensure that noise from them is kept to a minimum level.	SC	MOL	Monitor noise levels	During the entire operation
	The use of horns by project vehicles will be minimized. The use of pressure horns will not be allowed.	SC	MOL	Train drivers, check vehicles and record non-compliances	During the entire operation
	Generators will be kept within enclosures to minimize dispersion of noise.	SC	MOL	Check compliance	During the entire operation

Table 7.3: Mitigation Matrix for Seismic Activities

No.	Mitigation Measures	Execution	Monitoring	Action	Timing
	Movement of all project vehicles and personnel will be restricted to within work areas	SC	MOL	Advise all drivers, and monitor non-compliances	During the entire operation
Lakebed configuration	Receiver cables will remain surface-floating. No anchors, weights, or bed-fixed equipment will be used.	SC	MOL	Check compliance	During activity on water surface
	Aquatic vegetation clusters will be avoided to prevent entanglement of cables.	SC	MOL	Check compliance	During activity on water surface
	Disposal of waste within the Lake will be strictly prohibited.	SC	MOL	Check compliance	During activity on water surface
	Visual monitoring of the entire activity to spot any detachment.	SC	MOL	Check compliance	During activity on water surface
	All equipment and components will be logged and cross checked upon completion of activity.	SC	MOL	Check compliance	During activity on water surface
Flora	Avoid core conservation and sensitive habitats during survey design.	SC	MOL	Check areas	Prior to camp setup or construction
	Crew personnel while working along seismic lines will concentrate within a corridor of 4m.	SC	MOL	Supervise line clearing operation	Before and During land clearing operation
	Use of local wood as fuel will be prohibited	SC	MOL	Check compliance	During entire operation
	The number of access routes used will be kept to a minimum and road travel will be minimized.	SC	MOL	Approve access tracks and check road travel	During the entire operation
	Preparation of new access tracks will be minimized. Where improvement of existing tracks or development of short lengths of new tracks is unavoidable the width of the access track will not exceed 4 m.	SC	MOL	Supervise preparation of access tracks and randomly check width of access track	Prior to and during track preparation
	Off-road travel will be strictly prohibited and observance of this will be monitored during the operation.	SC	MOL	Approve access track and monitor off road travel	During entire operation
	The cutting of trees will be minimized. If clearing of vegetation is unavoidable the rootstock will be left in place to encourage better regeneration of vegetation.	SC	MOL	Supervise land clearing activities	During land clearing
	Earthen pits for preparation and disposal of bentonite mud will be located in an area where minimum vegetation clearing is involved	SC	MOL	Check compliance	During the entire operation
Fauna	Hunting, feeding, trapping or harassment of birds and animals will be strictly prohibited.	SC	MOL	Check compliance	During the entire operation

Table 7.3: Mitigation Matrix for Seismic Activities

No.	Mitigation Measures	Execution	Monitoring	Action	Timing
	Vegetation clearing and land uptake during all operations will be minimized.	SC	MOL	Check compliance	During the entire operation
	Clearing of vegetation and the cutting of trees will be minimized.	SC	MOL	Check compliance	During land clearing
	Off-road travel will be strictly prohibited and observance of this will be monitored during the operation.	SC	MOL	Approve access track and monitor off road travel	During entire operation
	Drivers will be instructed to keep a watch for domestic animals or wildlife in order to minimize the risk of road accidents	SC	MOL	Train the drivers and check compliance	During the entire operation
	Seismic deep holes and up-holes will avoid disturbing live bird nests and small mammal and reptile holes.	SC	MOL	Check compliance	During seismic
	Food wastes will not be left in the open.	SC	MOL	Check compliance	During the entire operation
	All mitigation measures recommended for waste management, noise and air emissions will be adhered with.	SC	MOL	Check compliance	During the entire operation
	Night traveling will be avoided.	SC	MOL	Check compliance	During the entire operation
	Compressors and vehicles will be maintained in good condition and provided with muffles to reduce noise	SC	MOL	Check maintenance logs and ensure the provision of muffles	During the entire operation
	For preparation of access tracks, routes involving minimum clearing of vegetation will be selected.	SC	MOL	Check development and clearance of access track	During the entire operation
	Clearing of dense patches of vegetation will be avoided	SC	MOL	Check development and clearance of access track	During the entire operation
	The time period of operation near surface water bodies will be minimized by good planning and efficient working to reduce the time period of disturbance to bird species	SC	MOL	Check proposed time of operation and plan	During the entire survey
Social issues	All community grievances will be recorded and maintained in a Community Complaint's Register.	SC	MOL	Check the provision of complaint register and its access for communities	During the entire operation
	In order to keep nearby local communities informed of the progress of the operation, communication channels will be maintained between local community leaders and community elders and MOL	SC	MOL	Check compliance	During the entire operation
	Labor from local communities will be recruited equitably (depending on availability of required staff / labor). The employment procedures will be transparent.	SC	MOL	Check compliance	During all operations

Table 7.3: Mitigation Matrix for Seismic Activities

No.	Mitigation Measures	Execution	Monitoring	Action	Timing
	Strict compliance will be observed with the EMP and MOL's HSE guidelines.	SC	MOL	Check compliance	During all operations
	Drivers will be trained in responsible and safe driving practices; safe speed limits for vehicles will be followed.	SC	MOL	Provide training and monitor compliance	During the entire operation
	All project personnel should be screened for communicable diseases prior to induction.	SC	MOL	Check medical records	Prior to start of different operations
	All project facilities, seismic lines and access roads will maintain the following minimum distances from cultural, Religious and archaeological sites; unless community demands greater distance from e.g. graveyards or mosques. - Seismic lines – 50 m - Access roads – 100	SC	MOL	Check distances	During the entire operation

Note: SC: Seismic Contractor

7.9 Emergency Response Plan (ERP)

As part of MOL Pakistan Emergency Response Manual, an emergency response plan is required to develop for all activities to be undertaken by MOL Pakistan under its direct control. Accordingly, Emergency Response Plan (ERP) will be developed for the project and implemented.

The ERP will identify the roles and responsibilities of all personnel involved in handling of emergency situation by means of a bridging document between MOL Pakistan site management and contractor's emergency response procedures.

The ERP will also highlight reporting requirements and necessary actions to handle emergency situation during exploration and associated activities in close coordination with contractor's emergency response procedure and MOL emergency response manual.

The ERP will be implemented under following scenarios:

a. Response to Medical Emergencies
b. Response to Road Vehicle Accident
c. Response to Fire and Explosion (use of explosives)
d. Response to Fire and Explosion (Camp)
e. Response to Condensate / Diesel Spill
f. Natural Disasters (earthquake and floods)
g. Security emergencies

MOL Pakistan Emergency Response Plan is attached as Annex-II.

7.10 Health, Safety and Environmental (HSE) plan

HSE plan (Table 7.4) outlines mitigation measures and best management practices. The Plan should be implemented to ensure that no significant adverse worker's health and safety issues arise from activities associated with the Project. The Plan will apply to all MOL personnel, employees and contractors for the project. The plan is based on following objectives;

- Provide adequate worker training.
- Use proper personnel protective equipment.
- Follow fire protection measures.
- Arrange availability of appropriate emergency response, rescue, and first-aid personnel and services.

Table 7.4: HSE Plan

Aspect	Safety Guidelines
Training	Survey employees should be trained for the work they carry out and be familiar with the manufacturer's safe operating procedures (SOPs) and guidelines in the instruction manuals that accompany the survey equipment and tools they use
Tracking System	• Develop a tracking system to record where employees are working each day. • Record the planned survey routes or work sites on a centrally located map or white board at the camp or base. • Location updates including changes in plans should be called in and recorded.

Table 7.4: HSE Plan	
Aspect	**Safety Guidelines**
Communication System	• Develop a communication call-in system to maintain contact with employees. • Employees should carry functioning communications equipment appropriate for the area.
Emergency Response Plan (ERP)	• Survey crews should acquire induction on ERPs that address site specific risks and hazards and potential injuries associated with specific surveys, terrain and the degree of remoteness. • When a contractor's employees are based at a project site, the ERP for survey crews should be integrated with the exploration project ERPs.
Tool and Equipment Check	• Before departing for work, each survey crew should check their equipment. They should have: (a) all tools, fully charged communication and navigation equipment with spare batteries; (b) required personal protective equipment (PPE), as appropriate; (c) suitable clothing for the weather and potential changes; and (d) appropriate survival kits and first aid kits. If conditions are dry, carry fire suppressant materials when using tools or survey equipment that could start a fire (e.g., chainsaw, small generator or electrical equipment).
Transportation	• Crews should perform an inspection check of their mode of transportation to make sure it is in good working order and all equipment is present.
Supervision	Workers should receive appropriate supervision in the field while performing survey.
Working Alone	Develop and implement the required SOPs if it is necessary for employees to work alone.
Weather related risks	• Be fully prepared for the local weather and climate. • Carry a suitable survival kit, extra water and food, etc. • Wear appropriate clothing and carry rain gear and extra clothing in case you become stranded and must spend a night away from camp. • Lightning can be a serious risk depending on the location and especially when carrying out electrical surveys.
Personal Protective Equipment (PPEs)	• Required PPE will vary depending on the risks and hazards of type of survey and drilling procedures and the terrain. • Safety glasses are required. It is usually advisable to wear high visibility vests. • Hearing protection may be required (e.g., when using a chainsaw). • Wear gloves to protect hands from cuts and infections.
Foot Wear	• Wear leather boots that provide good ankle support and traction appropriate for the terrain. • It is advisable to wear waterproof boots when working in extremely wet areas and heavy, insulating boots during very cold weather. • As stable footing is very important, appropriate high quality boots may be considered PPE by some companies.
Footing and Balance	• Carrying heavy equipment or samples hinders good balance. • Be vigilant when traversing cut lines and/or climbing over logs or debris.

Table 7.4: HSE Plan	
Aspect	**Safety Guidelines**
	• Since some surveys are carried out along straight lines, it may not be possible to avoid difficult and sometimes dangerous terrain (e.g., cliffs, swamps). • While trees and brush are usually cut down to ground level, stubs or "pungies" may remain if the ground was snow-covered when the lines were cut. It is easy to trip over them and get cut or impaled, especially when carrying a heavy pack or surveying equipment.
Fire Risks	• Carry appropriate fire extinguishing equipment, including: a fire extinguisher, extinguishing powder, water and/or a small shovel when using gasoline powered machinery (e.g., chainsaws, generators, brush cutters, power augers). • Keep the exhaust area clear of vegetation and place hot machinery on bare rock so it will not start a fire. Always observe fire bans.
Wild Animals and insects	• Where wild animals are a hazard, be trained in wild animal safety procedures and carry appropriate deterrents. • Be aware of potential fauna at ground level. Watch out for signs of bees or wasps which often build nests in the ground. • Do not place your hands where they might be bitten by a venomous snake or stung by scorpions or insects. • When working in insect infested areas and using insect repellent, avoid applying it to your eyes and mouth. • Do not overuse repellent as it is absorbed through the skin. • Be vigilant when wearing head nets as they restrict your range of vision. • Follow medical advice regarding the use of anti-malarial medications and avoid mosquito bites when working where malaria and other serious insect-borne diseases are present.
Audio entertainment equipment	• In general, it is not good practice to allow employees to wear personal electronic music devices with headphones or earplugs (including iPods) when working. • Headphones or earplugs interfere with the ability to clearly hear directions via radio communication, noise due to machine malfunctions and dangerous wildlife, etc.
Lightening Safety	Survey crews need to be aware of the weather around them while working. When a storm approach: • Immediately cease all operations. When thunder is first heard, shut off all power sources and disconnect all wires and cables from the instruments. • Do not attempt to collect any wires or cables. Lightning can travel more than a kilometer along wires. • Lengths of wire or large loops may have very high voltages induced by a lightning strike a long distance away; this is not only dangerous; it can also destroy equipment. • Move all personnel and easily portable instruments to a sheltered location, preferably a safe shelter or a field vehicle. • If it is necessary to remain outdoors, do not seek shelter under a tall tree.

Table 7.4: HSE Plan	
Aspect	**Safety Guidelines**
	• If working on high ground, attempt to move to a lower elevation. • Avoid areas of tall metallic objects (e.g., power lines, antennas etc.).
Seismic Survey	• Employees/workers who carry out seismic surveys should be competent and fully trained. • If explosives are used, obtain appropriate permits and make sure blasters have proper certification. • Most shallow holes used to contain explosives are dug by hand so employees should be trained to use their tools safely and keep them in good working order. • Wear appropriate PPE when using tools and equipment, which may include ear protection from noise as well as eye protection, good footwear and high visibility vests. • Develop a protocol to make sure the area is clear before a blast takes place.
Activity Completion	• When an activity is completed, remove all equipment, including wires. • Fill in holes if they present a future tripping hazard to workers or to animals.

7.11 Environmental Monitoring Program

The Environmental Monitoring Plan will be used as a management and monitoring tool for implementation of the mitigation measures identified by the EIA. The monitoring matrix lists down:

- The parameters, which will be monitored to ensure compliance with the mitigation measures;
- The person / organization directly responsible for adhering to or executing the required mitigation measures and monitoring adherence to the mitigation measures;

The timing at which the mitigation or monitoring has to be carried out MOL Pakistan will hold primary and overall responsibility for ensuring full implementation of the EMP. The Environmental Monitoring Plan has been provided for the proposed project activities in Table 7.5.

Table 7.5: Environmental Monitoring Plan						
S. No.	**Monitoring Aspects**	**Locations**	**Parameters**	**Frequency**	**Responsibility**	**Document**
1	Air quality	Survey site	CO, NO, NO_2, SO_2, PM	Once during the project	Contractor	Laboratory test Reports
2	Exhaust Emissions	Vehicles, Generators, Fuel operated Machinery	Smoke, CO, Noise	Once during the project	Contractor	Laboratory test Reports
3	Noise	Along Seismic Survey lines & near communities	Noise Level (dBA)	During routine monitoring	Contractor	Record of observations;
4	Solid Waste	Project site	Solid waste collection, storage,	During routine monitoring	Contractor	Complete record

			transportation and disposal			
5	Occupational Safety	Survey sites, project roads	HSE Records, Incidents and injuries	During routine monitoring	Contractor	Record of observations.
6	Ecology	Survey sites, project roads	Animal trap, injury, mortality	During routine monitoring	Contractor/MOL	Record of observations.

7.12 Waste Management

7.12.1 Sources of Wastes

The main sources of wastes at field locations are seismic activities, and maintenance activities. Waste is classified as Hazardous and Non-hazardous by identifying the physical, chemical and toxicological properties. A system to categorize wastes streams according to their health and environmental hazards is then developed. Designated drums, containers, bins etc. with specific labels are placed as collection methods at the wastes generating areas. Color coding of drums, containers, bins etc. for various type of wastes is done.

7.12.2 Waste Management Plan

MOL Pakistan Waste Management Plan provided at Annex-III will be implemented.

7.13 Change Management Plan

7.13.1 Change in Operations

Any change in the project design or project operation if required, will be made in relevance to the EMP and all the impacts associated with changed process will be either similar to the existing impacts and if different, will be assessed and included in the mitigation management plan. This has, on the basis of nature of process change, been distributed into three categories.

7.13.2 First-Order Change

Change leading to a significant removal of any operation from the project described in the chapter on description of project of this report and consequently requires a reassessment of the environmental impacts associated with the changes. In such an instance, updated environmental impacts of the proposed change will be sent to EPA for approval.

7.13.3 Second-Order Change

Change that entails project activities not significantly different from those described in the EIA report, and which may result in project impacts whose overall magnitude would be similar to the assessment made in this report. In case of such changes, the environmental impacts of the activity will be reassessed. Additional mitigation measures if required will be identified and documented for being reported to EPA for their record.

7.13.4 Third-Order Change

Change that is of little consequence to the EIA findings. This type of change does not result in impact levels exceeding those already assessed in the EIA report; rather these may be made onsite

to minimize the impact of an activity. The only action required in this regard will be to record the details of process change in the record register.

7.13.5 Change in Record Register

A record register will be maintained at project site at the start of project activities. All the changes to be made will be recorded in this register. This will assist in the step-by-step environmental monitoring and decision-making. Record register will be the responsibility of HSE department, and will be used internally.

7.13.6 Change in EMP

Changes in project design necessitate changes in the EMP. In this case, following actions will be taken:

- A meeting will be held between project management and contractor, to discuss and agree upon the proposed change to the EMP.
- Based on the discussion during the meeting, a report will be produced, which will include the additional EMP clauses and the reasons for their addition.
- Additional EMP clauses will be added to the original EMP as a second volume which will be distributed to the relevant project personnel and contractor.

8.0 Findings, Recommendations & Conclusion

The Environmental Impact Assessment (EIA) Study provides an assessment of the potential environmental and social impacts associate with the 2D and 3D Seismic survey activities proposed in Rawla Lake Catchment area, Margalla Block.

The 2D and 3D seismic survey activities are planned in Rawal Lake and its catchment area. The proposed survey will be conducted using both Vibroseis and dynamite as sound energy sources. Selection of the technique will depend on technical aspects, on accessibility, and environmental considerations. The general description of these activities is presented in Section 2 of this report.

Since the project activities will be located in sensitive area, the environmental and social issues related to local ecology, communities, and hydrology have been assessed and a management plan for same has been provided to ensure the impacts remain within acceptable limits.

The report includes a comprehensive environmental management plan to be owned and implemented by MOL Pakistan during the time frame of the project as a tool to enable sustainable exploration activities.

8.1 Summary of Findings

Assessment of environmental aspects and screening of potential impacts from proposed exploration activities provides following observations:

- Seismic surveys can reveal potential oil and gas reservoirs in the area which can be manifested to expand the oil and gas resources of the country.
- The project area has been thoroughly studied; however, any additional environmental data gathered during these operations will be extremely worthwhile.
- The potential direct benefits to the region and the country are foreseen from the exploitation of natural resources in the form of financial income and local business opportunities. Secondary indirect benefits are a potentially increased standard of living and better education, social services and amenities. All of which can potentially help raise awareness of the importance of environmental protection in the area.
- Rawal Lake being a sensitive area, requires careful planning and execution of project activities to protect the sanctity of the area.
- Protection of green cover and vegetation in the area is important and project planning must address this in its layout and designs. This is possible as 2D and 3D seismic survey design are flexible in its layout such that dense vegetation patches may be protected.
- Noise and vibration associated with data acquisition can impact local wildlife, hence planning and project timing is important. The survey schedules need to factor in the breeding, and nesting windows of the local wildlife.
- Land and water contamination from project activities is possible during fuel and chemical handling activities including storage. This is avoidable through careful implementation and monitoring.
- The impact on project area communities is possible during movement and transportation activities. Planning and scheduling of these activities in a sensitive manner can address this issue and prevent undesirable impacts.
- Impacts assessed to be of high importance are the risk of spills and disposal of waste material.
- Mitigation measures exist for these aspects of the operations and it is possible for operations to proceed without any significant long-lasting impacts to the macro-environment.

- Land permits will be acquired for areas of proposed seismic activities and compensations will be provided for the affected amenities in the area
- General impacts from exploration activities such as noise, wastewater generation and impacts from human activity would occur when exploration activities begin in the area. However, the impacts are manageable and can be reduced down to acceptable limits upon implementation of EMP by responsible on-site staff and supervisor.
- Occupational Health and Safety risks are likely to arise from exploration activities, the management responsibility of which lies with HSE Officer/manager and site supervisor. MOL Pakistan HSE Policy and general IFC EHS guidelines will be followed in this regard to ensure safety of staff during operation on site.
- Ecology of the microenvironment will be protected as priority. Vegetation will only be removed from seismic lines. Sites will be restored to the original landform when the activities come to an end.
- MOL Pakistan will undertake all measures to protect the local ecology, drainage pattern, and social aspects of relevance to the project.
- Sustainable exploration activities are possible under the condition that mitigation measures and EMP is being adhered to in its essence during project course.

8.2 Recommendations

A number of practical measures have been suggested in the EIA report related to the planning and execution of the exploration activities, which should be adopted in the project plans. In order to ensure that the mitigation is successful and impacts are minimized, the focus should be on ensuring that operations follow the established procedures, training of key personnel in oil spill response is carried out and drills/exercises are run to ensure that all personnel receive basic environmental awareness training and contingency plans are in place to deal swiftly with any potentially polluting incidents. The monitoring of project activities will ensure that the environmental management measures proposed in the report are adopted along with good industry practices. The ultimate objective is to ensure that the impacts remain as low as reasonably practicable.

8.3 Conclusion

In conclusion, there is obvious dedication by MOL Pakistan to carrying out these activities to a high environmental standard. Given the current operational commitments and proposed mitigation measures, it is considered that the proposed 2D and 3D Seismic Exploration Survey activities can be undertaken without significant impacts to the project's macroenvironment.

The Study therefore recommends that the EIA Report may be approved with the provision that the suggested mitigation measures will be adopted and the Environmental Management Plan will be followed in letter and spirit.

ANNEX I: EXPLOSIVE SHOOTING PROCEDURE

Title: Magazine Entrance procedure

Application: Magazine Accountant & Loading Crew

Purpose

To ensure the safety of personnel that visits the Explosive sto rage area and the rules implementation for magazine area.

Scope

This document describes the curr ent policy and practice of BGP (Pakistan)

PPE & Other Requirements

Any person entering Magazine camp must have the following perso nal protection equipment:-

- Anti-static clothes
- Footwear with good soles
- Magazine Pass

Procedure for Visitors:

- Any visitor going to magazine ca mp will be given Magazine pass from HSE Office.
- On Arrival at Magazine camp Magaz ine pass is provided to securi ty staff for authorisation.
- Security staff will enter the na me in security record register.
- All metallic & prohibited items(Jewelery,Watch,Mobile,Belt and any other metallic or material having ignition potential) is kept at main security re ception.
- Security staff will scan the body by metallic scanner.
- Security staff will allow visito r under supervision of Magazine accountant.
- Gate will be locked after entrance by security.
- Visitors have to release static charge by touching anti static p ole and dip shoes in water pot for static charge removal befo re entering in storage area.
- Only Three persons at one time are allowed in storage area.
- While coming outside Security st aff will scan and check the vis itors properly.
- After visit security staff will lock the magazine entrance.
- Signature for the visit is kept by security staff and magazine pass is returned.

Procedure for Explosive Handlers:

- Authorized person list signed by party chief is provided to sec urity staff.
- Security staff checks persons according to the list.
- Only authorized persons are allowed under supervision of Magazi ne accountant.
- Workers have to release static c harge by touching anti static p ole and dip shoes in water pot for static charge removal befo re entering in storage area.

Title: Explosive Issuance & Return Procedure Section: Explosives

Application: Magazine Accountant & Loading Crew

PURPOSE:

To outline the basic requirements for the proper issuance and r eturning of Explosive and to keep the record properly.

SCOPE:

This document describes the current policy and practice of BGP, Pakistan.

ORGANIZATIONAL UNITS AFFECTED:

Magazine staff & Loading crew

PROCEDURE:

- Magazine Accountant will receive Explosive and Detonator stock form Biafo industries truck after counting & cross check with the letter provided.
- Chief geophysicist will cross check the letter and the amount o f explosive received.
- For Daily Usage Magazine accountant will issue explosive as per field requirement to Laoding Foreman.
- Each Loading Foreman has two Veh icls.One for Dynamite & other f or Detonator.
- Magazine accountant will note all details and quantity issued t o Laoding Foreman in his record register.
- Loading Foreman will issue to loading Foreman on Line and maint ain the record as per the format.
- After field work completion Laoding Foreman will return the rem aining to Magazine and Magazine accountant will update the returning record.
- Record will be maintained in Magazine accountant Register.
- Daily Usage Report of Explosive is submitted to Geo Office at e nd of Day Shift.
- Chief Geophysicist cross check the quantity and usage in Field area.
- Chief Geophysicist Cross check the record on random basis.

RECORD FOTMATS:

- Record is maintained on the below attached formats.

Title: Explosive Misfire Procedure

Section: Explosives ***Application: Shooters***

MISFIRE PROCEDURE

To ensure the safety of personnel in the event of a primed char ge failing to expl ode when fired.

GENERAL INFORMATION

Definition of a Misfire

A shot shall be deemed a misfire if it fails to explode when th e shot has been taken once while using the correct blaster unit and shooting procedure.

Misfire Prevention

Most misfires occur as a result of a faulty firing circuit. They can be avoided by following correct pre-loading and shooting procedures. It is better to prevent a misfire by following correct procedu res than to have to implement this misfire procedure.

Every effort must be made to avoid misfires by carefully follow ing the correct pre-loading Procedures. Charges must be completely screwed together with no gaps between charges, and caps completely seated within the detonator well.

Continuity testing must be carried out before the charges are connected to the Firing line.

Misfires occasionally result because of defective explosive cha rges but this is very rare.

If a shot fails to fire it must always be assumed that it is dangerous, and an uncontrolled detonation could occur at any time within 5 minutes of the shot being fired from the blaster unit.

In the event of a misfire the following procedure must be follo wed.

MISFIRE HANDLING

1. Disconnect the firing line from the blaster and short the wi res together.
2. Inform the observer.
3. Wait 5 minutes.
4. The circuit should then be tested, using a safety galvanomet er. It is most important that all testing is done from a safe place (preferably the firing point) and that all pe rsonnel are safe from any possible explosion which might occur during testing.
5. If a fault is discovered, one person may then approach the s hot point and check the connections between the firing line and the detonator leads, and remedy any defect found. The firing line must remain disconnected from the bla ster unit while p ersonnel are i n the shot point area. It must be shorted at all times.

6. Keep the shot point areas clear except for the person conduc ting the firing circuit test.
7. When the circuit has been tested and the shot point area is clear of all personnel, a further attempt to fire the shot can be made. Connect the firing line to the blast er unit and follow normal shooting procedures. No one is allowed to approach a misfired shot at this time.
8. If there is still a misfire, the shooter must inform the obs erver and again disconnect the firing line from the blaster unit and short the wires together.
9. The shooting crew must then wait for 30 minutes.
10. After 30 minutes have passed the shooter must ensure that the detonator wires are cut as deep down the hole as is possible and covered. The charge must be le ft to deteriorate naturally. No attempt must be made to recover the charge.
11. The observer must inform the party chief of the location of the misfire.
12. The party chief must ensure that the client and any local authorities are informed of the misfire. Any legal requirements of the country of operation must be observed to ensure the mis fire location is properly marked and fenced off. Any warning signs or barriers a s required by law must also be posted around the misfire location.

Observers must maintain a record of all misfires . Information r equired is as follows:

a. Location of the shot
b. Depth of charge
c. Type of explosive
d. Charge size
e. Date and time of misfire

All misfires must be treated with the greatest care, and only t rained, experienced, conscientious and careful personnel may deal with them. No one is allowed to approach a m isfired shot until a period of at least five minutes has elapsed in the case of electrical shot firing and n ot less than 30 minutes in the case of shots fired by safety fuse. Until such time as the misfire has been remedied, no drilling o r any other work may be carried out in the vicinity of the misfire.

PRINCIPAL CAUSES OF MISFIRES

The principal causes of misfires during electric shot firing ar e as follows:

1. Current Leakage - Although a blaster unit of sufficient capacity must always be u sed, damp or wet conditions may cause current leak age to earth or a short across connections. This may result in insufficient current passing through some of the detonators, th ereby giving rise to misfires. This fault can be eliminated by covering al l joints with jo int insulators, and by taking care to keep the joints dry and well away from strata or metallic objects. This applies especially to uphole harnesses .
2. The Firing Line - The firing line must always be checked before shooting commence s. It is sometimes possible for the firing line to get damaged if a shot blows out. If this occurs, a careful inspection must be made in order to rectify any bared or broken wires before it is used again. Check the firing line every morning and at any time there is a blow o ut.

The shooter must ensure that only two wires are present in the firing line. Excess wires must be cut off if geophone cable is used to make a firing line.

3. Incorrect Operation of the Blaster – Ensure the correct procedure (shooting procedure) for blaster operation is followed.
4. Incorrectly Connected Circuits - If care is not taken to keep connections separated, a detonator may be short circuited and will misfire. In addition, if the fi ring circuit is not tested, loose or dirty connections may introduce high resistance es that will pass undet ected and cause a misfire. In very large patterns, detonators may be mistakenly omitted from the c ircuit, and occasionally some detonators may be connected together in a closed circuit and no t included in the main circuit. *These errors can be avoided by careful and systematic checking of all connections.*

Title: Explosive Storage Procedure

Section: Explosives ***Application: Loaders & Shooters***

PURPOSE:

The purpose of this procedure is to provide guidance with the entire necessary requirement for constructing magazines, receiving and storing explosive materials.

ORGANIZATIONAL UNITS AFFECTED:

Crew management, geophysical department and explosives handlers .

POLICY:

Explosive Magazine Design and Construction.

- Approval from the relevant authority (License & local NOC) shal l be obtained prior to construction of the magazines.
- The location of the magazine shall be away from buildings or an y area to which the public has access. Full advantage should be taken of the natural features for protectio n in the event of an explosion, e.g. heavily wooded area, hills, banks, etc.
- The magazine complex shall be fenced off to prevent unauthorized entry.
- Explosives and detonators shall be stored in segregated locatio ns.
- The Magazines shall be free of natural hazards such as trees, o verhanging rocks, rain flooded rivers, rock sliding areas etc.
- Storage pits will be: -
    a. Buried in the ground.
    b. Constructed from solid material – cement block work. Or Containers with woodwork from inside.
    c. Built to large enough dimensions to ensure there is room for th e safe storage of the material.
    d. Freely ventilated to prevent degradation of explosives.
    e. Appropriately protected from the weather.
    f. So designed as to prevent anybod y from dropping anything into t he magazine.
    g. Lockable: -
    - Main gate in the outer perimeter fence.
    - Gate in the inner perimeter fence.
    - Doors into the magazines
- Signs warning not to use radios within the required distance of the store are to be posted.
- Adequately earthed lighting conductor shall be fitted.

Storage Procedures

- The magazines will not be filled with any explosive materials u ntil the license and local NOC has been obtained.
- Under no circumstances will the explosive stock exceed the lice nsed storage limits.
- Explosives shall be stored off the ground on sound pallets.
- Explosives shall be put in shelves or stacked in piles (interla ced in a brickwork manner) to a height of not more than 2 meters and well clear (5 inches minimum) from the walls.
- There shall not be material othe r than explosives stored in or around the magazine.
- No energy sources such as matche s, cigarettes, naked fire, batt eries, radios, cameras, video recorder, fuel, etc. in the immediate vicinity of the explosive's magazine.
- There shall be fire extinguishers available in the store, to fi ght an external fire.
- Waste paper, empty explosives boxes and similar material shall not be allowed in the store area. Repackaging of explosives shall be done outside the magazine.
- The storage rules and procedures should be posted in the store.
- Appropriately trained magazine accountant shall be placed twenty- four hour a day.
- A proper number of armed securit y people shall be deployed at t he magazine area at all times. These people shall also be trained on the storage rules and procedures.
- Personnel entering the storage area shall wear "Explosive Magaz ine Pass" at all times. Personnel without this Pass on will not be allowed to enter.
- Proper reliable communication to the crew's office to raise the alarm in case of emergency shall be made available to the magazine accountant or security personnel.
- Proper lighting shall be provided in the magazine area for the security people to detect any trespassers trying to sneak in the storage area at night.

Record Keeping, Distribution and Handling:

- Explosives shall be used in the order in which they are deliver ed so that old dated stocks are not allowed to accumulate.
- If any explosives have been present in a magazine for more than three months, a weekly inspection for deterioration of the explosives shall be done by the accountant and the geophysicist in charge of the magazine.
- A written record of all explosiv es received, issued and returne d to the magazines shall be maintained properly and to be inspected by the geophysicist in charge on a weekly basis .
- Contaminated or damaged explosives shall be disposed of under t he strict supervision of the geophysicist & HSE Staff.

Title: Explosive Transportation Procedure

Section: Explosives ***Application: Loaders & Shooters***

PURPOSE:

To outline the basic requirements for transporting explosive ma terials during the course of operation.

ORGANIZATIONAL UNITS AFFECTED:

Crew management and explosives vehicle drivers.

POLICY:

- Transport of explosives shall comply with local / government re gulations governing the movement of explosives at all times and they will obtain a valid license for transportation of expl osives along with “E Form” and a route map of the area.
- Are vehicles used in the transport of the explosives shall be m echanically well maintained.
- All vehicles used for explosives transport shall be diesel powe red (not petrol) and dedicated to this purpose.
- The driver of the explosives vehicle shall be trained in explos ives handling.
- Are all parts of the vehicle in contact with the explosive load constructed or covered with a non-sparking material.
- When an open body vehicle is used for road transport of the exp losives, the explosives are to be covered with a water resistant tarpaulin, or put in well designed and made woo den boxes with padlocks. The wooden container shall have a security fitted lid and securely fastened to the b ed of the vehicle.
- Each vehicle shall have a “Danger- Explosives” sign or suitable indication of a dangerous load.
- A proper static chain shall be installed. It should be attached to the metallic part on the chassis of the vehicle.
- A Red Flag will also be fitted at the top of the vehicle body f or easy identification of the explosive vehicle.
- Each vehicle shall be properly equipped with at least one fire- fighting extinguisher in a proper easily accessible location, a shovel and a First Aid Box.
- Radio / Transmitters are not allowed to be fixed inside the Exp losive Vehicles.
- The driver of explosives vehicle shall know the purpose of the fire extinguisher on his vehicle (to fight fire outside, NOT to fight an explosives fire).
- Explosives and detonators are to be transported in separate veh icles. Small quantities of explosives and detonators for LVL operation can be carried in one vehicle but they shall be contained in separate lockable wooden boxes and segregated properly.

- Each vehicle shall carry a security guard to ensure that the ve hicle is protected and will never be left unattended.
- Other vehicles standards will also be implemented on explosive vehicles.
- Explosives vehicles must not refuel or enter a workshop for ser vice when they have explosives carried on.

In- Field Transportation and Distribution

- Site carriage containers shall be appropriately constructed and used:
    a. They shall be constructed of non-ferrous material such as leather, moulded rubber, wood or reinforced canvas.
    b. They shall be sealed and lined to prevent entry of water and dust.
    c. Locks, rivets, etc. shall be made of brass and suitably protect ed from direct contact with explosives.
    d. Plastic containers of any descri ption shall be strictly prohibi ted for the transportation or carriage of detonators.
- Explosives fitted with detonators shall never be carried or tra nsported.
- Explosives and detonators shall always be carried in separate c ontainers.
- Explosives handlers shall carry a book to record the quantities of explosives stored and distributed.

Title: Explosive Shooting Procedure

Section: Explosives ***Application: Loaders & Shooters***

Purpose

To ensure the safety of personnel at the shot points and elimin ate misfires caused by incorrect connection of detonators/ firing lines and blasters.

ORGANISATIONAL UNITS AFFECTED

Observers and shooting personnel.

PPE Requirements

All shooters and helpers must have the following personal prote ction equipment :-

- Hard hat
- Eye Protection
- Hearing Protection
- Reflective vest
- Gloves
- Footwear with good soles
- Loose fitting clothing

Additional Equipment: Whistles and Flags

The shooter and observer must have a copy of the hole depths and charge sizes, and a table of safe firing distances.

At the start of each day the blaster unit must be tested as follows:-

Communications check with observer

1. Ensure the radio is properly connected
2. Turn the radio on and check operating channel
3. Call the observer and say the following :- “Blaster No # Ready”
4. Turn the switch to the test position as shown and hold it in th at position while the observer sends a tone. Do not release the switch unt il the tone has finished.
5. The observer will inform the shooter if the test is good.
6. When the test is complete shooting can begin

Before Shooting

1. The firing line must not be connected to the blaster until the area is clear and the pattern is ready for shooting. The firing line must be shorted as shown.
2. BEFORE CONNECTING CHARGES, THE SHOOTER AND ALL PERSONNEL MUST ENSURE THEY ARE UPHILL FROM THE SHOT TO BE FIRED. NO PERSONNEL PERSONNEL MUST REMAIN UPHILL FROM THE SHOT POINT WHILE THE SHOT IS FIRED

Connecting charges

A flag must be placed to indicate the shot point or pattern whi ch is going to be fired

On deep hole shots, the detonator wires must be separated and c onnected in series to the firing line as shown by the arrows. When the wires are connected, they should be buried.

Pop Shots

All pop shot charges must be connected in series as illustrated below before the firing line is

connected :-

- bury each connection with

FIRING LINE

The firing line must be shorted at all times until the detonators are ready to be connected.

When the charges are connected, all personnel must get clear of the shot point and make sure that nobody goes near it.

They must stay at least 50 metres from the shot point

When all personnel are clear they will give one loud whistle blast which will tell the shooter that the charge is connected, and the area is clear. All personnel must use hearing and eye protection as well as other PPE items at this time.

Explosives

The shooter will respond with 3 whistle blasts to indicate that he is going to connect the firing line to the blaster.

WHEN THE SHOOTER HAS BLOWN THE WHISTLE 3 TIMES NOBODY MAY GO NE AR THE SHOT POINT UNTIL THE SHOT HAS BEEN FIRED

The person operating the shooting box (“shooter”) is personally responsible for clearing the shooting pattern before connecting the firing line and arming the blaster. He is responsible for keeping it clear until after the shot is fired.

THE SHOOTER MUST BLOW THE WHISTLE 3 TIMES

THE SHOOTER WILL CONNECT THE FIRING LINE TO THE BLASTER WHEN HE IS CERTAIN THAT ALL PERSONNEL ARE AT A SAFE DISTANCE FROM THE SHOT

THE SHOOTER WILL THEN PERFORM A CAP TEST . HE WILL TURN THE SELECTOR TO THE "CAP TEST" POSITION AND CHECK THE READING ON THE OHMMETER TO MAKE SURE THE FIRING CIRCU IT IS GOOD .

THE SHOOTER WILL SWITCH THE BLASTER UNIT TO THE "ARM" POSITION AND HOLD IT THERE WHILE THE OBSERVER SENDS THE TONE TO FIRE THE SHOT . HE MUST NOT RELEASE THE SWITCH UNTIL THE TONE HAS FINISHED AND THE SHOT HAS FIRED .

The shooter will then call the observer and say the following:-

The observer will tell him to "ARM" the blaster unit.

THE SHOOTER WILL REPORT WHEN THE SHOT HAS FIRED.

IF THERE IS THUNDER OR LIGHTNING …….

WHEN THE SHOT HAS FIRED THE SHOOTER WILL SOUND ONE LONG BLAST ON THE WHISTLE TO INDICATE THAT THE SHOT HAS FIRED AND IT IS SAFE TO APPROACH THE SHOT POINT.

HELPERS WILL THEN PULL UP THE CAP

- IF THERE IS A THUNDERSTORM WITHIN 5 KILOMETRES OF THE SHOOTING OPERATION , WORK MUST BE SUSPENDED.
- ALL EXPLOSIVE CONTAINERS MUST BE CLOSED AND PERSONNEL MUST REMAI N AT A SAFE DISTANCE FROM THEM .
- (INCLUDING EXPLOSIVE VEHICLES DRIVERS , IF THERE IS EXPLOSIVE INSIDE THE VEHICLES)
- THE SHOOTERS MUST WAIT FOR AT LEAST 30 MINUTES AFTER THE STORM HAS PASSED BEFORE THE WORK MAY RESUME.

ANNEX: II: EMERGENCY RESPONSE PLAN

Emergency Response Plan

Contingency and Emergency Response Plans

- **PURPOSE AND SCOPE OF THE DOCUMENT:**

The objective of this Emergency Response Plan is to explain the line of action to be followed in case of an emergency on Seismic operations and to define the responsibilities of different persons. All the concerned CONTRACTOR employees will act as a team on both the ends i.e. Islamabad office and field location. Once issued, the plan will be used as a guideline to deal with all the medical emergencies and will be practiced through drills on reg ular basis.

Under no condition the plan should be changed without the infor mation of Management in Islamabad, and any change should be followed, in not more than 24 hrs, by the written report of the reason of the change from documented guidelines**.**

- **CONTRACTOR MEDICAL FACILITIES:**

To cover the medical problems on the field, CONTRACTOR will set a well-managed medical system, with contacts at reliable health facilities to take care of grave medical emergencies. The brief description is as follows:

- **CONTRACTOR FIELD DOCTOR:**

CONTRACTOR has employed the services of qualified medical doctor for its G&M and seismic operations in Project site. He is responsible for providing the medical coverage for minor health problems on the field. He is also responsible for providing first aid in case of a medical emergency and to giving suggestion to management r egarding evacuation of a diseased person in case of medical emergency.

- **HEALTH FACILITIES**
- ***CONTRACTOR FIELD CLINIC:***

CONTRACTOR will set a fairly well equipped clinic on the project for the medical coverage of its field employees. It will contain all the first aid material required to stabilize a casualty in case of serious medical emergency and Most of Life Saving Drugs.

MEDICAL EMERGENCY AT CONTRCTOR RILED LOCATION

There can be situations in which we can come across medical emergencies during our field operations. These emergencies can be:

- *Medical emergencies for example uncontrolled high-grade fever, severe dehydration, flaring up of gastric ulcer, burns etc .*

- All such emergencies will be referred to the nearest hospital m entioned in the list of hospitals.
- *Surgical emergencies for example acute abdomen, trauma, fractures etc.*
- All such emergencies will be referred to the nearest hospital mentioned in the list of hospitals.

Insect bites

- The field clinic has the capability to treat scorpion and snak ebite cases. However, all such cases will be referred to the Shifa, QA Hospital for treatment on the decision of the onsite doctor.
- All the daytime or night time s nakebite cases will be referred to nearest hospital. Field doctor will accompany the victim to the hospita l and will return after ensuring that the right person has started the pro per treatment. Company has a reasonable stock of anti-snake venom on the field . Under all conditions these sera will be carried along, due to possibility of non-availability in the hospital. If the snake has been killed, it will be carried along for identification.

Medical Emergencies related to Road Traffic Accidents

- All such cases will be referred initially to nearest facility. If after the initial evaluation, the person is found to have Multiple Severe Injuries or Head Injury, then he will be shifted to Shifa / QA hospitals, ISB/Rwp as soon as possible, after initial stabilization.
- Daytime / Night time Medical Emergency
- Emergencies related to heart problem will later be shifted to Shifa, QA hospital for specialized care.

CONTRACTOR FIELD DOCTOR:

CONTRACTOR will designate a qualified medical doctor on seismic operations. He will be responsible for the quick assess ment of the sick or injured person, as per his professional knowledge and the administration of first aid and stabilization of the person, who has been reported sick or injured.

a. IF FIRST AID IS ENOUGH:

- Inform the Field In-charge about the incident and the condition of the person.
- Record the incident as a First Aid Case in the record.

b. IF FIRST AID IS NOT ENOUGH:

- He will stabilize the victim in the field clinic, or at the site of the incidence (if required).
- Make Primary and Secondary assessment of the person and start the initial treatment. The assessment form is attached with the document as Annex-1 of this chapter. A copy of the form will accompany the patient in case of medical evacuation.

- Pass on the status of the patient to the Field Management. He will assess the need for the possible evacuation of the person and discuss it with the Base Camp field management.

The Field Doctor will remain in contact with the field manageme nt about the condition of the patient and the Field Management will further inform the Operation Manager and HSE Manager in Islamabad Office about the final plan. He will contact the hospital authorities, as per the advi ce of the Field Management, and will ensure that adequate arrangements have been made for safe evacuation.

c. IF DECIDED TO EVACUATE THE PATIENT:

- Field doctor will inform the Field Management about the status of the patient and will discuss the details about this Medevac, so that necessary arrangements for the safe and earliest possible evacuation of the patient can be made.
- Measures to be taken for the safe traveling of the patient be decided and documented.
- As soon as the patient is stabilized, evacuation will be done to the hospital, as decided earlier, u sing the best available transportation facility. The doctor himself or his nominated medic will travel with the patient, until he is handed over to medical personnel in the recommended health facility.

TRANSPORTATION OF THE PATIENT:

Well-equipped ambulances, one in each camp and two in the field with medics will be provided during seismic operations . Patient from seismic site w ill be evacuated and transported to medical facility in the nearest city. Hospital a ssurance survey will be conducted soon after mobilization of the crew to assess medical facilities in/around project area.

A doctor, medic and security escort will be ensured for night-time transportation of patient

Emergency Routes

Following routes will be followed in case of emergency.

Base Camp to nearest city

Will be updated prior to crew mobilization in the project area.

Primary Route

Will be updated prior to crew mobilization in the project area.

Total Distance = to be calculated

Total Time Taken=to be calculated

Alternative route from Base camp to Islamabad / Rwp

Will be updated prior to crew mobilization in the project area.

Total Distance = to be calculated

Total Time Taken=to be calculated

EMERGENCY TEAMS

1..1 Emergency Response Team (ERT)

This team shall be established on site and shall have personnel who are experts to deal with the emergenc ies like fire fighting, oil sp ill control, man lost etc.

This team shall include the trained personnel, radio operator, and camp boss.

1..2 Incident Management Team (IMT)

This shall be formed at the crew/field level normally headed by the party chief. In his absence Party Manager will fulfil his responsibilities. This team shall include Party Chief, Party Manager, HSE Advisor , Chief Geophysicist, Chief Surveyor, Cable Chief, Doctor, and Camp Administrator, security supervisor, vehicle supervisor and other responsible person on crew.

1..3 Emergency Management Team (EMT)

This team shall be based in the head-office Islamabad. This team shall be formed for managing the incidents/ accidents. Normally it shall be headed by the Deputy Country Manager.

The team shall include Deputy Country Manager as team leader, M anager HSE, Manager Operations, Manager HR, Manager Finance, Manager Security, Manager Admin & IT.

Additionally, EMT shall be announced on weekly basis to confirm the member's availability and circulated among the clients and field operations.

Any incident/ accident shall be r eported to EMT by the IMT. EMT shall decide the seriousness of the incident/ accident and informed the Country manager about the situation, who will decide if a crisis need to be dec lared.

Responsibilities

TEAM Leader

Team Leader holds the ultimate res ponsibility of safe and earliest evacuation in case of medical emergency. He will be heading the EMT and wi ll ensure that all the EMT members play their role satisfactorily and in time to proceed with this evacuation without any unnecessary delay.

OPERATION MANAGER

Operation Manager will ensure that all the necessary support and help is provided for the safe and quick medical evacuation and remain in touch with the field and the city arrangements in this regard.

PARTY CHIEF/PARTY MANAGER AND ADMINISTARTION

Party Chief/Party manager and Crew Administrator are responsibl e to ensure that overall field conditions are suitable for the free movement of vehicles and personnel during the evacuation and no security or logistics problem occur on the way. In coordination with EMT, he will provide all the support for the quick and safe evacuation of the casualty.

Crew HSE Advisor

Crew HSE Advisor is responsible to ensure that all hazards in field and camps are identified. He will also support and coordinate with crew management and administration incase of any emergency and will ensure the safe and quick evacuation of causality.

MANGER ADMINISTARTION ISLAMABAD OFFICE

In coordination with other members of EMT, Manager Administrati on will support all the facilities required for the evacuation activities towards Islamabad, or during overseas evacuation. His support may include coordinating the activities of other EMT members, arranging ambulance at Islamabad etc.

The contact detail of all the EMT members is mentioned in Annex-2.

MADICAL EMERGENCY TEAM BASE CAMP

Will be updated prior to crew mobilization in the project area.

FIRE CONTINGENCY PLAN

Fire is a major hazard in any situation where large numbers of people work and sleep in a relatively confined area. This Applies equally t o a seismic crew and to a town-based operation.

Four essential steps in the control of the fire hazards are:

1) Reduction of the Basic Risk by:

- Restricting cigarette smoking.
- Upgrading and maintenance of electrical fittings.
- Posting warning notices.
- Training - both in the use of fire-fighting equipment and in ge neral awareness of the hazards and what to do in the event of fire.

2) Early Detection by:

- Means of smoke alarms
- Personal vigilance

3) Prompt Reaction by:

- Shouting “Fire! Fire! Fire!”
- Sounding the fire alarm
- Evacuating the tents and containers
- Fighting the fire, if appropriate

4) Immediate Response by:

- Using the nearest suitable fire extinguishers
- Isolating the electrical supply, if appropriate
- Accounting for all personnel (Head count)
- Organizing available personnel to assist with fire-fighting, if appropriate

There shall be one Fire Chief/ Fire Fighting Team Leader. He will form a Fire Team from available personnel if th e fire team member not prese nt.

- When the Fire Alarm is sounded, the trailers or tents must be evacuated immediately, and the occupants must proceed directly to the Muster Point designated for their living area as due to pan demic COVID -19 all the workers are not allowed to gather at 1 muster point. Infact the camp is divided into different grids according to the field groups.
- A head count and search must be carried out soon by the Grid Incharge and report to Fire chief.

ON DISCOVERING A FIRE

Fire extinguishers, Dry Powder fire extinguishers are located n ear the door of every container, tent and on each vehicle. Foam fire extinguishers shall be located near fuel locations.

On discovering a fire, you should immediately attempt to fight it with the nearest extinguisher UNLESS :

- There is no extinguisher on hand OR
- The fire is near the exit to your room OR
- There is a noticeable quantity of smoke OR
- You are not confident of using the extinguisher OR
- The fire is visibly increasing in size. OR
- A fuel tank has caught fire (EVACUATE THE AREA)
- In which case, GET OUT AT ONCE AND SOUND THE ALARM .

- All personnel, upon hearing the alarm, proceed to the designated Grids Muster Point immediately.
- Any one near a radio upon hearing the alarm will make a general call announcing, “Fire in Camp - Fire in Camp”.

If a fire is extinguished, remember that it can re-ignite spont aneously. Do not leave the scene until it is assured that the fire is out and wi ll not re-ignite. Then immediately report the incident to the Party Chief, HSE Adviser or the most senior person in camp.

ON HEARING THE FIRE ALARM:

- Everyone is to proceed directly to the designated Grid Muster point. A head count will be conducted at the Grid Muster point. After headcount information will be shared with Fire chief that all persons have been evacuated from the grid.
- (FOLLOWING PROCEDURES ARE DESIGNED TO ENSURE THE SAFETY OF PERSONNEL .)
- All the fire wardens will check their Grid areas allotted to th em.
- The fire team will approach to the fire scene under the direction of the fire chief.
- The Fire Chief / Fire Team is to proceed directly to the fire and carry out the crew procedure for dealing with the situation.

Crew FIRE FIGHTING PROCEDURES

These are guidelines only to give a general outline towards getting a fire extinguished should the situation arise. Below assumes that we have a major fire in the camp area. Hopefully before it gets to this situati on somebody has been able to put the fire out while it is minor.

A fire fighting team will be set up from available personnel. T his team will be trained in correct fire fighting procedure. Other crew members will also be trained so they maybe co-opted onto the team as required. Eventually all crew members should be trained in the use of fire extinguishers and basic fire control.

THE PRIME CONCERN IN CASE OF FIRE IS THE PROTECTION OF PERSONNEL EQUIPMENT IS SECONDARY!!

- The person discovering the fires hould raise the alarm, immediately evacuate everyone from the area and notify the fire chief.
- The “ FIRE CHIEF” will be the most experienced in camp and will take complete charge of fire fighting and directing the “FIRE TEAM”.
- The senior member of the kitchen staff will account to the coordinator for their personnel, including the camp boss. The Cable Shop foreman will account for his men. The Camp boss will be responsible for accounting for foreigner camp staff and alerting the junior camp.
- The coordinator gets a head count at the designated muster points.

- At the same time the electrician will cut off the power to the fire location. Power should only be cut to the fire site as power is required for lighting if at night and also to run water pumps, if available.

THE LEAST PEOPLE INVOLVED THE BETTER. ALL OTHER PEOPLE ARE TO STAY AT THE DESIGNATED MUSTER POINT. SHOULD THEY BE REQUIRED THEY WILL BE DIRECTED WHERE TO GO AND WHAT TO DO.

REMEMBER THAT THIS IS ONLY A GUIDE. NOTHING EVER HAPPENS AS PLANNED.

MAN/VEHICLE LOST FLOW CHART

TO AVOID GETTING LOST:

- Plan your route in advance. Know the route. If in doubt, ask. I f marked tracks exist, use these rather than striking out across country .
- Inform someone of your destination and route. It is imperative that you inform the Base Camp Radio R oom, who runs Journey management of your destination, route etc and any other locations that you will be visiting.
- Cancel this information promptly on your return, or call from y our destination and have someone cancel it.
- Be sure your vehicle is equipped, no matter how short the journey.
- Check: Oil, Water, Tyre Pressure, Spare Wheel, Jack, Tools, Drinking Water, Tow Strap, Shovel, and Radio, before departure.
- If you are traveling on poorly defined tracks, be constantly aw are of where you are. The instant you do not know where you are, be fully aware for definite landmarks.
- If, after a few minutes (MAX. 5 MINS) you are still uncertain, STOP AT ONCE AND GO BACK ALONG YOUR TRACKS until you do know where you are and start again. This will only loose you a few minutes, and often only a few hundred meters.
- Failure to do this and continuing to drive on in the hope of finding a familiar track, is the most common cause of getting lost.
- Finally, take your Journey Management seriously. If you are lost or overdue, a search will be launched, and you will be found.

However, a Man Lost Emergency and Search causes a great deal of anxiety and effort by a large number of people. You will not be popular if you become the object of a full scale search because you neglected one of the simple points above!!

IF LOST OR BROKEN DOWN:

- DO NOT LEAVE YOUR VEHICLE - It's easier to locate a vehicle than a man.
- If possible, go back along your tracks to the last known point.
- If this is not possible - Go to the nearest high point.
- Protect yourself from the sun and conserve your energy. Tasks are better carried out in the cool of the morning or evening.

- Do not park under a tree or in the shadow of a large rock.
- STAY CALM - Anxiety and apprehension is common as the reality of being lost or immobile sets in.

Your absence has been noted from the Journey Management sheet and the Man Lost Procedure has started. You will be found.

- Use your radio every 30 minutes, on the hour and half hour. These are the times that people will be listening for you.
- Transmit your approximate location, route taken, any problems, and the amount of water you have on hand. Transmit "blind" even if you get no reply.
- If the engine will start, you should run it periodically to charge the battery.
- Signal every hour on the hour, using the most suitable means. Signal from the highest point in the area.

DAYTIME SIGNALS:

- The most effective non- radio signal is the heliograph - reflecting the sun's rays by means of a mirror.
- Use any of the vehicle mirrors and practice aiming the reflected image onto the ground in front of you, up to the horizon, and back again. Repeat this process through 360, covering the entire horizon.
- Smoke - the denser the better- is the second option. Use a spare tyre, but be sure to completely deflate it first, using a stick or pencil, to open the valve. Diesel will help the tyre burn, if any is available.

Add any kind of oily rags, green vegetation etc. that will ensure the maximum amount of smoke on the hour. This is the time when search vehicles will be stationary and actively looking for you.

NIGHT TIME SIGNALS:

- The only effective night signal is light, the brighter the bett er.
- Light a fire and have extra fuel ready to increase the size of the blaze on the hour.
- Use the vehicle headlights. If possible, remove one and use it as a spotlight. Sweep the horizon (as with the heliograph) on the hour.
- STOP at midnight, and sleep.

SEARCHING

PARTY CHIEF / PARTY MANAGER/HSEA IN CAMP TO CO ORDINATE ALL MAN LOST ACTIVITIES

- A Man Lost Situation occurs automatically when any person is no tified as being overdue by VJM, back in camp, or at his destination.

- Before commencing a search, it is imperative to check thoroughly the base camp to ensure that the missing party has not arrived. If possible, any likely alternative destinations should be checked out.
- CONTRACTOR Islamabad Office must be informed, day or night, if a Man Lost Situation exists.

DAYLIGHT SEARCH

- The destination and planned route are to be ascertained from the Journey Management Board. Planning should start at once to identify and search the most likely areas.
- Search vehicles are to be prepared.
- There must be two people in eac h vehicle and pre departure checks must ensure that:

  1. Fuel tanks are full

  2. Water tanks are full

  3. You have a good spare wheel and tools

  4. You have Maps and a GPS navigator

  5. You have a working radio

- A common radio frequency must be established and made known to all personnel involved in the search. Select the channel most likely to be used by the lost party.
- The controller must appoint one pe rson (maybe himself) to maintain a radio and telephone watch.
- A written Log of all activities, messages, decisions, and timings must be kept by the controller from the outset. A fifteen (15) minute call schedule must be maintained between search vehicles and the controller.
- An initial search should follow the lost person's route as noted on the Journey Management Register. If sufficient light remains, a search of all known roads and tracks in the area should be made.
- At dusk the vehicles will either return to camp or commence night search procedures, at the discretion of the P.C. or controller.

NIGHT SEARCH:

- A night search will be conducted at the sole discretion of the Party Chief.

DO NOT SEARCH IN DUNE AREAS IN THE DARK – IT IS HIGHLY DANGEROUS

- Factors affecting the decision on whether to conduct a night search include:

  6. The urgency of the search. Whether there is reason to believe that the lost party is injured.

7. The general type of terrain. Sand dunes or rough rocky areas in itially present unacceptable safety hazards at night.

- If a night search is to be launched, the vehicle preparations are the same as for a daylight search, but additionally:

8. Only the most experienced sta ff from survey department is to participate, and they should be familiar with the whole area to be searched.

9. Flashlights must be carried, and the vehicle should also carry a couple of blankets if there is the poss ibility or getting stuck.

- The controller should consider calling off the night search if the weather or terrain are causing problems for the search parties.
- Each vehicle must be stationary every hour on the hour in order to look for signals from the missing party.
- Close the highest piece of ground a few minutes before the hour. Stop and douse the lights in order to maximize night vision.
- A night search should not continue past 23.00 hours and the aim should be to have all search vehicles back in camp before midnight.

FIRST FULL DAY SEARCH

- The lost party may now be overdue by 18 hours. This is an extre mely serious emergency, and every available resource must be made available to locate the missing party.
- CONTRACTOR Islamabad Office must be kept informed of the search and any progress.
- All crew personnel must be involved in the search. Outside agencies must also be considered to help with the search.
- With the assistance of a surveyor, the controller must calculat e the theoretical range of the lost vehicle and use this distance as the radius of a circle centered on the point of origin of the lost party. The circle must be divided into sections and thoroughly searched.
- All tracks and water sources must be checked, and inquiries mad e of local inhabitants.
- If the lost party is not found, the search will continue until instructed to do otherwise by CONTRACTOR management.
- Refer to the emergency contacts for a listing of all relevant phone numbers and contacts.

WEATHER CONTINGENCY PLAN

In case of severe weather conditions the following precautions will be taken:

FOG

- No one shall leave the camp until the PC has assessed the situation and is satisfied that the visibility is such that driving will not be hazardous. All vehicles will travel with headlights on until the fog has completely cleared.

- Vehicles will travel in convoy if necessary.
- Should you be driving in the field when fog descends, you should stop and switch your headlights on. Remain stationary with your engine running. Do not attempt to drive to your destination especially in uneven terrain as disorientation is a possibility. Call base camp to inform them of your late arrival and present location

HEAVY RAIN

Driving in the rain calls for extra care and driving skills. The roads will be slippery, and acceleration and braking must be made gently. Reduce your speed and be aware of other road users. Should the rain be heavy enough to impair your vision, you should pull off the road in a safe location and wait for the weather to pass. Call base camp to inform them of your late arrival and present location.

WINDSTORM

Visibility will be seriously im paired, and disorientation is a possibility. Take care exiting the vehicle as the strong wind could blow the door out of your grasp. Call base camp to inform them of your late arrival and present location. If contact is not possible, the Man Lost situation may be started under the direction of the PC / APC

FIELD OPERATIONS

In all severe weather conditions the senior observer will decide upon the best course of action for the line crew and trouble shooters. Should the situation dictate, production will be stopped and personnel ordered to take shelter. Department heads will co-ordinate with their field units to decide upon the safest course of action.

All vehicles standing by on weather should call base camp and inform them of their status and position.

HEAVY RAIN & FLOODING

Excessive or “heavy” rainfall in an area over several days substantially increases the risk of loss or damage to both personnel and equipment. Heavy rainfall can result in flooding and mud slides.

Flash Floods

Flash flooding is the number one cause of deaths from naturally occurring phenomena - rain!

Personnel should ensure that they stay away from electrical installations during rains.

FLOODING PROCEDURE

In the event of flooding the following procedures shall be foll owed:

- If heavy rain is considered to be imminent, withdrawal to the camp location by all personnel shall be considered.
- Keep all vehicles fueled so that evacuation can be conducted without delay.
- If a flash flood warning is issued in your area immediately cease all operations and move to higher ground.
- If you come upon floodwater, STOP, TURN AROUND AND GO ANOTHER WAY. Never try to walk, swim or drive through swift water. Even six (6) inches of fast-moving floodwater can knock you off your feet and remember a depth of two (2) feet will float vehicles!
- If personnel become cut off from camp by flood waters, they shall move to high ground and notify camp via radio immediately. If safe to do so, shelter may be considered at a local CLIENT Facility.
- Should the lives of camp personnel become endangered due to serious camp flooding, the Party Chief shall instruct personnel to vacate to a designated area.
- The Party Chief shall keep CONTRACTOR Head Office and CLIENT informed of the situation and request assistance when required.

Flood Evacuation

PURPOSE*:*

- To evacuate to safety all personnel who would be at risk in th e work area in the event of flooding.

RESPONSIBILITY:

- Supervisors and Foremen working in the field are responsible for reporting deteriorating weather conditions. The Party Chief/PM is responsible for ensuring that all personnel at risk from flooding are evacuated safely.

SCOPE:

Flood Evacuation Procedure.

ORGANISATIONAL UNITS AFFECTED:

All units

Priority-I: Foremost goal must be to protect/save lives of the employees/human beings during flooding/excessive rains

Priority-II : The second priority after the lives must be assets/equipment's/vehicles of the organization

PROCEDURE:

- In the event of flooding the following procedures shall be followed:

- The Party Chief shall keep CONTRACTOR Base office and CLIENT informed of the situation and r equest assistance when required.

  a) At the first sign of inclement weather, supervisors and fore men shall inform their direct Supervisor , who in turn shall inform the Pa rty Chief.

  b) The Party Chief shall inform all departments and may request a further weather forecast from the local CLIENT facility or CONTRACTOR Operations Head Office.

  c) Designated area selected for the crew personnel where evacuees may be accommodated must be safe from floods and communicated to all the crew personnel in advance.

PRECAUTIONS

- Camp Administration should ensure that enough dry food supplies for at least seven days must be available at the crew food store.
- Weather forecast must be monitored through some reliable sites and communicated to all the Line Managers regularly.
- Crew Doctor to keep enough medicines for the purpose of skin allergies and snake bite must be available at the site to counter emergencies.
- The crew should keep sufficient funds available to pay-off the crew employees on time during the floods.
- Responsibilities of the Key Personnel before, during and after heavy rains/flood:
- Party Chief/PM: will be the overall in charge of the crisis management team and will be the authority to decide all the actions and communicate with the clients and head offices.
- Line Supervisors: will report directly to Party Chief and will get updates and guidance from time to time. All the line supervisors will be responsible for their subordinates.
- HSE Advisor: will communicate the evacuat ion plan to all the crew members and will give advice on safety issues and the risks related to rains/flooding to all the crew members especially drivers.
- Crew Administrator/Camp Boss: will ensure that the POB available must be provided with best possible welfare facilities
- Crew Doctor/Medics: will be in a state of emergency and highly alert along with enough medicine available for GIT, infectious & communicable diseases.
- Radio Room/Radio Operator: will communicate all the updates of rains/floods from the field and camp and report directly to Party Chief. He will be in continuous communication with the field crews.
- Electrician: will ensure that all the electric al equipment's are in working condition and shock free in waters and must be alert all the ti me.
- Vehicle Supervisor: will ensure that all the vehicles are evacuated to a safe place outside and parked on the right place along with right parking without halting roads for the local communities and loc al traffic.

- Mechanics: will ensure that all their emergency equipment/tools e.g. tow chains etc. are in place.
- Security Supervisor: will ensure that the security must keep eyes on the security situation and keep on the field camp and also on the place where the evacuees will be stayed. They will also ensure that all the crew employees and the assets/equipments are safe

FIELD OPERATIONS

In all severe weather conditions, the senior observer will decide upon the best course of action for the line crew and trouble shooters. Should the situation dictate, production will be stopped and personnel ordered to take shelter Department heads will co-ordinate with their field units to decide upon the safest course of action.

All vehicles standing by on weather should call base camp and inform them of their status and position.

EMERGENCY SPILL PROCEDURE

STOP THE FLOW AS SOON AS POSSIBLE

Use any safe, practical means at your disposal. Remember to lo cate and check the operation of all valves daily. Remember that every gallon you keep from leaking is one less to clean up later.

CONTAIN THE SPILL IN THE SMALLEST POSSIBLE AREA

Sound judgment is the key to good containment. Keep in mind th at other regulatory agencies have very definite ideas about what you can or cannot do with the natural resources around the fuel site If you use th e material around the spill to create a dike, be sure that it can be restored to its original condition after clean up is complete.

REPORT THE SPILL THROUGH THE PROPER CHANNELS AND INITIATE CLEAN-UP PROCEDURES

Prompt, accurate reporting is imperative and should be done as soon as possible after discovery of the spill. If the spill is minor a nd the clean up is obvious you should go ahead but if a major spill occurs you should stand by for detailed instructions. Remember that disposal of waste created by clean up has to be taken care of properly and not left to create anot her problem. In some cases, this may require evacuation of the waste to a suitable site designated by the authorities. In conclusion, you must do ever ything possible to prevent a spill but if one does happen you should STOP THE FLOW , CONTAIN THE MATERIAL and REPORT THE INCIDENT through proper channels, AND CLEAN IT UP .

Man overboard response plan

General

AS SOON AS PEOPLE ARE ON BOARD OF A BOAT - WHETHER THEY CAN SWIM OR NOT- THERE IS A RISK OF DROWNING.

At least one member of the boat crew must be capable of first aid and trained for overboard rescue and retrieval. *THE MOB AND DROWNING PREV ENTION BEGINS FROM A STRICT DISCIPLINE ON BOARD*.

Passengers must remain seated and never move from their assigne d position on board. Life jackets must be worn and a ttached before embarkation (pass engers and crew). All personnel boarding a boat must be given the necessary HSE a nd job related training thus being familiar with some *BASIC PRINCIPLES FOR SURVIVAL IN THE WATER:*

- Unless very close to the jetty or some safe place, any individ ual falls overboard / in the water must try to maintain his position.
- A MOB must never try to fight the current as this will tire the individual out and reduce the chances of survival. An experienced swimmer can scarcely swim at more than a knot and a one knot current is a weak one. SWIM ONLY IF VITAL.
- Any non-swimmer who falls in t the water must remember: The huma n body tends to float even in fresh water. So, if there are no floating objects nearby to hold onto, the individual must just float.
- A MOB must ATTRACT ATTENTION by shouting, blowing the whistle on the life jacket, keep an arm raised above his head if there are waves et c. DO NOT PANIC.
- A MOB must attempt to conserve BODY HEAT by going into the huddle position with knees drawn up, arms by the side and wrapped around the knees. If there is more than one person, up to ten people can link arms and adopt the huddle position.

Action to be taken by the boat

The first crew member sees a man falling overboard will be designated as the “spotter”. He will immediately shout “MAN O VER BOARD” to alert all personnel and throw the MOB ring to the person in the water. The Spotter must monitor the position of the man in the water at all times (keeps a finger pointed at the location of the victim).

CALL FOR ASSISTANCE (SUPPORT BOAT).

No other crew member will get into the water until help is avai lable from another boat and the rescue is coordinated. If retrieving the person by the crew other than the support boat, make the approach placing the individual with the bow pointing into current. Arriving next to the person in the water, the engines must be cut off until the person is retrieved. Any man falling overboard must be examined by medical personnel upon returning to base camp. MOB must not be left on his own until fully recovered. Resuscitation of a drowned person: Stretch the victim out on a fi rm flat surface, clear the respir atory air ways and apply artificial respiration.

The coxswain will advise all boat passengers and request assist ance from boat team members.

Note: It is necessary for the cable ch ief or drilling supervisor to s end a boat to travel to the location to assist, as it may be that the two remaining crewmembers have difficulty retrieving the casualty from the water.

This difficulty might be due to

- river and weather conditions
- the nature of the injuries
- the size and weight of the casualty
- the strength (or lack of) of the crewmembers
- one of the crew members may have received an injury in the inc ident
- one of the crew members may be upset and "panicky" and be able to provide only limited help

In the event there are two crew members in the water the problem of recovery by one person might prove to be impossible.

General duties

Coxswain

- Be responsible for the safe operation of the rescue boat
- Will keep on site supervisor advised
- Will assist with the recovery of the casualty from the water

Assistant of coxswain

- Initially acts as lookout
- Pinpoints casualty position in the water
- Establishes verbal contact with casualty (if conscious) and gathers information
- Ensures coxswain is kept advised
- Will take hold and secure the casualty
- Will assess the situation relating to condition of the casualty

Method of Recovery

The method of recovery in all i nstances will be dictated largel y by the circumstances encountered and equipment on hand. Determining factors such as weather and river state, the risk o f fire and the physical state of the casualty must be taken into account.

The degrees of urgency are also factors to consider.

Positioning the boat

- Avoid the situation where the boat may be blown down onto and over the casualty
- Approach the casualty from a position heading into the wind

- Start initial approach about 5-7 boat lengths distant
- Be at slowest steerage speed at a bout 2 boat lengths distant
- Alter course to approach alongside
- Stop alongside and secure the casualty

Recovery of Man Overboard

Three recognized methods of recovery are:

Vertical Recovery

Where a degree of urgency is required, or conditions do not allow for other means of recovery e.g. the casualty is face down in the water and you suspect breathing has stopped.

This method is best achieved by two persons.

Depending upon physical size of the casualty it may be difficult for the two crewmembers to lift him directly onto the sponson.

In this case it may be helpful by “bobbing” the MOB underwater momentarily in order that they gain some upward momentum prior to lifting.

- Position the casualty in such a way that his back is towards the sponson allowing his legs to rise to the surface
- Firmly hold both arms under the armpit and by the wrists; haul the casualty onto the sponson
- Move the casualty to a position along the inside of sponson, head aft, and hold secure
- If necessary First Aid can commence immediately e.g. check air way, start CPR
- Lower the casualty carefully to the deck to further investigate and treat injuries appropriately
- Notify the supervisor of the recovery

Horizontal Recovery with rope of life ring

Where injury is obviously not life threatening and weather conditions allow, a horizontal means of recovery is preferred.

Shout "man overboard" on the wind and designate a crew member to spot and point to the victim’s position in the water. The spotter should not take his eyes off the victim.

Provide immediate flotation. Throw buoyant object such as life rings and so on. This object may not only come to the aid of the victim but will "litter the water" where he went overboard and help your spotter to keep him in view. The rope can be used in either a rolling or straight lift action as appropriate to the degree of injury.

Assisted Lift

- To be used in cases where the rescue boat crew determines the survivor is fit and willing to board the rescue boat by himself
- To avoid chance of injury the cr ew will assist th e survivor as required

MOB back on Board

Once on board, First Aid treatment should be administered as far as possible and the condition of the casualty reported to base camp Doctor, so that preparations can be made. The casualty should be kept warm and monitored for signs of shock. More examinations and (if appropriate) MEDEVAC arrangements should be made on board ship

Be aware of "post rescue" collapse. This occurs when a casualty relaxes following rescue. Casualties can often suffer heart attacks immediately after being pulled out from the water.

First aid for drowning Rescue

ANNEX III: WASTE MANAGEMENT PORECDURE

Waste Management Procedure

(Local Operative Regulation)

Responsible for creation and maintenance of this Regulation:

.....for.....
David Clegg
Head SD&HSE

Approved by:
.....
Graham Balchin
Managing Director/ CEO

RELATED HIGHER LEVEL REGULATIONS

HSE_1 Health, Safety and Environment Management System (Group Guideline)
US_1_G1_MOLPA1 Environmental Standard in E & P (Local Operative Regulation)

COMPLIANCE SIGNATURES

Finance	Production	P&FE
.....	for	.....
Andras Rudner Chief Financial Officer	Muhammad Zaheer Alam Director Production	Khalid Iqbal Director P&FE
Drilling	**SOD**	**Administration**
.....	.....	.....
Muhammad Tashfeen Head Drilling	Inam ul Haque Head SOD	Ishtiaq Ahmed Head Administration

Table of Contents

1. DEFINITION OF SCOPE AND RESPONSIBILITY

1.1 Objective of the Regulation

The purpose of this procedure is to provide guidelines and simplify the process of categorizing, quantifying, managing, treating and disposing wastes. Waste management is a critical component of MOL Pakistan operating policies. Waste management includes the proper handling, accumulation, storage, manifesting, transportation, and disposal/recycling of the waste generated. The procedure is designed to assist in a company wide effort to provide protection for the environment and to comply with MOL corporate requirement, environmental laws and regulations regarding proper waste management.

1.2 Scope of this Regulation

Waste streams generated as part of drilling, production and projects operations and from field camps shall be managed as per this procedure. Guidelines for proper handling, categorization, recording, minimization, recycling and disposal of all types of waste associated with MOL Pakistan operations and projects are part of this procedure.

This procedure shall be followed at all MOL Pakistan sites by all MOL personnel and contractors working for MOL Pakistan.

1.3 Date of effect

From the Date of effect, **29 December 2017**, the provisions of this Regulation are obligatory and binding for affected employees.

1.4 Responsibilities

Head SD&HSE is responsible for the creation, maintenance and supervision of implementation of this Regulation.

1.5 Access restrictions

Access to this Regulation is not restricted within MOL Pakistan. If external use of this Regulation is requested, it has to be approved in written form by the Head SD&HSE.

2. REGULATION DESCRIPTION

2.1 Detailed description of the Regulation

2.1.1 Definitions

Waste
Any material, for which no further use is intended, is considered a waste. It can be solid, semi-solid or liquid. Additionally, abandoned materials and materials intended to be recycled are considered wastes. It is very important to understand this concept, because even though something is going to be recycled, it must be managed as a waste until it is actually recycled.

Hazardous Waste
Waste is categorized as a hazardous waste if it has one or more of the following properties:

- Ignitability (flash point less than 60°C);
- Corrosivity (pH less than or equal to 2.0, or greater than or equal to 12.5);
- Reactivity (inherently unstable under ordinary conditions or when exposed to water);
- Toxicity (may present an unreasonable risk of injury to health or the environment.)

Non-hazardous Waste

The wastes are categorized as Non-hazardous wastes, if they do not possess any of the hazardous characteristics as defined above. However, non-hazardous waste may still present hazards to employees who handle them. All recommended safety and handling practices must be followed.

2.1.2 Legal Requirements

Waste disposal in Pakistan is regulated through the following legislations:

- Pakistan Environmental Protection Act 1997.
- Khyber Pakhtunkhwa Environmental Protection Act, 2014
- Pakistan Environmental Protection Agency (Review of IEE & EIA) Regulations, 2000
- The Pollution Charge for Industry (Calculation & Collection Rules), 2001.
- Hazardous Substances Rules, 2003
- Environmental Sample Rules, 2001
- National Environmental Quality Standards (Self-Monitoring and Reporting by Industries) Rules, 2001.
- Environmental Tribunal Rules, 1999

2.1.3 Procedure

Priorities to manage the waste are listed below:

- Eliminate waste production. Use the material for its intended purpose on site, if possible.
- Minimize waste production.
- Reuse whereby waste is re-used in its original form.
- Recycle waste by which waste can be reformed to their original state or reprocessed to form another non-waste product.
- Dispose of waste in a proper waste disposal facility.

2.1.4 Waste Minimization

To minimize waste, the following steps shall be taken by all personnel working on MOL Pakistan sites:

- Only the needed amount of materials shall be ordered. Before purchasing hazardous material, all alternatives for non-hazardous material should be explored.
- Prior consideration shall be given to the sizes of containers available when ordering products that could potentially generate waste. The intent is to avoid unused products and/or their containers from becoming wastes that require special handling.

2.1.5 Waste Categorization

All wastes generated at MOL Pakistan facilities shall be categorized in two major categories (i.e. Hazardous wastes and Non-hazardous wastes) as per the definitions in Section 3. Each category has different types of requirement for handling, storage and disposal. Table 1 shows the categories of most of the waste generated at MOL Pakistan sites/ facilities/ camps.

2.1.6 Segregation / Labelling

Waste management becomes very complicated if different types of waste are mixed together. A small amount of hazardous waste, mixed with a non-hazardous waste or recyclable material, can make the whole mixture a hazardous waste. Disposal costs and liabilities for hazardous waste are very high, so it is extremely important to identify wastes and keep them segregated.

The scheme of segregation is as follow:

(i) All hazardous waste shall be segregated from other types of hazardous waste as well as non-hazardous wastes.

(ii) At all facilities, following types of containers, with color coding for easy identification, shall be kept to collect and segregate common wastes:

- Wood, and Paper Waste - Green
- Glass, Plastic and Metal – Yellow
- Cartridge, chemical and oily rags - Red

(iii) Food waste shall be collected in separate containers.

(iv) Medical waste shall be separately collected, labelled and stored near medical facility.

(v) All containers must be properly and clearly labeled. The label must clearly mention the name or type of waste. Also, if the waste is hazardous, it should be

clearly labeled on the container along with its hazardous characteristics (e.g. flammable, toxic, radioactive, etc.). This is important to workers and to emergency response teams, who need to know what they are dealing with. Missing or unreadable labels must be replaced.

(vi) At field locations, all the waste shall be collected at site in bins, from where it shall be transported to main camp for segregation, handling and disposal accordingly.

2.1.7 Storage and Handling

(i) Sufficient number of waste bins shall be placed all across the facility for collection of waste. All field waste shall be collected and transported back to camp/facility.

(ii) All the waste generated shall be regularly collected from bins and segregated.

(iii) All the segregated waste shall be properly placed at waste storage facility.

(iv) Waste that will be sent for recycling or off-site disposal shall be temporarily stored at waste storage facilities available at different sites such as Junkyard, Scrap yard, pits, etc.

(v) The oily sludge, contaminated soil and other hazardous liquid waste (e.g. rinsate, chemicals, etc.) shall be stored in labelled drums.

(vi) All other wastes awaiting disposal shall be kept in closed containers separately. Care must be taken to prevent wastes giving rise to secondary environmental problems, such as odors or soil and groundwater pollution through rainwater leaching.

(vii) All stored wastes must be clearly labeled with type of waste and warning signs. (For guidance on each type of waste refer Annexure-A).

(viii) All workers handling wastes shall use proper PPE and properly trained.

(ix) Waste shall not be accumulated or temporarily stored for more than one year or as per the manufacture directions.

(x) All wastes packaging containers shall not have any MOL Pakistan marking / logo to ensure no liability is directly or indirectly imposed on MOL Pakistan.

2.1.8 Recycling

Recycling and reuse minimizes the quantity of waste requiring disposal. Some of the wastes can be reused within MOL Pakistan facilities while others can only be recycled at off-site recycling centers. For example, recycling of used oil is possible in some of the Lube Oil Recycling companies; batteries may be sent back to manufacturer or distributor for recycling.

Waste shall not be sold to the unauthorized contractors / companies, who may not have proper recycling facilities, to avoid misuse and to reduce associated liabilities. The possibilities of recycling of each waste are discussed in Annexure-A.

2.1.9 Treatment

Some of the wastes, such as wastewater from camps, oily wastewater from process, etc., require proper treatment before disposal. The treated water should comply with National Environmental Quality Standards (NEQS). Potential treatment options include:

- Biological methods (waste water treatment, composting, tank-based reactors).
- Bio-remediation.
- Thermal methods (thermal desorption and detoxification).
- Chemical methods (precipitation, extraction, neutralization)
- Incineration.
- Physical methods (gravity separation, filtration, encapsulation centrifugation).

2.1.10 Disposal

Disposal becomes the only available alternatives, if reuse and recycling options are exhausted. A material should be classified as a waste for disposal only if no other useful purpose can be identified and if the material cannot be beneficially reused or recycled. The choice of a suitable disposal option for any waste depends on both environmental and economic considerations. The final disposal can be either at on-site disposal facilities or at off-site disposal facilities.

2.1.10.1 On-site disposal facilities

Burial Pits

Only segregated food waste shall be buried in burial pits. Buried waste should be covered with a thin layer of soil to reduce the environmental problems, such as odour from decaying of waste, spreading of waste into other areas due to wind, etc. The burial pit should be located away from the camp area and downwind of the residential area. The burial pit shall be located at least 500m away from the local communities or as per the requirements of EMP.

Reserve Pits

These pits are used to temporarily store drilling waste, chemical waste, oily sludge and contaminated soil. The pits should be properly designed and lined with HDPE liner to avoid soil, groundwater and surface water contamination.

Incineration

Trash can be disposed of by burning at waste incinerator. Recyclable waste such as; plastics, metal, glass and any other hazardous item should be segregated prior to incineration and should not be burnt. Any hazardous waste such as dry batteries etc. should not be burnt in incineration. Ash of the incinerator shall be buried in the approved lined landfill.

Evaporation Ponds

The evaporation ponds are used to dispose of produced water at some facilities by evaporation. All evaporation ponds should be properly designed and lined with HDPE liner.

Injection and Disposal Wells

These wells are primarily used for re-injection or disposal of produced water. However, some of the wells could be chosen to dispose drill cutting, oily sludge and other hazardous liquids. Tubing and casing integrity of such disposal wells should be verified as per international standards.

Lined Landfills

At the moment there is no properly designed landfill available in Karak for the disposal of such wastes which cannot be reused or recycled or sold to third party contractors because of its hazardous characteristics.

For the time being, two options are available with MOL Pakistan; i.e. either temporarily store all those wastes or dispose of through approved contractors at off-site disposal facilities.

2.1.10.2 Off-Site Disposal Facilities

In Pakistan, properly designed and well-operated commercial waste disposal facilities are very limited. All such facilities are being explored and evaluated for possible future use.

2.1.11 Waste Management Options

Waste management options for each type of waste are listed in the following Table (Table 1) along with the category of waste. Detailed data sheets for each type of wastes are attached as Appendix 2.

Table 1 - Summary of Waste Management Options

S. No.	Waste Type	Category	Disposal Options	Ownership/ Responsibility
1	Aerosol Cans (Empty)	Non-hazardous	Empty canisters can be recycled though contractor.	Camp Admin.
2	Asbestos	Hazardous	Lined landfill (HSE will advise suitable location).	Concerned Team Leader handling the job
3	Batteries (Dry)	Hazardous	Recycle batteries with the distributor or manufacturer or contractor.	Warehouse
4	Batteries (Lead Acid)	Hazardous	Recycle batteries with the distributor or manufacturer.	Warehouse
5	Chemical Spills (corrosion inhibitors, emulsifiers, scale inhibitors etc.)	Hazardous Depending on the chemical spilled. (refer to MSDS)	Disposal by incineration at properly designed off site hazardous waste incinerator.	Concerned Team Leader handling the job
6	Clinical Waste	Hazardous	Incinerate at off-site incinerator.	Field Doctor
7	Construction / Demolition Debris including Scrap	Non-hazardous	Recycle, reuse or sell to third party contractor.	Concerned Team Leader handling the job
7	Construction / Demolition Debris including Scrap	Non-hazardous	Recycle, reuse or sell to third party contractor.	Concerned Team Leader handling the job
8	Crude Oil / Condensate Waste	Hazardous	Return crude oil liquid and condensate to the appropriate production stream or incinerate	Production, Business Support
9	Descaling Acids	Hazardous	Reuse when possible. Dispose of in disposal / injection well.	Production
10	Drilling Fluids / Solids	Hazardous	Dispose of drilling wastes (fluids and solids) in the lined waste pit. Treat oil based mud at Bioremediation site.	Concerned Team Leader/ Drilling
11	Empty Drums and Containers	Non-hazardous	Cleans drums at drum draining pit. Crush metal drums in Drum Crusher and cut plastic drums. Disposed them off through recycler.	Concerned Section In Charge/ Ware House / Material Man
12	Filters	Non-hazardous	After draining oil, recycle drained oil as used engine oil. Sell the drained filters through approved contractor.	Ware House

S. No.	Waste Type	Category	Disposal Options	Ownership/ Responsibility
13	Fluorescent Light Tubes	Hazardous (if contain mercury)	Send fluorescent tubes to manufacturer. Dispose of mercury-free lamps in a landfill.	Warehouse Camp Admin.
14	Food Waste	Non-hazardous	Incinerate or burial in ground Dispose of through contractor.	Camp Admin.
15	Glycols	Non-hazardous	Reuse if viable. Return to vendor for recycling.	Concerned Section In Charge / Ware House
16	Laboratory Wastes	Hazardous	Sell or exchange excess unused chemicals. Incinerate at off-site incinerator.	Concerned Section In Charge
17	NORM Containing Waste (Tubulars / Equipment / Scale / Sludge)	Hazardous	Use concrete or properly designed lined tanks to temporarily hold the sludge or other liquid waste with NORM. Reinject, if viable. Incinerate sludge at off-site incinerator. Immobilize scale by mixing with cement / concrete.	Concerned Section In Charge (Production, Drilling)
18	Oil Contaminated Soil	Hazardous	Recover free liquids and recycle in production streams. Treat at bioremediation site.	Concerned Section In Charge
19	Oily Rags (Used)	Hazardous	Incinerate at off-site incinerator. Dispose of through contractor.	Concerned Section In Charge
20	Paraffins	Hazardous	Return to production stream. Incinerate at off-site incinerator.	Concerned Section In Charge
21	Produced Water	Non-hazardous	Inject produced water in disposal or injection wells. Use produced water for hydro-testing pipelines, equipment, tanks.	Concerned Section In Charges (Production, Drilling)
22	Rig wash	Non-hazardous	Collect and reuse for subsequent rig wash downs or for first stage washing of equipment. Dispose of rig wash in the lined waste pit.	Drilling
23	Sand Blasting Wastes	Non-hazardous Hazardous due to possibility of lead in old lead containing paints.	Disposal along concrete debris. Use in concrete as fine aggregate.	Concerned Team Leader handling the job
24	Sanitary Wastewater	Non-hazardous	Treat wastewater in ETP or septic tanks before disposal.	Camp Admin / Production

S. No.	Waste Type	Category	Disposal Options	Ownership/ Responsibility
25	Scale (Pipe and Equipment)	Non-hazardous	Recover all free oils and return back in production stream or Incinerate. Immobilize scale by mixing with cement / concrete.	Production
26	Septic Pit Bottom Sludge	Non-hazardous	Disposal by burial into earthen pit at site	Camp Admin.
27	Sludge	Hazardous	Reinject, if viable. Incinerate at off-site incinerator.	Concerned Section In charge
28	Trash	Non-hazardous	Segregate glass, metal, plastic from trash. Recycle all recyclable items. Burn remaining trash in incinerator or dispose of through contractor. Bury ash from incinerators in a properly designed lined landfill.	Camp Admin.
29	Used and Torn HDPE Liner	Non-hazardous if clear from contaminations	Disposal by auction from Junk Yard to recycling contractors. Larger pieces can be utilized for lining of ash burial pits.	Production Team Leaders / Ware House
30	Used Computers and Electronic Equipment's	Hazardous if broken Non-hazardous	Disposal by auction from Junk Yard to recycling contractors. Off spec equipment to be sent back to vendor	Ware House/ IT
31	Used Cooking Oil From Kitchen	Non-hazardous	Disposal by off-site incineration	Camp Admin
32	Used Engine Oil	Hazardous	Recycle used engine oil through the approved recycling contractor.	Ware House/ Concerned Section In Charge/ Material Man

Note: The disposal techniques shall comply with NEQS limits

2.1.12 Training

Adequate training shall be provided to all employees and contractors involved in generating, handling and managing wastes by the contractor and field staff. Recommended training to be provided shall include, but not limited to the following areas:

- Identification of waste types
- Chemical and physical properties of the waste
- Proper use of emergency equipment and personal protective equipment
- Procedures for proper handling and storage of waste
- Legal requirements and / or industrial standards
- Notification and consignment / manifest document requirements and

- Emergency procedures for responding to spills, accidental / releases or fires involving hazardous wastes

2.1.13 Recording and Reporting

MOL Pakistan has to record the information about source, composition, quantity, and final disposition of the waste. This information is needed for regulatory compliance, risk assessment and setting reduction targets and objectives as well as corporate statistics. The Waste Tracking Form, as shown in the following page shall be used to record this information by all MOL Pakistan teams, while waste is being dispatched outside facility or MOL Pakistan controlled location. It is the responsibility of the Team Leader to assign a suitable person (such as Lead Operator at all manned fields) to sign off the *Waste Tracking Form*, before the waste is dispatched outside.

3. RELATED REGULATIONS (EXTERNAL AND/OR INTERNAL)

The following external regulations (laws) and/or internal Regulations on the same and/or lower level are in connection with and have impact on this Regulation.

Identifier and Title	Description of relationship
US_1_G1_MOLPA1 Environmental Standard in E&P	This LOR defines the management of environmental impacts.

4. ANNULMENT(S)

By the issue of this Regulation, no Regulations have been annulled.

5. APPENDICES

Appendix number	Appendix title
Appendix 1	Glossary
Appendix 2	Waste Data Sheets - Guidelines for Waste Management
Appendix 3	Waste Tracking Form

List of Acronyms

Acronym	Definition
ACM	Asbestos-Containing Materials
CO_2	Carbon Dioxide
E&P	Exploration and Production
EIA	Environmental Impact Assessment
EMP	Environment Management Plan
EPA	Environmental Protection Agency
H_2S	Hydrogen Sulfide
HSE MS	Health Safety Environment Management System
IEE	Initial Environmental Examination
MSDS	Material Safety Data Sheet
NEQS	National Environmental Quality Standards
NORM	Naturally Occurring Radioactive Material
P&FE	Projects & Facility Engineering
PPE	Personal Protective Equipment
SOD	Sub-Surface Operation & Development
TDS	Total Dissolved Solids

Waste Data Sheets - Guidelines for Waste Management

Aerosol Cans

Description	Container used for spraying various substances with pressurized gas as propellant.
Components	• Container • Paints, starter fluids, oils, insecticides, etc.
Waste Category	• Canister shall be considered hazardous waste if not empty or still pressurized. • Aerosol cans are non-hazardous if there is no propellant or product inside.
Analysis	No laboratory analysis required. Identify the components by referring label and/or Material Safety Data Sheet (MSDS).
Ownership / Responsibility	Camp Administrator
Accumulation/ Storage	Store empty can in recycling bin for metals (make sure it is a non-burnable trash).
Waste Reduction	• Use all of the contents. • Order only the quantity needed.
Disposal Options	• Empty canister can be recycled through contractor. • For contents of aerosol can, refer appropriate sheet.

Asbestos
Synonyms: Actinolite, Chrysotile, Tremolite

Description	White, or greenish-blue, or gray green fibrous, odorless solid.
Components	• Polytetrafluoroethylene Teflon™. • All the asbestiform varieties of serpentinite (chrysotile), riebeckit (crocidolite), cummingtonite-granerite, anthophyllite, and actinolite-tremolite.
Waste Category	Hazardous Waste
Analysis	No analysis is required.
Ownership / Responsibility	Concerned Team Leader handling the job
Accumulation/ Storage	• Store in rigid, leak-tight containers, such as metal, plastic or fiber drums, or bags or non-rigid containers that are dust and sift-proof. • Asbestos storage containers must be marked with the following: ➢ CAUTION; HAZADOUS WASTE ➢ CONTAINS ASBESTOS FIBERS; ➢ AVOID CREATING DUST • If asbestos or asbestos-containing materials (ACMs) are spilled, then the following actions must be completed: ➢ Sweep all spilled substance into sealable containers (if appropriate, moisten first to prevent dust formation); and ➢ Carefully transfer to a safe place for storage.
Waste Handling	• Asbestos is a human carcinogenic substance, so use the proper personal protective equipment (PPE) when handling. • Prevent dispersion of dust; • Avoid contact; • Wear protective clothing; • If clothes become contaminated, rinse with plenty of water; • Wear a self-contained full face respirator or air-purifying full face respirator with a high-efficiency particulate filter; and • Wash hands thoroughly after handling.
Waste Reduction	• Purchase asbestos-free products and equipment. • Conduct routine maintenance on ACMs to prevent exposure of asbestos.
Disposal Options	ACMs to be removed by trained personnel and disposed in a lined

	landfill.

Batteries (Dry)
Synonyms: Nickel, Cadmium, Mercury, Lithium, Silver-oxide batteries

Description	• A dry electrical storage battery. • Used in consumer goods; some are rechargeable.
Components	Nickel, cadmium, mercury, lithium, silver/silver oxide.
Waste Category	• Dry cell batteries containing hazardous components (i.e., nickel, cadmium, mercury, lithium, silver oxide, etc.) are hazardous waste. • Some dry cell batteries used in consumer goods (e.g., AA, D, C, etc.) do not contain hazardous components (i.e., they are free of nickel, cadmium, mercury, etc.) and therefore considered as non-hazardous waste. If unsure about the battery components, consult the original package to see if there is any hazardous component in the battery.
Analysis	No analysis is required.
Ownership / Responsibility	Warehouse
Accumulation/ Storage	Hazardous batteries must be accumulated / stored as follows: • Label each container with “Hazardous Waste – Battery(ies)”; • Label containers with the date on which the first battery became a waste; • Do not accumulate waste batteries for more than one year. • Place damaged, ruptured, or leaking batteries in a closed, structurally sound, and compatible container to prevent releases to the environment; • Pack batteries without other materials in container or package; • Protect batteries in order to prevent short circuits. Insulate at least one terminal of each battery with electrical tape to prevent short circuits and possible fire; and • Do not use battery terminals to support any weight.
Waste Handling	Handle batteries in the following manner to prevent exposure: • Wear impervious gloves if handling broken units; and • Wear safety glasses, face shield, or goggles when handling damaged batteries.
Waste Reduction	• Use rechargeable batteries wherever possible. • Arrange for battery exchange or credit from dealer or sale to approved contractor
Disposal Options	Recycle batteries with the distributor or manufacturer or through contractor.

Batteries (Lead Acid)

Synonyms: wet cell battery, electric storage battery

Description	• Liquid-filled or gel-filled lead acid batteries. • Used in vehicle engine starting and uninterrupted power supply systems.
Components	• Lead/lead oxide. • Sulfuric acid.
Waste Category	Hazardous waste.
Analysis	No analysis is required.
Ownership / Responsibility	Ware House
Accumulation/ Storage	Batteries waste must be accumulated / stored as per following instructions: • Label each container with “Hazardous Waste – Battery(ies)”; • Label all containers storing several batteries with the date on which the first battery became a waste; • Label all batteries stored individually with the date on which the battery became a waste; • Do not accumulate for more than one year; • Damaged, ruptured, or leaking batteries must be placed in a closed, structurally sound, and compatible container to prevent releases to the environment; • Pack batteries without other materials in the container or package; • Protect batteries in order to prevent short circuits. Insulate at least one terminal of each battery with electrical tape to prevent short circuits and possible fire; • Do not use battery terminals to support any weight; and • Draining the electrolyte due to Safety consideration after being neutralized.
Waste Handling	Used batteries should be handled in a manner to prevent exposure to skin and inhalation: • Wear impervious gloves if handling broken units; • Wear safety glasses, face shield, or goggles for handling damaged product; and • Wear respirator with an acid-mist cartridge if there is a risk of acid release.
Waste Reduction	Arrange for battery exchange or credit from dealer.
Disposal Options	Recycle batteries with the distributor or manufacturer or contractor.

Chemical Spills

Description	Chemical spills and contaminated soils from chemical spills (corrosion, scale inhibitors; biocides etc.
Components	• Chemicals
Waste Category	• Hazardous • Depending on the chemical spilled. (refer to MSDS)
Analysis	No analysis is required.
Ownership / Responsibility	Concerned Team Leader
Accumulation/ Storage	• Collect all chemical spilled and chemical contaminated soil. • Store at waste storage sites in bins with lids. • Label each storage containers with name of chemicals spill stored, along with hazard signage. (refer to MSDS for labeling info)
Waste Handling	• Do not mix one type of chemical with another type of chemical. • Do not mix with oil sludge or oil contaminated soil. • Wear appropriate (to the contaminants) personal protective equipment while handling chemical spills and chemical contaminated soil.
Waste Reduction	• Proper storage and handling of chemicals. • Secondary containment for chemical storage areas.
Disposal Options	• Disposal by incineration at properly designed off site hazardous waste incinerator.

Clinical Waste

Synonyms: Medical waste, Hospital waste, Infectious waste, Expired medicines

Description	Waste generated from field clinics.
Components	Used cotton and bandages, expired medicines, used syringes, etc.
Waste Category	Hazardous
Ownership / Responsibility	Field Doctor
Analysis	No analysis is required.
Accumulation/ Storage	Collect and seal in polythene bags
Waste Reduction	Do not mix with other wastes (such as paper)
Disposal Options	Incinerate at off-site incinerator. Field clinic also required to send the clinical waste to off-site incinerator and keep the record of incineration.

Construction / Demolition Debris

Synonyms: Metal Scrap, Wood Scrap, Spoil, Vegetation

Description	Scrap metal, wood, or other materials from a construction or demolition site.
Components	Components depend on the material.
Waste Category	Construction and demolition debris that is not contaminated by chemicals, asbestos, oil, or NORM is a non-hazardous waste.
Ownership / Responsibility	Concerned Team Leader handling the job
Analysis	If material is suspected of NORM contamination, measure the contamination level (count/sec) with contamination monitors. If the readings are twice or above the background levels then refer the Waste Data Sheet on NORM for more details.
Accumulation/ Storage	If the construction or demolition debris is not contaminated with other substances (i.e., chemicals, oils, NORM, etc.), it doesn't need any special handling. However care must be taken so that the dust emanating from the debris is well under control.
Waste Reduction	Recycle material when possible.
Disposal Options	If construction and demolition debris is not contaminated with other substances, the following disposal options are applicable: • Recycling, reusing or selling to a third party contractor; and • Disposal in a landfill.

Crude Oil and Condensate Waste

Description	Crude oil and natural gas condensate waste generated due to spills, leaks.
Components	Hydrocarbons.
Waste Category	Hazardous waste
Analysis	No laboratory analysis is required.
Ownership / Responsibility	Concerned Team Leaders / Production/ Business Support
Accumulation/ Storage	• Return crude oil and condensate to the production system or incinerated • Label each storage container with the name of the material in the container and the appropriate hazard warnings (Flammable). • Store crude oil and condensate in a structurally sound and compatible container.
Waste Handling	• Use appropriate PPE (e.g., gloves, boots, etc.) when handling crude oil and condensate.
Waste Reduction	• Prevent leaks or spills by carrying out regular inspection and maintenance of all surface lines and facilities. • Return crude oil liquid and condensate to the appropriate production stream.
Disposal Options	• Return crude oil liquid and condensate to the appropriate production stream.

	• If crude oil is not being recycled to the production stream due to excessive water content, separate the water and crude through any appropriate separation mode and recycle the crude oil.

Descaling Acids

Description	• Liquid. • Used for pipe and vessel descaling, cleaning agent for laboratory equipment.
Components	Depends on the type of acid and contaminants.
Waste Category	Hazardous waste (Corrosive)
Analysis	No analysis is required.
Ownership / Responsibility	Concerned team Leader
Accumulation/ Storage	• Store in sealed containers, which are compatible with acids. • Store in containers that are properly constructed and do not contain leaks, corrosion, gouges, bulges, or creases. • Store in a cool, dry, ventilated storage area with acid resistant floors and good drainage. • Protect from physical damage. • Keep out of direct sunlight and away from heat, water, and incompatible materials. • Do not wash out container and do not use for other purposes. • When diluting, always add acid slowly to water and in small amounts; never use hot water and never add water to acid. • Label each container with the name of the material in the container and the “Hazardous Waste”.
Waste Handling	• Consult the MSDS for the proper personal protective equipment (PPE) required when handling this chemical. • Use non-sparking tools when opening metal containers. • Wear rubber or neoprene gloves, impervious boots, apron, or coveralls to prevent skin contact. • Use chemical safety goggles and/or a full-face shield when there is a possibility of splash. • Maintain eyewash fountains and quick-drench facilities in work area. • Neutralize prior to disposal.
Waste Reduction	• Neutralize acids in pipe cleaning process. • Do not order more than needed. • Reuse as pH control whenever possible. • Use for neutralization of caustic wastes.

Disposal Options	• Reuse when possible. • Dispose of in disposal / injection well.

Drilling Fluids/Solids

Description	• Water or oil-based mud returned from down hole; • Cuttings from down hole removed when reconditioning returned mud; • Unused drilling chemicals.
Components	• Muds and solids. • Cement returns. • Saltwater. • Oil. • Formation cuttings.
Waste Category	Hazardous waste
Analysis	No analysis is required.
Ownership / Responsibility	Concerned Team Leader/ Drilling
Accumulation/ Storage	• Store drilling fluids in the reserve pit. • Store lubricating oil separately from drilling fluids • Store chemicals separately from drilling fluids in leak-proof containers and label each container with the name of the material in the container and the appropriate hazard warnings. • Segregate lubricating oil and chemicals for disposal so that they do not enter the reserve pit. • Use De-watering system to de-water mud pits for immediate pit closure.
Waste Handling	Wear protective clothing and avoid eye or skin contact.
Waste Reduction	• Prevent spills and leaks. • Optimize solids control equipment. • Substitute less toxic products and additives. • Use a closed-loop mud system whenever possible to reduce volumes of drilling fluid wastes. • Minimize use of oil-based drilling fluids. • Use inventory control and careful planning to avoid accumulating unused materials. • Minimize water usage and excess chemical and additives. • Transfer unused additives for use at other sites.
Disposal Options	• Dispose of drilling wastes (fluids and solids) in the lined reserve pit. • Reuse water-based mud whenever possible. • Reuse waste drilling mud for upcoming well spudding or plugging operations.

	• Encapsulate surplus additives and oil-based mud to avoid it mixing with other environmental mediums.

Drums and Containers

Description	Drums and containers either empty or having some residue.
Components	Packaging components and residue.
Waste Category	• Drums and containers containing hazardous material would only be considered empty, if no more than 1 inch of residue remains in the container. • Empty drums and containers after cleaning are considered as non-hazardous waste.
Analysis	No analysis is required.
Ownership / Responsibility	Concerned Section In Charge/ Ware House / Material Man
Accumulation/ Storage	• Drums / containers should be checked to verify that they are empty. • All drums that are not empty must be marked with legible labels. • Store drums on pallets, racks, or other structures to keep them from direct contact with the soil.
Waste Handling	• Cleans drums at drum draining pit. • Take proper pre-cautions when handling & emptying the drums or containers that contain hazardous material. • Consult relevant MSDS for PPE when emptying drums of hazardous material.
Waste Reduction	• Switch to purchase of materials and chemicals in bulk containers, reducing the amount of drums requiring handling. Additionally, less drum handling reduces the chance of spills and releases requiring cleanup. • Purchase materials in returnable or recyclable drums / containers. • Reuse uncontaminated drums for other purposes (e.g., storage and transfer of non-hazardous waste).
Disposal Options*	• Crush metal drums in Drum crusher and cut plastic drums • Disposed them off through recycler • Drums that are not empty should not be disposed of.

Filters

Description	• Used oil filters from gasoline, diesel, vehicle, and generator engines. • Fuel oil filters. • Glycol filters. • Production filters.

	• Chemical filters.
Components	Filter media. Residue from waste stream.
Waste Category	Used oil filters are considered non-hazardous waste, if the filter is punctured.
Analysis	No analysis is required.
Ownership / Responsibility	Ware House
Accumulation/ Storage	• All filters must be punctured, drained, and free of any liquids prior to accumulation and disposal. • Drained oil from filters is handled as used oil. • Place drained filters in a labeled and closed container. • Label each storage container with the name of the material in the container and Hazardous Waste.
Waste Handling	• Place drained fuel and oil filters in a labeled and closed container for recycling. • Do not mix drained liquids from filters with other materials. • Wear protective clothing
Waste Reduction	• When handling filters, take care to prevent oil spillage and the contamination of soil. • Change filters only when necessary; use differential pressure as an indicator of needed change. • Where possible, use reusable filters.
Disposal Options	• After draining oil, dispose of oil as used engine oil. (Refer Data sheet for Used Engine Oil.) • Recycle drained liquids (chemicals) back into production stream. • Sell the drained filters through contractor. • Send filters free of liquid to off-site incinerator.

Fluorescent Light Tubes

Description	Light tubes or ballasts.
Components	• Glass. • Chemicals associated with fluorescent tube; may contain mercury.
Waste Category	• Fluorescent light tubes containing mercury are hazardous waste. • Mercury-free fluorescent light tubes are non-hazardous.
Analysis	No analysis is required.
Ownership / Responsibility	Camp Admin
Accumulation/ Storage	• Do not accumulate wastes for more than one year after the generation; • Contain unbroken lamps in closed packages that minimize breakage during normal handling conditions; • Contain broken lamps in packaging that minimize releases of lamp fragments and residues.
Waste Handling	• Cleanup and place any broken light tubes in a structurally sound container that will prevent escape of any material into the environment.
Waste Reduction	• Use mercury-free light tubes whenever possible.
Disposal Options	• Send fluorescent tubes to a lamp recycler or manufacturer. • Dispose of mercury-free lamps in a landfill or through contractor.

Food Waste

Description	Waste generated from Kitchen.
Components	Non-recyclable food waste
Waste Category	Non-hazardous waste.
Analysis	No analysis is required.
Ownership / Responsibility	Camp Admin
Accumulation/ Storage	• Store separately. • Do not mix with trash. • Wear protective clothing
Waste Reduction	Segregate all recyclable items e.g. plastic bottles, glass bottles.
Disposal Options	Incinerate. Dispose off through contractor.

Glycols
Synonyms: Ethylene Glycol, Propylene Glycol, Triethylene Glycol (TEG)

Description	• Colorless, odorless liquid. • Ethylene glycol or propylene glycol is used as anti-freezing agent in heat exchange operations. • Triethylene glycol is used for dehydration of natural gas.
Components	• Constituents depend on the glycol material being used. • Waste glycols may be contaminated with light hydrocarbons and salts.
Waste Category	Non-hazardous waste.
Analysis	No analysis is required.
Ownership / Responsibility	Concerned Section In Charge / Ware House
Accumulation/ Storage	• Do not mix waste glycols, because each glycol must be recycled separately. • Store glycols in a structurally sound and compatible container. • Label each storage container with the name of the material in the container.
Waste Handling	• Observe the following requirements when handling this material: ➢ Wear protective gloves and coverall; ➢ Use chemical safety goggles; and ➢ Maintain eyewash fountain and quick-drench facilities in work area.
Waste Reduction	• Properly maintain and operate dehydration units to minimize waste and emissions (e.g., flow rates and temperatures). • Regenerate waste glycols for reuse.
Disposal Options	• Return to vendor for recycling. • Dispose with spilled soil / sludge.

Laboratory Waste
Synonyms: Laboratory Chemicals

Description	Waste resulting from sample testing
Components	Depends on sample tested and chemicals used
Waste Category	Hazardous waste
Analysis	Refer MSDS to determine the characteristics of chemical and materials tested.
Ownership/ Responsibility	Concerned Section In Charge
Accumulation/ Storage	• Do not mix waste chemicals. • Store wastes in appropriate containers (e.g., non-metal

	containers for corrosive substances). • Label each storage container with the name of the material in the container and the appropriate hazard warnings.
Waste Handling	Consult the appropriate MSDS for personal protection and safety requirements when handling specific chemicals.
Waste Reduction	• Buy only the required amount. • Minimize testing by conducting analysis of only required samples. • Use test methods that generate less or no waste.
Disposal Options	• Sell or exchange excess unused chemicals. • Dispose off laboratory wastes (acid, base and test material) after neutralizing. • Non-hazardous waste such as rinsed chemical and acid empty bottles sent to waste contractor for recycling. • Incinerate at off-site incinerator.

NORM Containing Waste (Tubulars, Equipment, Scale, Sludge, etc.)

Description	NORM (Naturally Occurring Radioactive Materials) may be present in oil and gas operations at some locations. NORM can be found in down hole tubing, produced water, above-ground processing equipment, contaminated soils (well work overs, tank cleaning, and saltwater leaks), pipe cleaning, and other associated operations.
Components	Radioactive material generally consists of radionuclides: uranium, thorium, and radium (radium-226 and radium-228).
Waste Category	Hazardous Waste
Ownership / Responsibility	Concerned Section In Charge (Production, Drilling)
Analysis	Measure the contamination level (count/minutes) using contamination monitors. If the readings are twice or above the background levels then composite sample shall be collected for radio-chemical analysis.
Accumulation/ Storage	• All NORM-contaminated equipment, whether in service or not, should be labeled. • All out-of-service NORM contaminated equipment should be segregated and labeled. • Use concrete or properly designed lined tanks to temporarily hold the sludge or other liquid waste with NORM. • Wear protective clothing
Reporting Requirement	It is recommended that concerned supervisor maintain records of types, volumes, analytical data, destinations, and transportation mechanism of NORM wastes and reports the same to HSE Team.
Waste Handling	Proper industrial hygiene and necessary precautions and equipment are required. Consult the MOL Pakistan NORM management procedure for drilling activities.
Waste Reduction	• Do not accept any used equipment that contains NORM.

	• Use scale inhibitors where NORM scale accumulates.
Disposal Options	• NORM wastes can be reinjected in abandoned wells. • Contaminated soil and sludge can be incinerated at off-site incinerator. • Immobile scale by mixing with cement / concrete. • Engage specialized contractor for disposal

Oil Contaminated Soil

Description	Soils that have been contaminated due to a release of oily compounds or products (i.e., condensate, produced water, hydrocarbons, etc.).
Components	• Soil. • Hydrocarbons
Waste Category	Hazardous waste
Analysis	Not required
Ownership / Responsibility	Concerned Section In Charge
Accumulation/ Storage	• Contaminated soil must be stockpiled in a bunded area that is lined. • Contaminated soil may be temporarily stored in designated drums with lid
Waste Handling	Prevent skin contact with contaminated soil by wearing impervious clothing, gloves, and boots.
Waste Reduction	• Prevent soil contamination by: ➢ Properly maintaining equipment and pipes to prevent leaks and spills; and ➢ Using containment devices in chemical storage areas. ➢ Using good quality transport bowsers. • Use leak detection equipment. • Use appropriate measures to stop and contain spill or leak if one occurs. • Pick up free liquids or solids spilled as soon as possible after the spill is contained and recycle.
Disposal Options	• Recover free liquids and recycle in production streams. • Treat at Bioremediation site.

Oily Rags
Synonymous: Absorbent Pads

Description	Oily rags or absorbent pads are used to clean up: Crankcase oil; Crude oil; Diesel fuel; Hydraulic fluid; and Other petroleum products.
Components	• Hydrocarbons. • Rag or absorbent material.
Waste Category	Hazardous waste.
Analysis	No analysis required.

Ownership / Responsibility	Concerned Section In Charge
Accumulation/ Storage	• Place oily rags in a closed container and keep the drum closed unless materials are being added or removed. • Add enough absorbent at the time of packing to soak up free liquid.
Waste Handling	• Return liquid to the crude oil stream if it is crude oil, crankcase oil, diesel fuel, hydraulic fluid, or other non-hazardous petroleum distillates. • Do not return halogenated solvents (e.g., “chloro”, “flouro”, or “bromo” in the name on the MSDS) to the crude oil stream. • Prevent skin contact with oily rags and if skin contact should occur, wash skin. • Wear protective clothing
Waste Reduction	• When possible, use absorbents that can be wrung out and reused. This reduces the volume of waste pads. • If possible, return free liquids to the production stream.
Disposal Options	• Send for incineration.

Paraffins

Description	• Component of crude oil, which can be shipped to a refinery by drum as “crude oil” if not suitable for pipeline. • Accumulate in pumps, tubing, surface equipment, and tank bottoms.
Components	Oily waste
Waste Category	Hazardous
Analysis	No analysis required.
Ownership / Responsibility	Concerned Section In Charge
Accumulation/ Storage	• Store paraffins in a structurally sound and compatible container to prevent releases into the environment. • If the paraffin has thickened, thin the paraffin by mixing with a solvent and recycle in the production stream. • Label each storage container with the name of the material in the container and the appropriate hazard warnings.
Waste Handling	Wear protective clothing and avoid eye and skin contact.
Waste Reduction	• Recycle by adding to the production streams. • Minimize overuse or excessive usage. • Use hot-oil treatment to dissolve paraffin in well and flow lines; send to production. • Use paraffin inhibitor chemicals.
Disposal Options	• Return to production stream. • Incinerate at off-site incinerator.

Produced Water

Description	Water brought up from the hydrocarbon-bearing strata during the extraction process.
Components	• Formation water. • Injected water. • TDS. • Petroleum hydrocarbons. • Naturally occurring metals. • Additive chemicals.
Waste Category	Non-hazardous (if no oil present)
Analysis	Analysis required
Ownership / Responsibility	Concerned Section In Charges (Production, Drilling)
Waste Reduction	• Use rock plugging with gel slugs to block off water production in completions where there is a separation of the oil and water zones. • Dually complete the oil zone and water zone to allow water to be produced simultaneously but separately from oil and allow control of water coning. • Carefully plan well completions. • Re perforate well to reduce water production. • Drill wells to minimize water production. • Optimize production rate to minimize influx of water.
Disposal Options	• Inject produced water into disposal or injection wells. • Disposal into lined evaporation pits. • Reuse produced water whenever possible. • Use produced water for hydro-testing pipelines, equipment, tanks.

Rigwash

Description	Water used to wash down the rig floor.
Components	• Water. • Detergents.
Waste Category	Non-hazardous if it doesn't contain spilled chemicals and oils.
Analysis	No analysis required.
Ownership / Responsibility	Drilling
Accumulation/ Storage	• Collect rigwash in the waste pit. • Collect oily layer through absorbent pads. • Store any segregated used oil appropriately
Waste Handling	• When handling rig wash, avoid eye and skin contact. • Segregate any used oil and paint solids before disposing of rigwash in the reserve pit. • Wear protective clothing
Waste Reduction	• Use water wisely in rig maintenance.

	• Use high-pressure, low-volume hose nozzles with automatic cutoffs. • Set up a regular maintenance program for water systems to reduce leaks and drips. • Reduce rigwash use by sweeping or other dry cleaning when feasible.
Disposal Options	• Collect and reuse rigwash for subsequent rig washdowns or for first stage washing of equipment. • Use as make-up water in drilling and completion operations. • Dispose of rigwash in the lined reserve pit.

Sand Blasting Waste

Description	Grit from sand blasting operations
Components	• Sand / grit • Surface coating over metal, paints & metal oxides.
Waste Category	• Non-hazardous • Hazardous due to possibility of lead in old lead containing paints.
Analysis	No analysis is required.
Ownership / Responsibility	Concerned Team Leader handling the job
Accumulation/ Storage	• Collect and store in a bin with proper lid. • Label storage containers with the words “Sand Blasting Waste.”
Waste Handling	• Do not mix with other trash. • Wear protective clothing
Waste Reduction	Sand blasting to be performed where needed.
Disposal Options	• Disposal along concrete debris. • Use in concrete as fine aggregate.

Sanitary Wastewater

Description	Wastewater from camps.
Waste Category	Non-hazardous
Analysis	Analysis required Physical monitoring /inspection as per guidelines for operations and maintenance of septic tank system.
Ownership / Responsibility	Camp Admin
Waste Handling	When handling sanitary wastewater, protect yourself from direct contact by using appropriate personal protective equipment.
Waste Reduction	Reduce water use.
Disposal Options	Treat wastewater in ETP or in septic tanks before disposal after complying NEQS.

Scale (Pipe and Equipment)

Description	Formed during the production process within wellbores and production equipment due to temperature and pressure changes.
Components	• Barium sulfate. • Iron sulfide. • Calcium carbonate. • Other inert materials. • Some may contain NORM.
Waste Category	Non-hazardous unless it exhibits hazardous waste characteristics.
Analysis	If material is questionable for NORM contamination, measure the contamination level (count/sec) using contamination monitors. If the readings are twice or above the background levels then composite sample shall be collected for radio-chemical analysis. (See the Waste Data Sheet on NORM for more details.)
Ownership / Responsibility	Production
Accumulation/ Storage	• Store scale in a structurally sound and compatible container to prevent releases to the environment. • Returned to the production stream or Incinerate. • Label each storage container with the name of the material in the container and the appropriate hazard warnings.
Waste Handling	Wear protective clothing and avoid eye and skin contact.
Waste Reduction	• Use scale inhibitors. • Avoid mixing incompatible produced waters that can result in scale formation. • Design facility to reduce locations prone to scale formation (i.e., avoid large pressure drops and unnecessary pipe elbows). • Reduce the volume of water produced. • Coat material surfaces with chemicals at critical points in the production system to reduce the availability of nucleation points for scale formation.
Disposal Options	• Recover all free oils and return back into production stream. • Immobilize scale by mixing with cement / concrete. • For NORM contaminated scale, refer sheet on NORM Containing Waste.

Septic Pit Bottom Sludge

Description	Septic pit
Components	Decomposed human excreta, water, scum, and suspended solids
Waste Category	Non-hazardous
Analysis	No analysis is required.
Ownership / Responsibility	Camp Admin
Accumulation/ Storage	Do not accumulate and dispose immediately after removal.

Waste Handling	• Do not mix septic tank (sludge) with other wastes • Wear appropriate PPE.
Waste Reduction	• Routine maintenance of septic pits • Regular inspections
Disposal Options	• Disposal by burial into earthen pit at site or to municipal drain after approval from municipal authorities.

Sludge

Description	Material (sediment and water) originally from downhole or that gathers on the bottom of treatment and storage tanks (i.e., production separator fluid treating vessels).
Components	• Sands. • Oils. • Solids. • Emulsions.
Waste Category	Hazardous Waste
Analysis	• Test a material that may contain NORM in the following manner: ➢ Measure the contamination level (count/sec) using contamination monitors. If the readings are twice or above the background levels then composite sample shall be collected for radio-chemical analysis.
Ownership / Responsibility	Concerned Section In charge
Accumulation/ Storage	• Reprocess material if possible: • Return free oil to process stream; and • Dispose of water as produced water. • Material that cannot be reprocessed must be contained in drums, tanks, or containers or in properly lined pits. • Label each storage container with “Oily Sludge – Hazardous waste”.
Waste Handling	• Do not mix NORM containing sands or solids with other produced sand. • Wear protective clothing
Waste Reduction	• Separate solids and liquids to minimize volumes • Design perforations in completion operations to minimize sand production. • Modify process to reduce waste (e.g., tank bottom accumulation).
Disposal Options	• Reinject, if viable. • Send for offsite incineration. • For NORM contaminated sludge, refer sheet on NORM Containing Waste.

Trash

Synonyms: domestic, office, warehouse, maintenance trash

Description	Trash and paper products.
Components	Constituents depend on the item.
Waste Category	Non-hazardous waste.
Analysis	No analysis is required.
Ownership / Responsibility	Camp Admin
Accumulation/ Storage	Segregate and store trash in the drums or covered bins.
Waste Handling	• Use caution to avoid splinters, cuts, and general harm. • Wear protective clothing
Waste Reduction	• Recycle. • Limit use of styrofoam and/or paper.
Disposal Options	• Segregate glass, metal, plastic from trash. • Recycle all recyclable items. • Burn reaming trash in incinerators. • Bury ash from incinerators in a properly designed lined landfill.

Used and Torn HDPE Pit Liner

Description	Used / recovered HDPE pit liner from evaporation and other pits.
Components	• High Density Polyethylene • Contaminations
Waste Category	Non-hazardous if clear from contaminations
Analysis	No analysis is required.
Ownership / Responsibility	Production team leaders/Construction Team
Accumulation/ Storage	Store at designated area, along with other reusable items at site.
Waste Handling	• Care to be taken if any contaminants are present on the used HDPE liner. • Wear appropriate (to the contaminants) personal protective clothing while handling used HDPE liner.
Waste Reduction	Recycle at other locations; such as used as secondary containment during temporary storage of chemicals and materials. Regenerate waste glycols for reuse.
Disposal Options	• Disposal by auction from Junk Yard to recycling contractors. • Larger pieces can be utilized for lining of ash burial pits.

Used Computers and Electronic Equipment

Description	Used computers and computer accessories and other electronic equipment such as communication devices, toners, etc.
Components	• Plastics, metals, glass • Electronic circuitry
Waste Category	• Hazardous if broken • Non-hazardous
Analysis	No analysis is required.
Ownership / Responsibility	Ware House/ IT
Accumulation	• Store at suitable location; away from direct sunlight, rain water and extreme temperature.
Waste Handling	• Handle with care, specially monitors etc. to avoid breaking. • Wear protective clothing
Waste Reduction	Minimize generation of this stream by properly utilizing the equipment.
Disposal Options	Disposal by auction from Junk Yard to recycling contractors.

Used Cooking Oil
Synonyms: cooking oil, edible oil

Description	Used cooking oil from kitchen.
Components	Edible cooking oil
Waste Category	Non-Hazardous Waste
Analysis	No analysis is required.
Ownership / Responsibility	Camp Admin
Accumulation/ Storage	• Collect and store in a container with lid, container should be in good condition and not leaking. • Label storage containers with the words “Used Cooking Oil.”
Waste Handling	• Do not mix used cooking oil with any other materials. • Wear protective clothing
Waste Reduction	Minimize volume of used oil discarded.
Disposal Options	Disposal by offsite incineration.

Used Engine Oil
Synonyms: lube oil, engine oil, motor oil, lubricating oil

Description	Used oil generated when maintaining and lubricating production, drilling, workover, and gas plant equipment.
Components	• Hydrocarbons. • Process contaminants.
Waste Category	Hazardous waste
Analysis	No analysis is required.
Ownership / Responsibility	Ware House/ Concerned Section In Charge/ Material Man

Accumulation	• Collect and store in oil barrels /drums that are in good condition, and not leaking. • Label storage containers with the words “Used Oil.”
Waste Handling	• Do not mix used oil with any other materials. • Avoid contamination with other materials. • Wear protective clothing and avoid eye and skin contact.
Waste Reduction	• Minimize volume of lube oil by extending its use and using high-grade oil. • Use oil additives that improve oil performance.
Disposal Options	• Sell to the approved recycling contractor for recycling. • Disposed in facility skim pit for final disposal into production stream.

Waste Tracking Form

Location of Generation:	
Reporting Team:	
Submitted by (Name):	
Submitted on (Date):	

Waste	**Unit**	**Approx. Quantity**	**Disposal Location**
Aerosol Cans (Empty)			
Asbestos			
Batteries (Dry)			
Batteries (Lead Acid)			
Chemical Spills (corrosion inhibitors, emulsifiers, scale inhibitors etc.)			
Clinical Waste			
Construction / Demolition Debris including Scrap			
Crude Oil or Condensate Waste			
Descaling Acids			
Drilling Fluids/Solids			
Drums and Containers (Empty)			
Filters			
Fluorescent Light Tubes			
Food Waste			
Glycols			
Laboratory Wastes			
NORM Containing Waste			
Oil Contaminated Soil			
Oily Rags (Used)			
Paraffins			
Produced Water			
Rigwash			
Sand Blasting Wastes			
Sanitary Wastewater			
Scale (Pipe and Equipment)			
Septic Pit Bottom Sludge			
Sludge			
Trash (i) Glass (ii) Metal (iii) Plastic (iv) General Trash			
Used and Torn HDPE Liner			
Used Computers and Electronic Equipment's			
Used Cooking Oil From Kitchen			

Used Engine Oil			

Checked and Signed:_____

Dated: _____