Electricity Distribution Efficiency Improvement Project (EDEIP)

Islamic Republic of Pakistan

Environmental and Social Impact Assessment (ESIA)

Volume II – Annexes

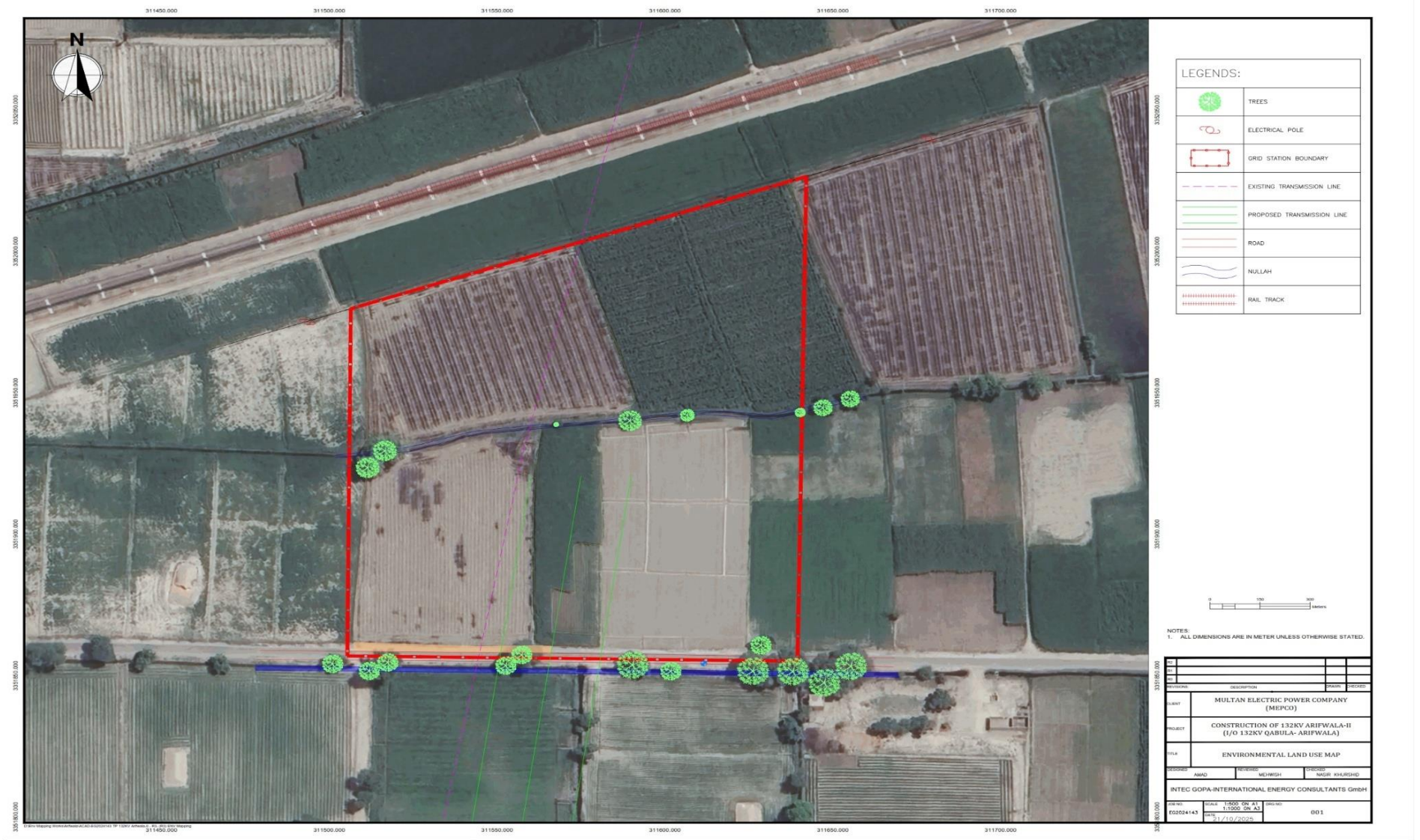
of

132-kV Arifwala-II Grid Station,
132-kV Dera Ghazi Khan-III Grid Station,
132-kV Khanewal-II Grid Station,
132-kV Layyah-II Grid Station,
132-kV Rahim Yar Khan-III Grid Station,
132-kV Shah Jamal Grid Station,
and
Associated Transmission Lines

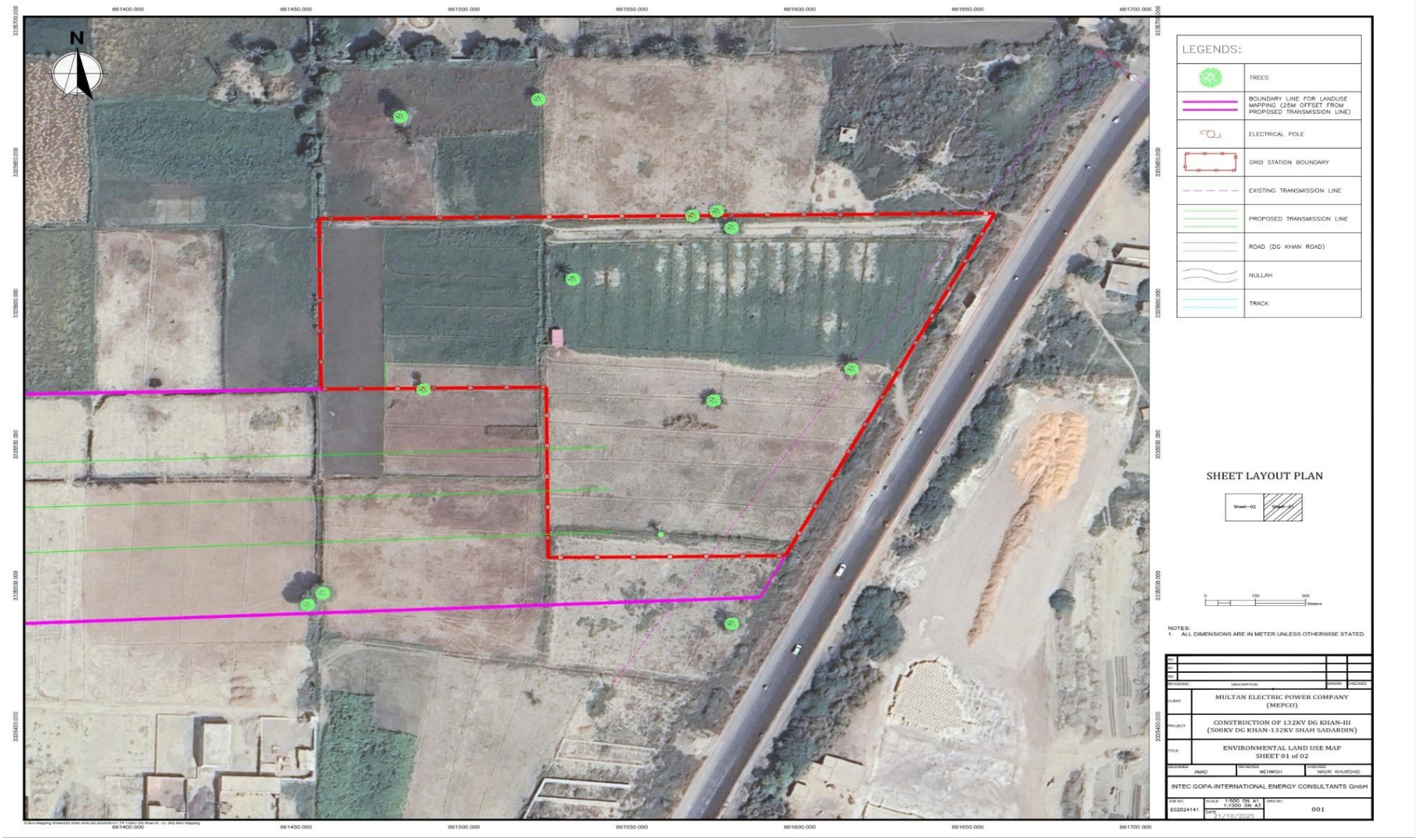
Multan Electric Power Company (MEPCO)

January 2026

Annex A: Landuse Maps



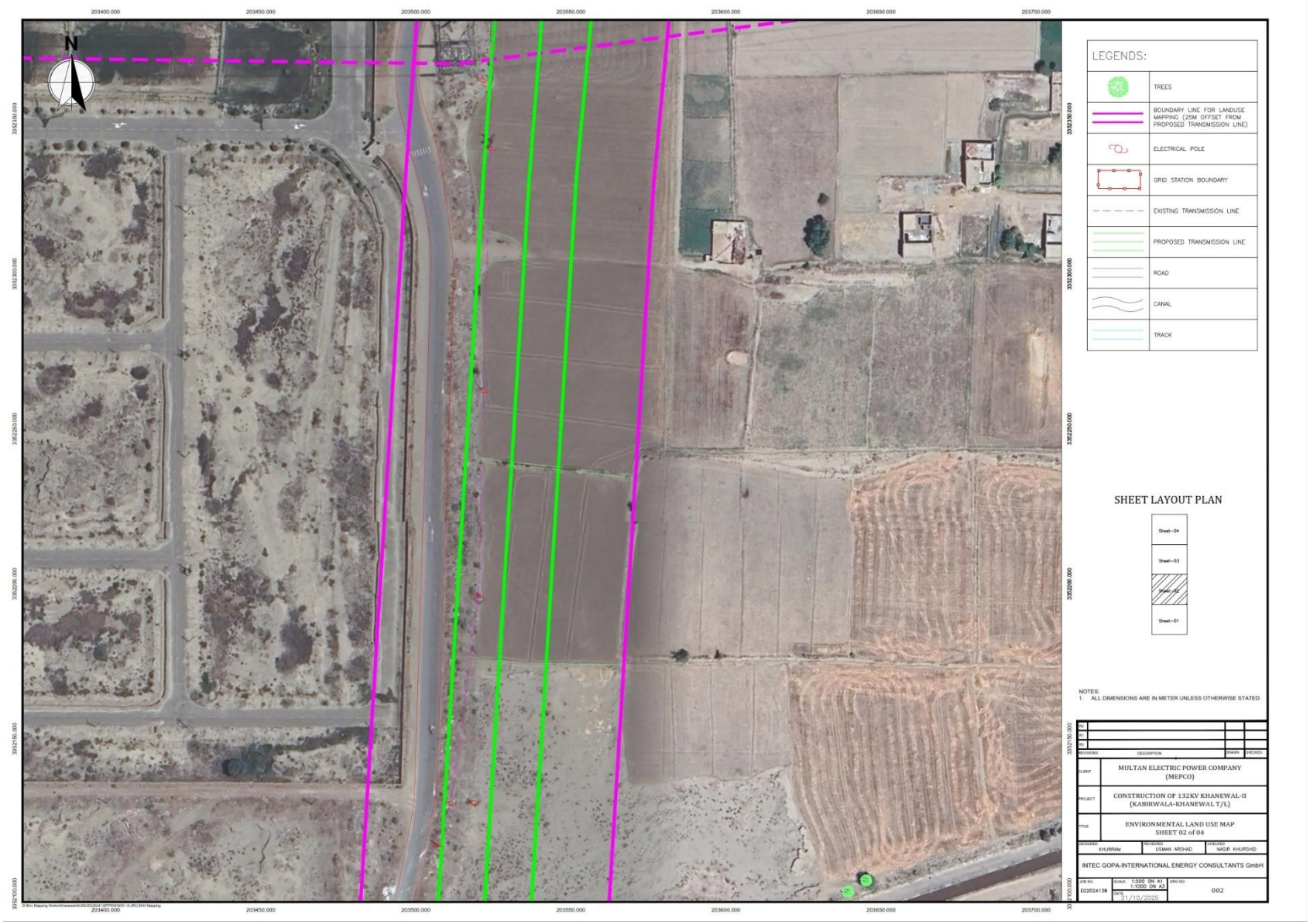
Landuse of 132-kV Arifwala-II Grid Station Site



Land Use of 132-kV Dera Ghazi Khan-III Grid Station Site and Associated Transmission Line Route

Route of Transmission Line Associated with 132kV Dera Ghazi Khan-III Grid Station

132-kV Khanewal-II Grid Station Site and associated Transmission Line Route



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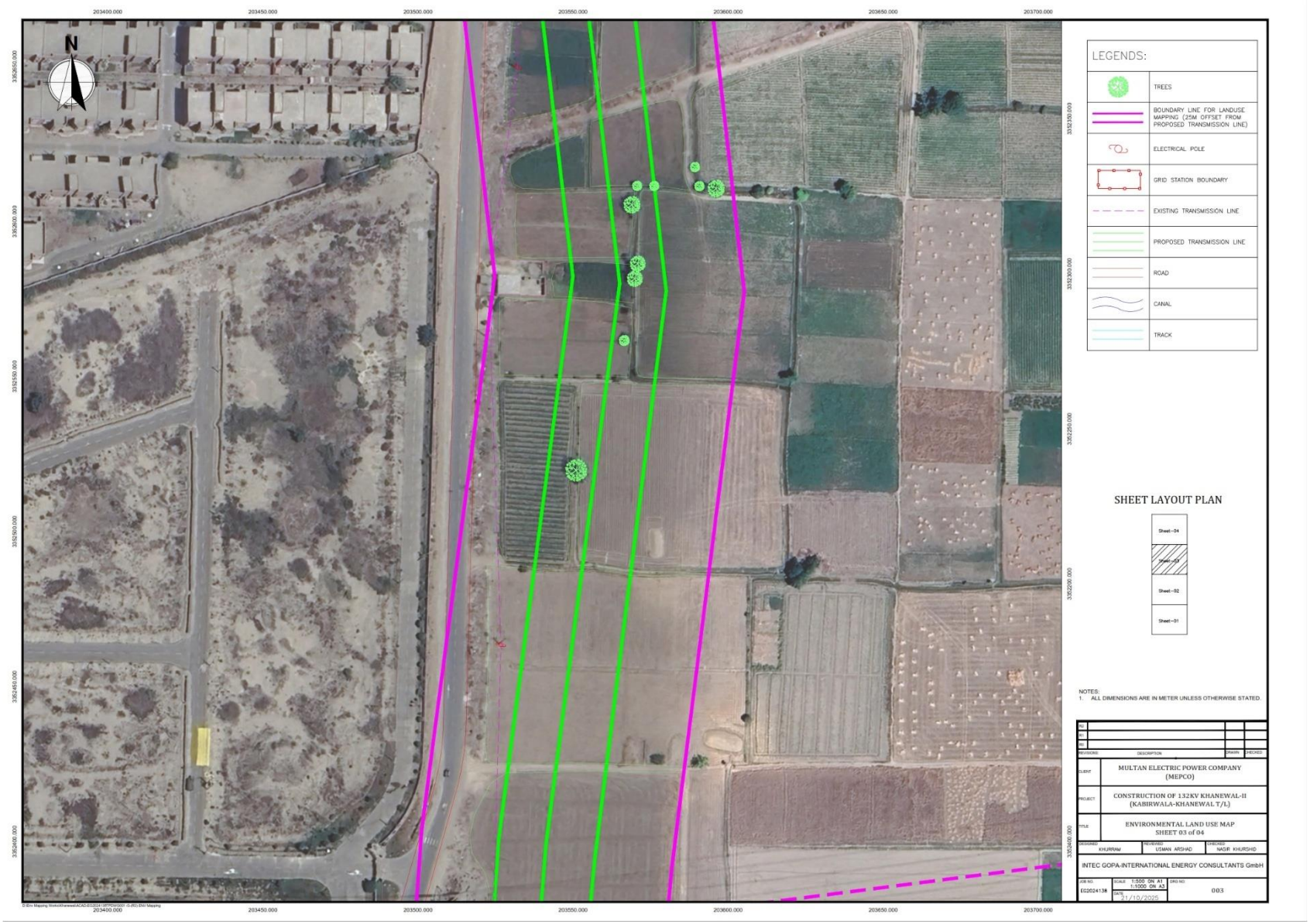
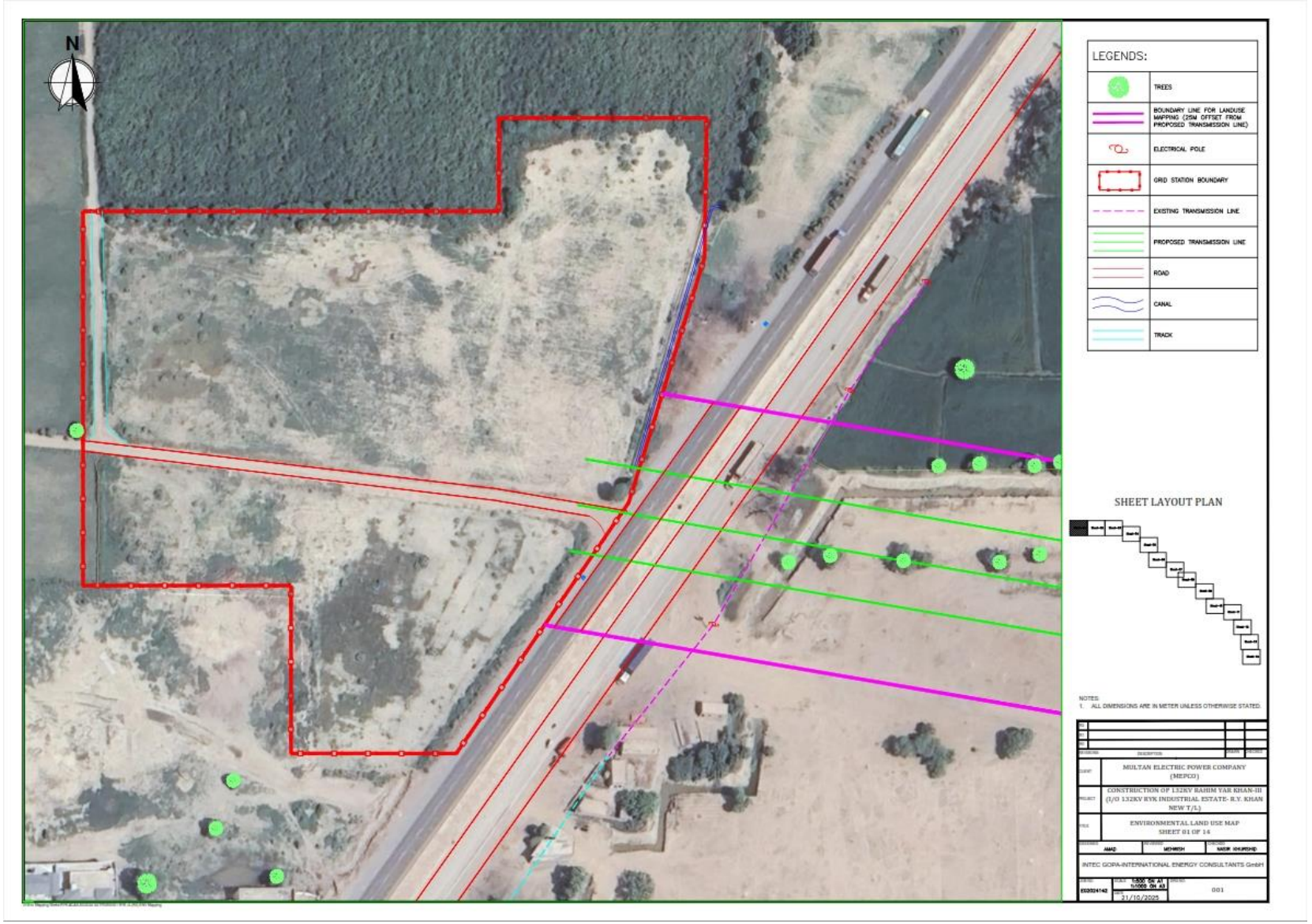


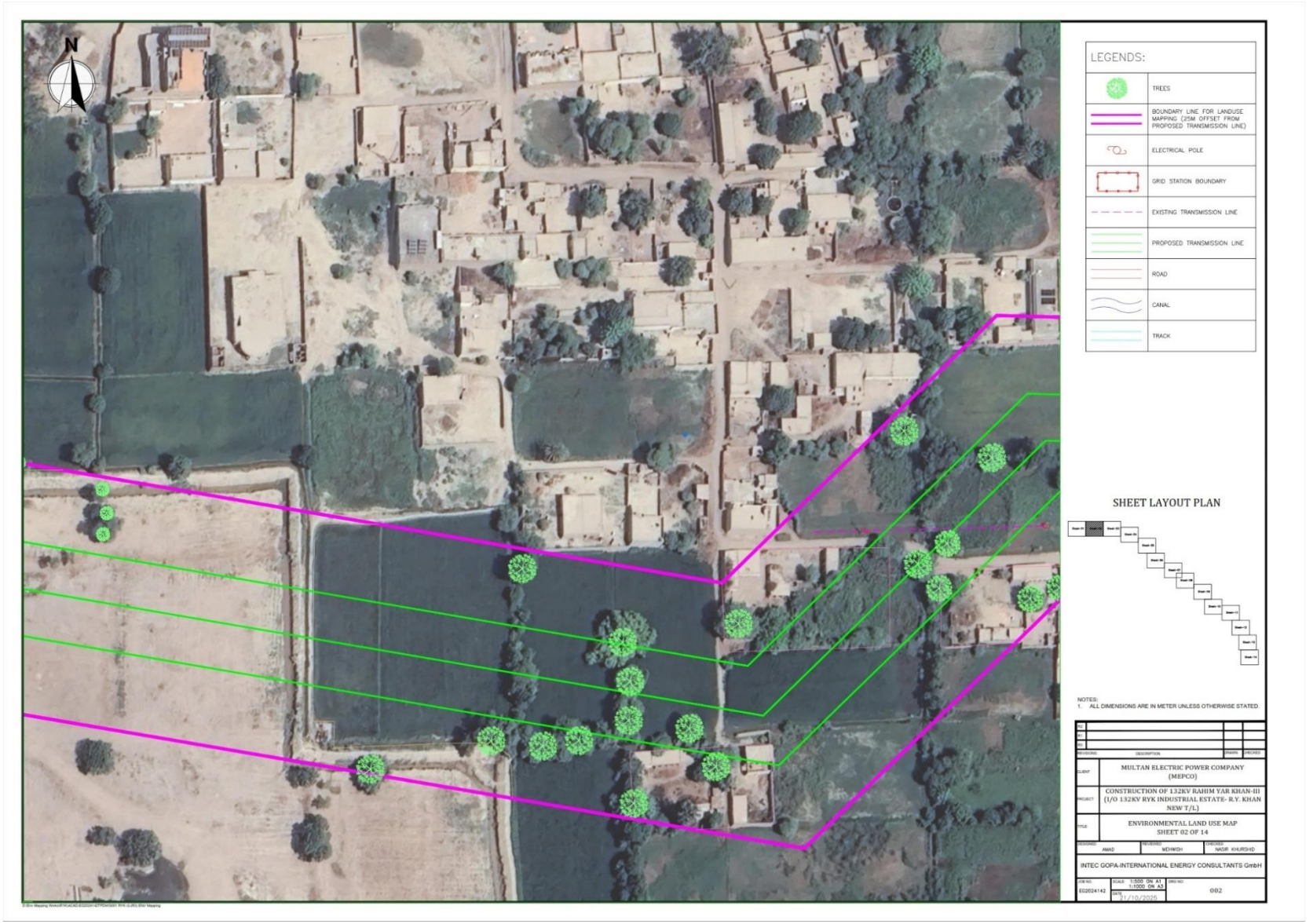
Route of Transmission Line Associated with 132kV Khanewal-II Grid Station

Route of Transmission Line Associated with 132kV Khanewal-II Grid Station

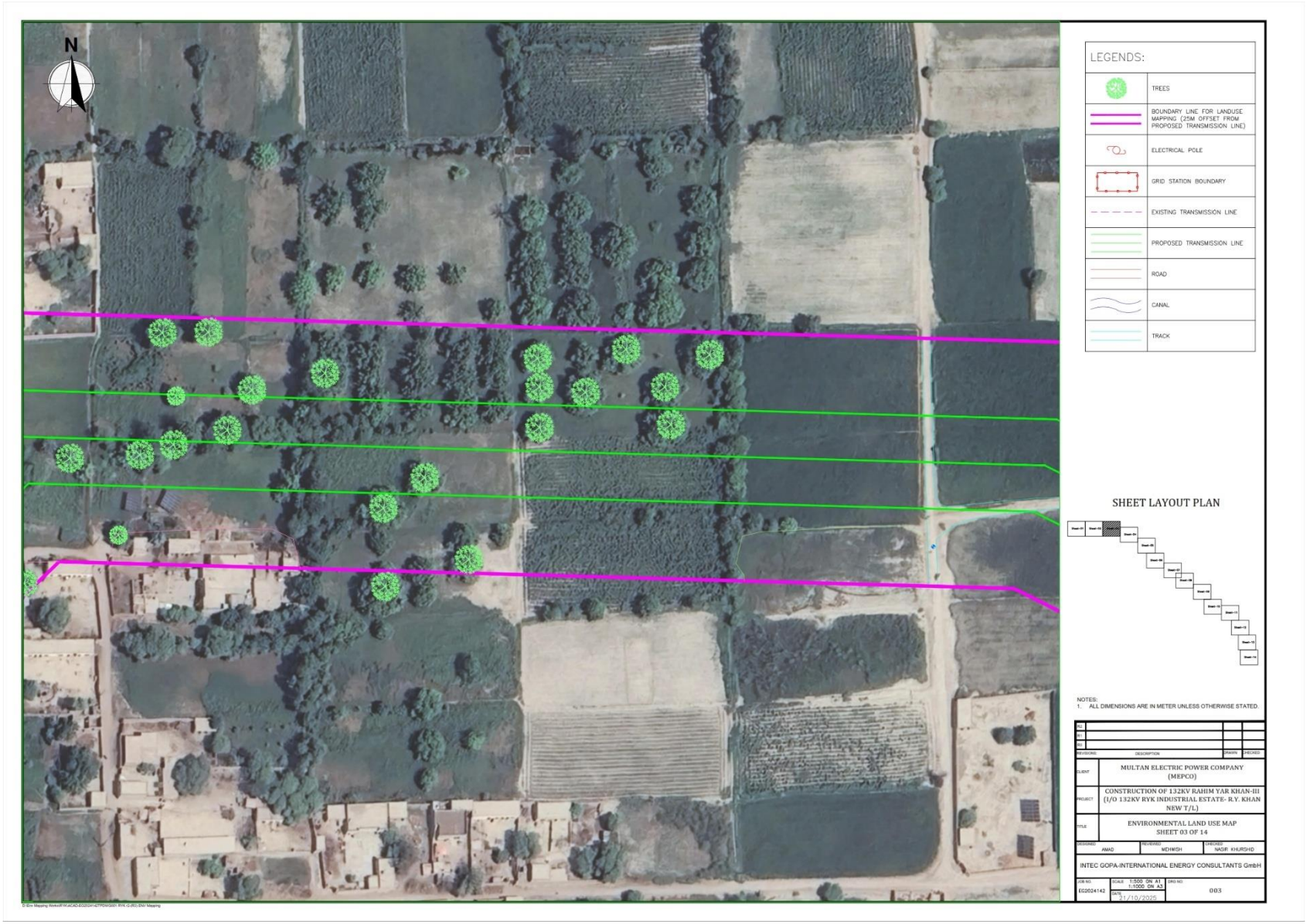
Land Use of 132-kV Layyah-II Grid Station Site and associated Transmission Line Route



Land Use of 132-kV Rahim Yar Khan-III Grid Station Site and associated Transmission Line Route



Route of Transmission Line Associated with 132-kV Rahim Yar Khan-III Grid Station



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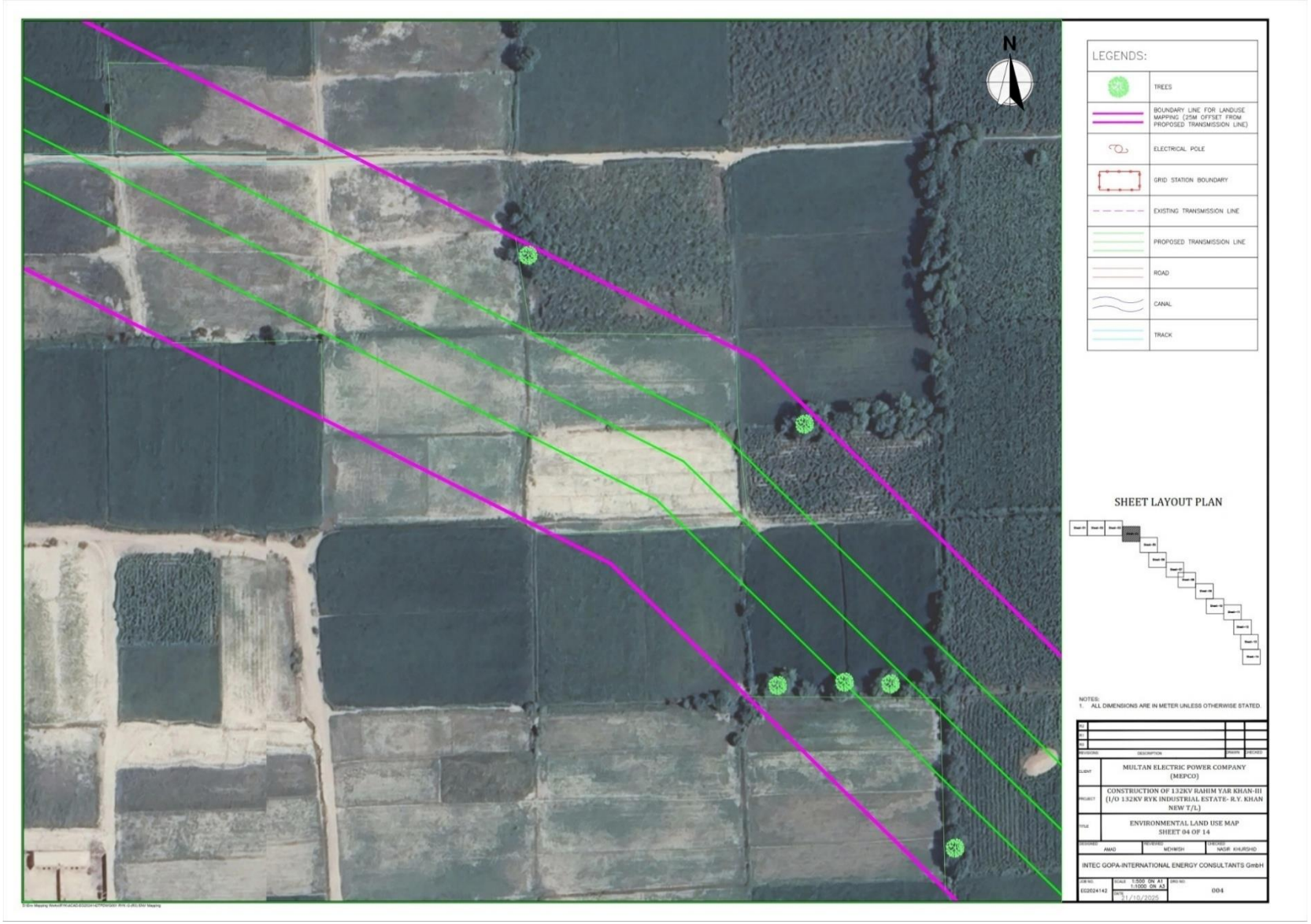

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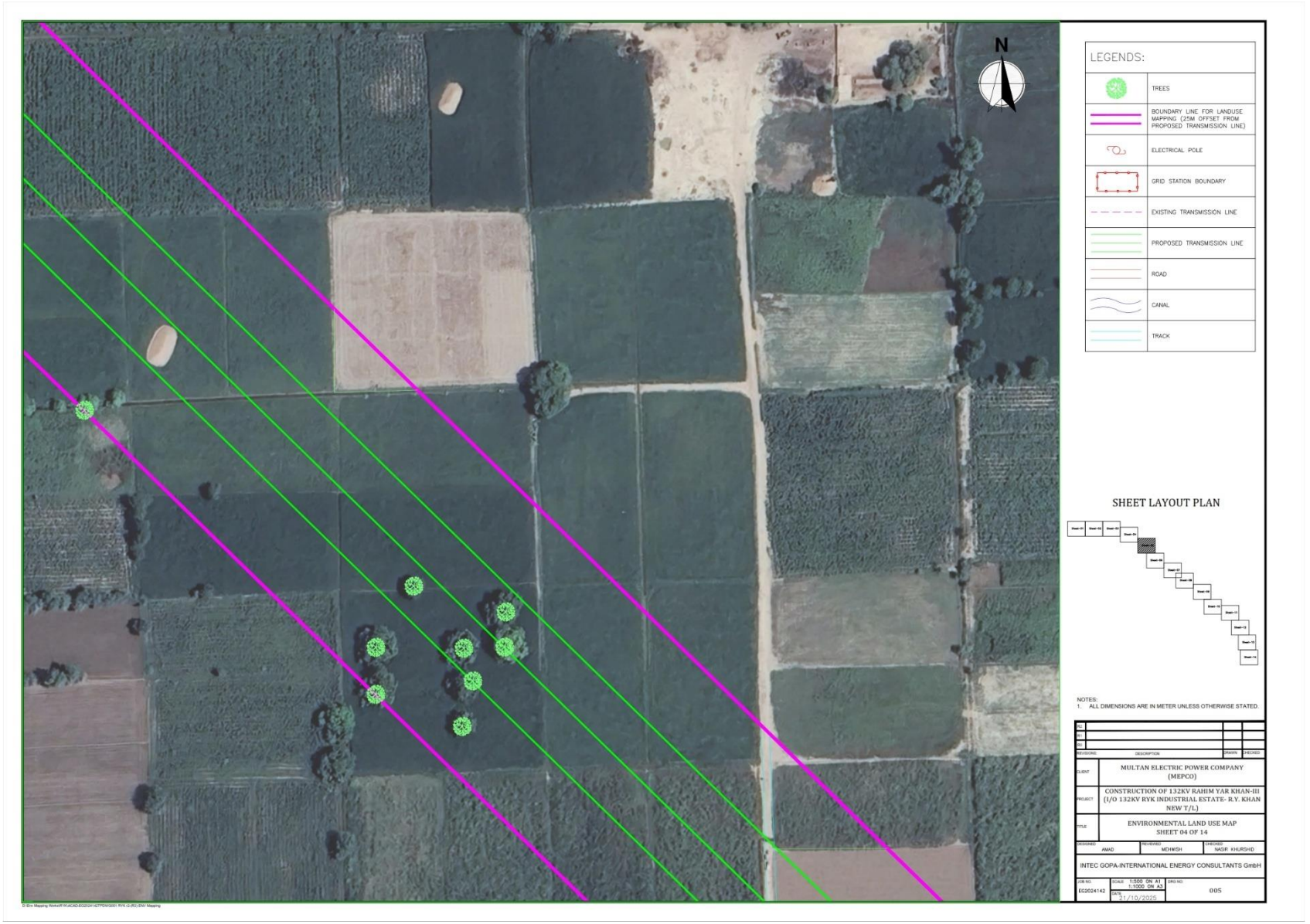

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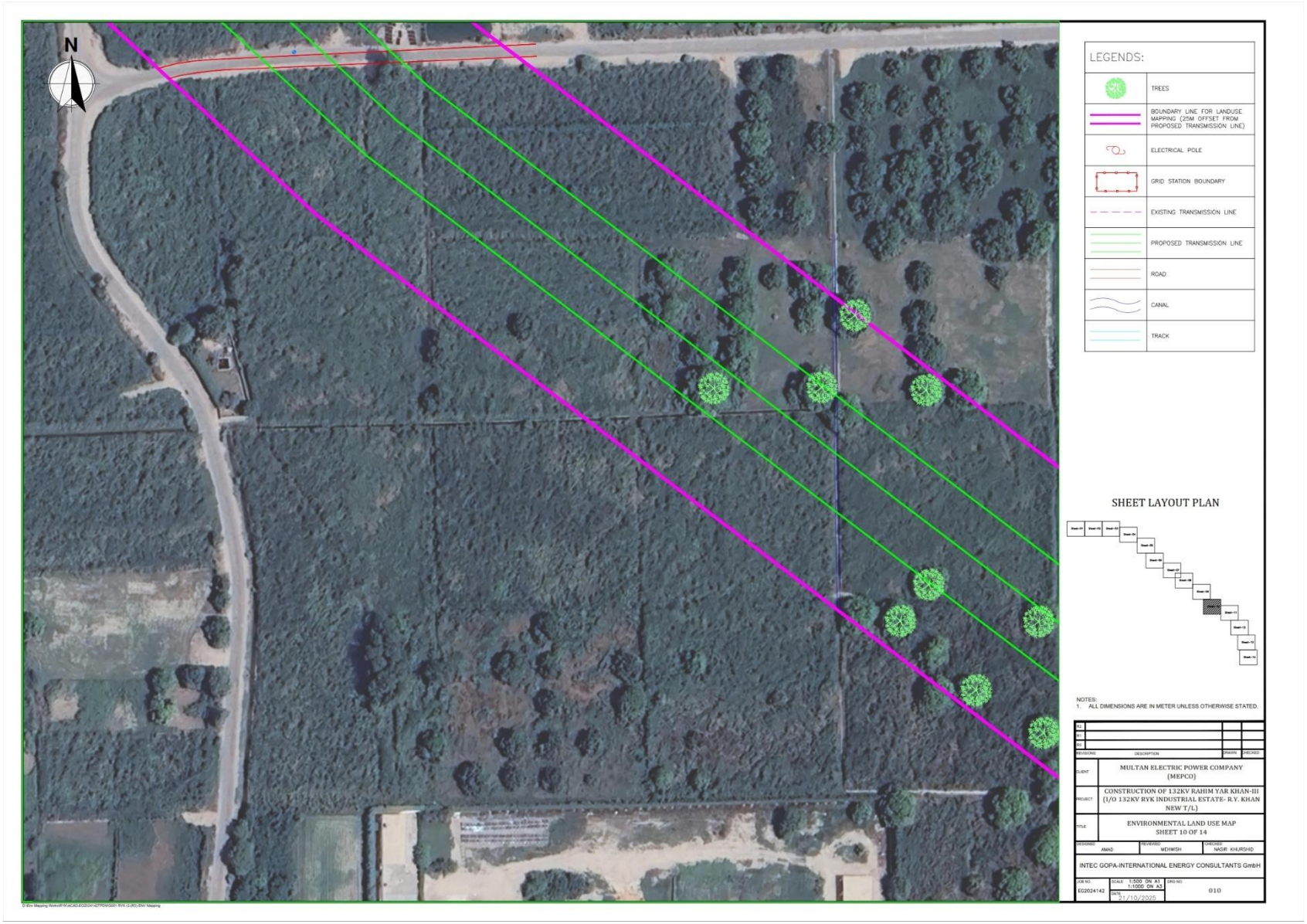

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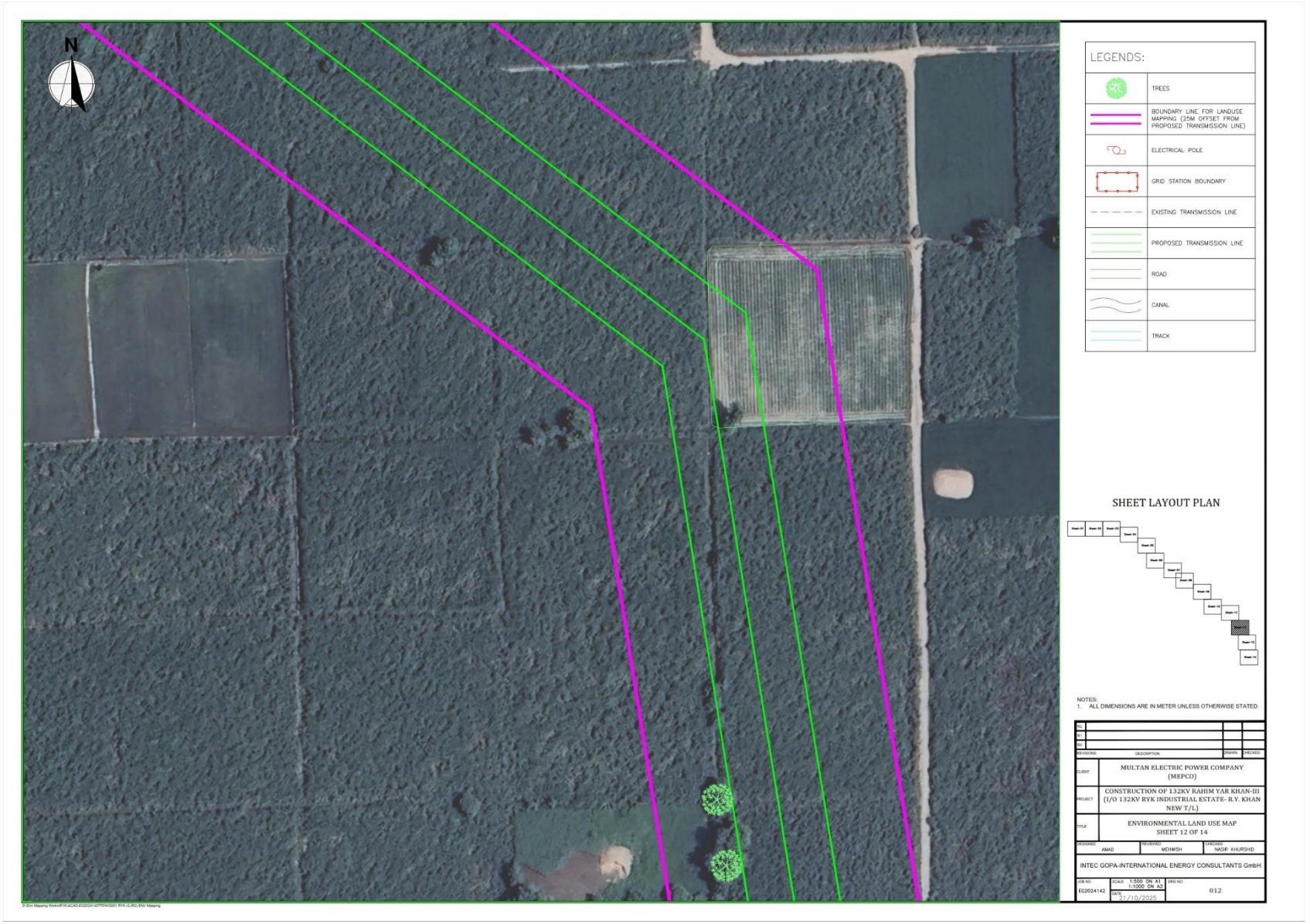

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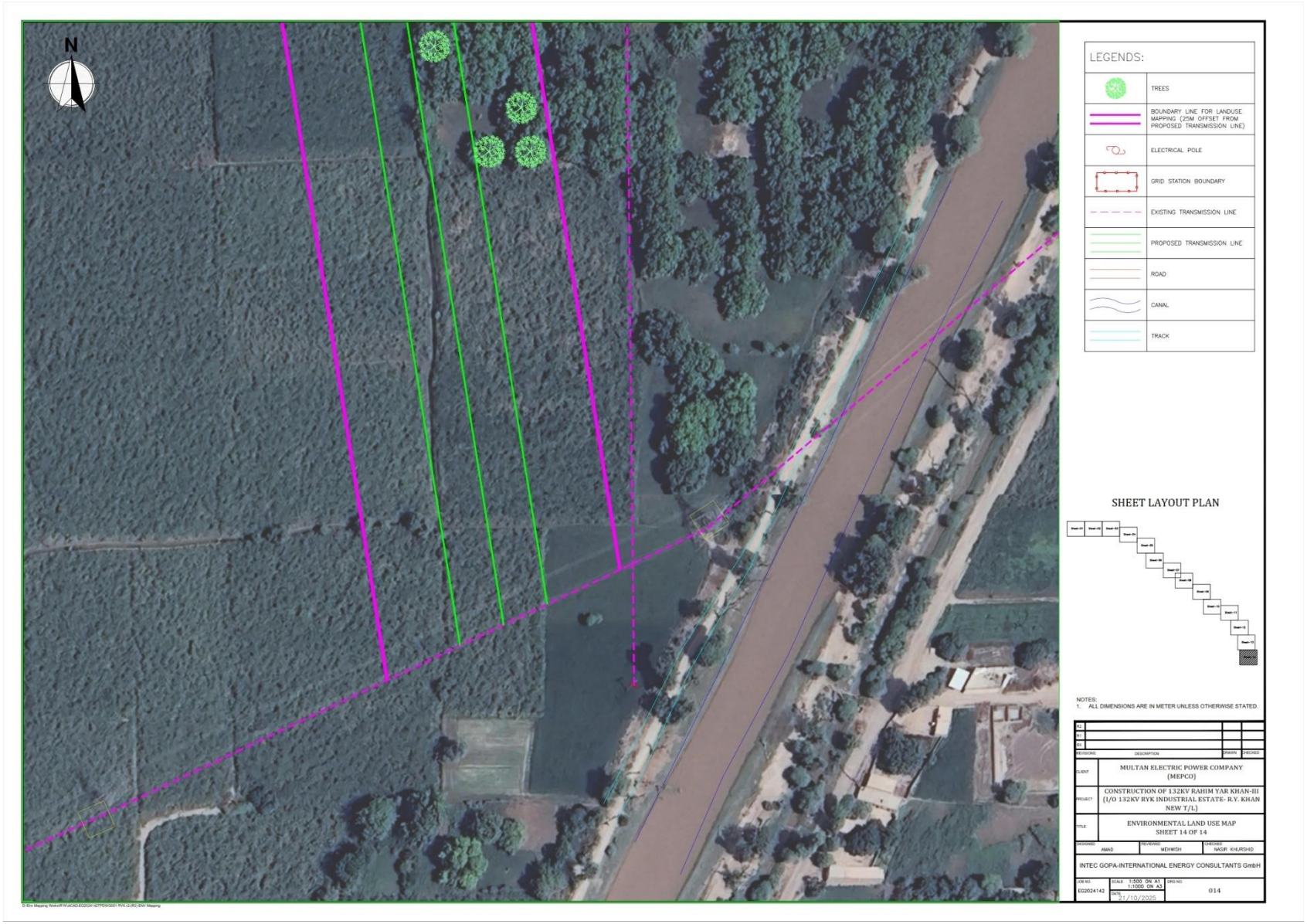

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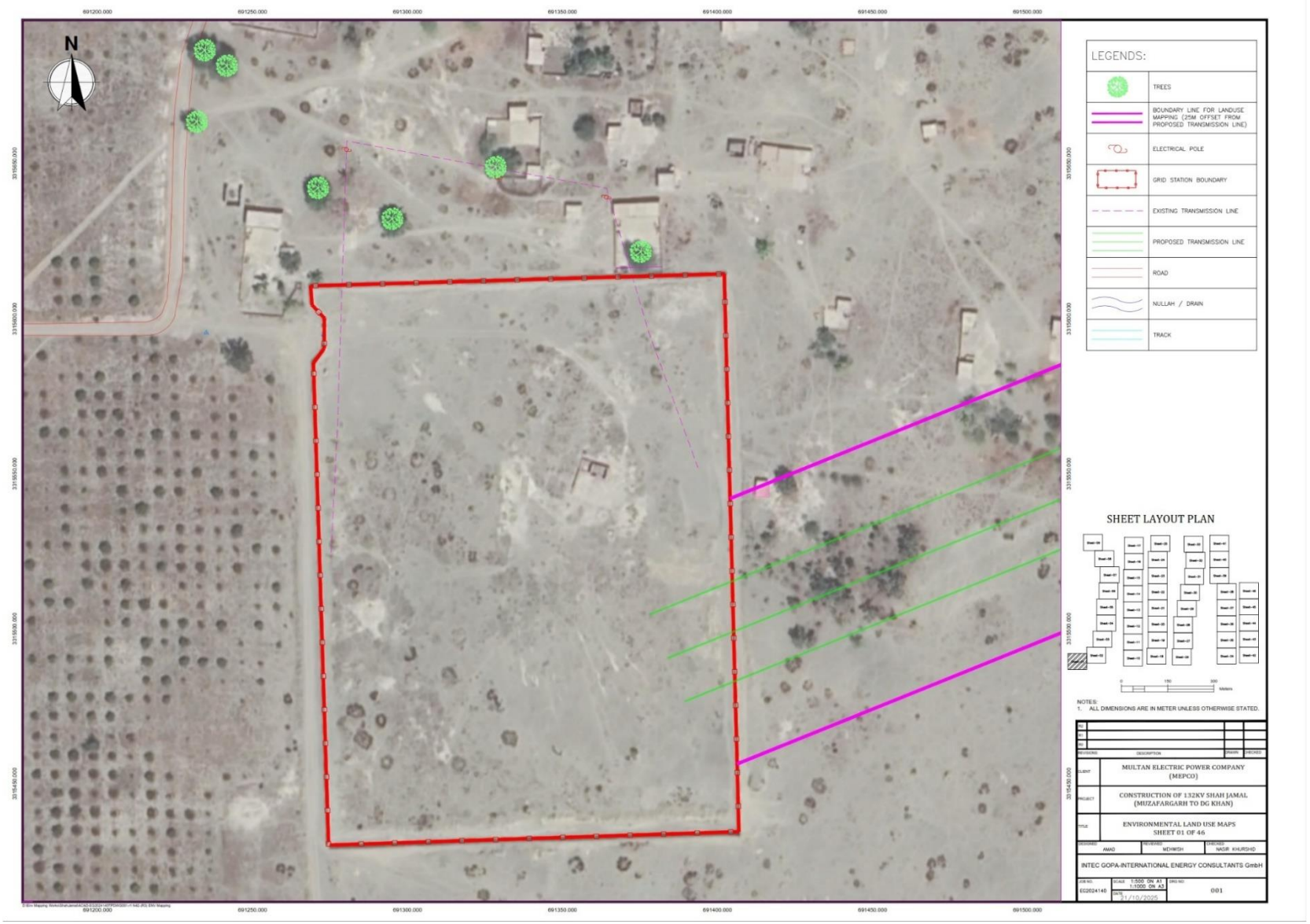
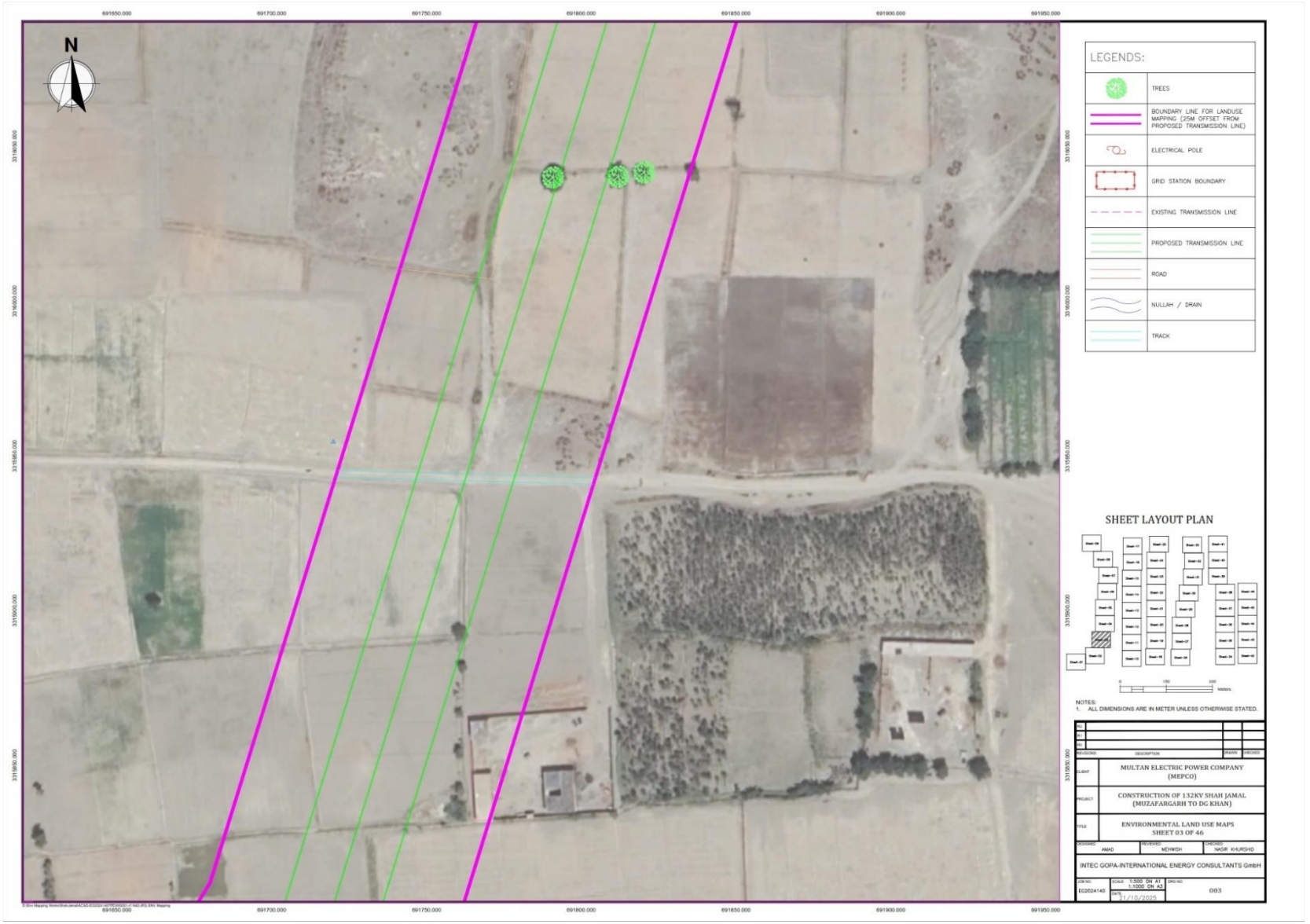


Landuse of 132-kV Shah Jamal Grid Station and associated Transmission Line Route

Route of Transmission Line Associated with 132-kV Shah Jamal Grid Station



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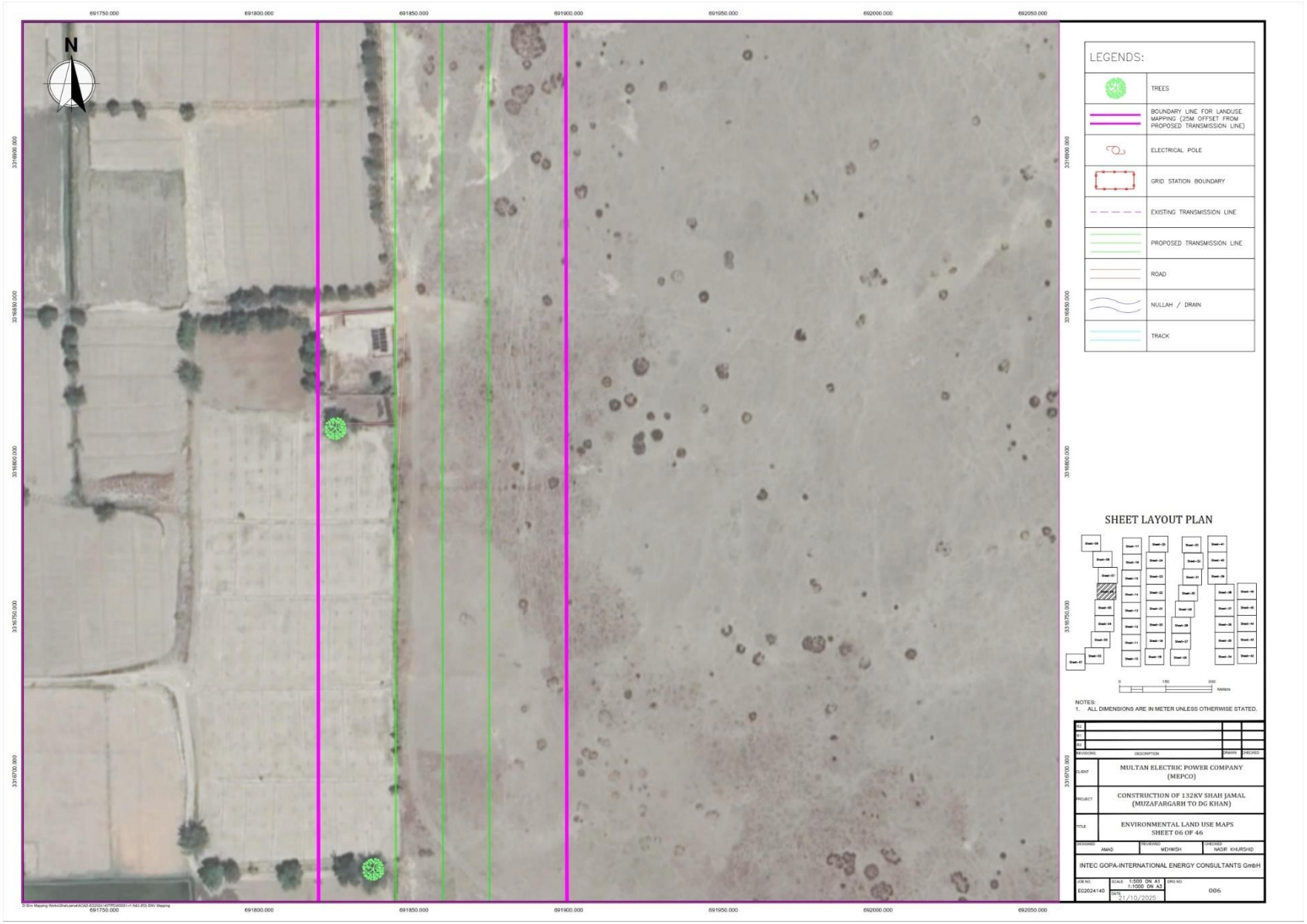

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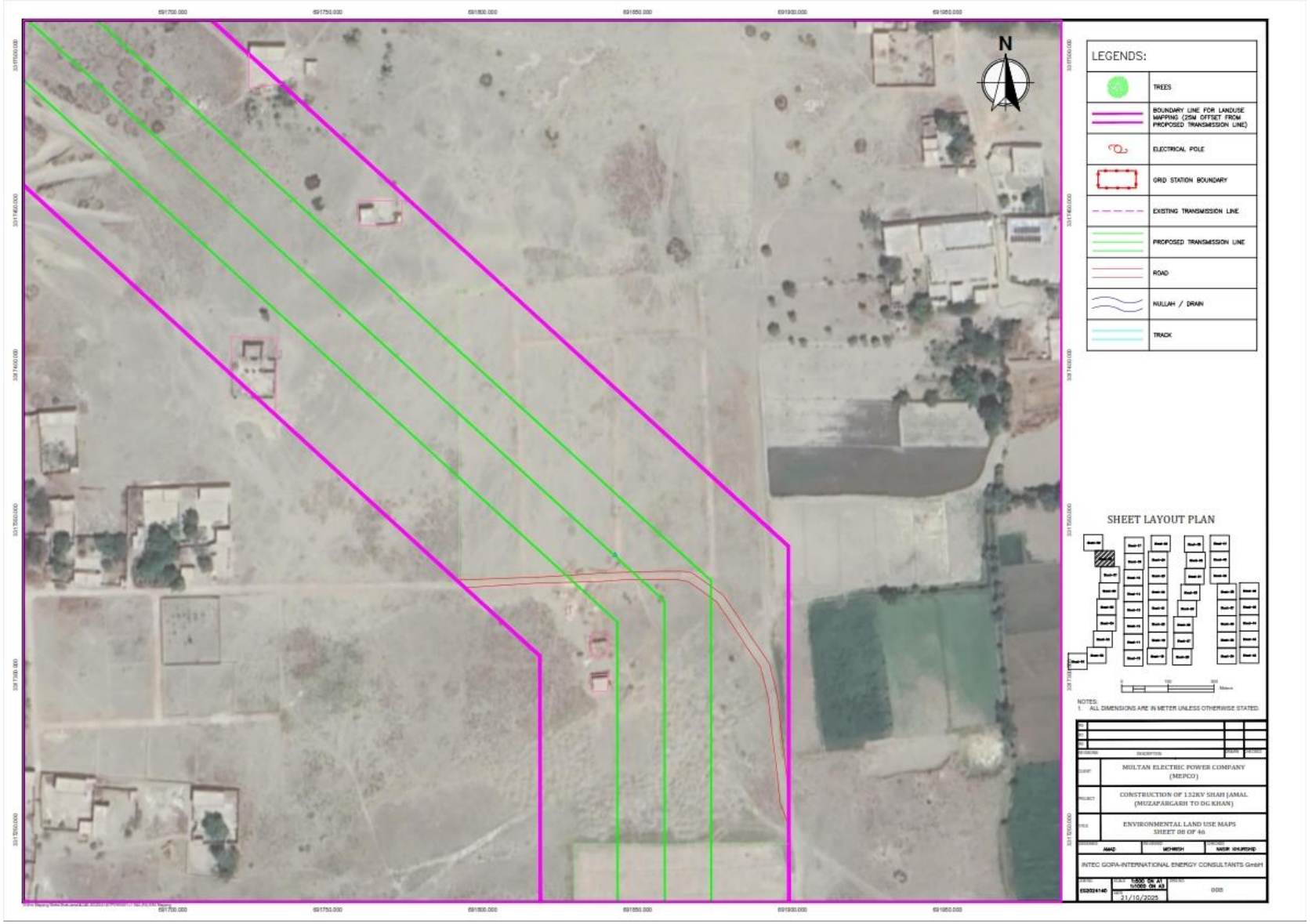

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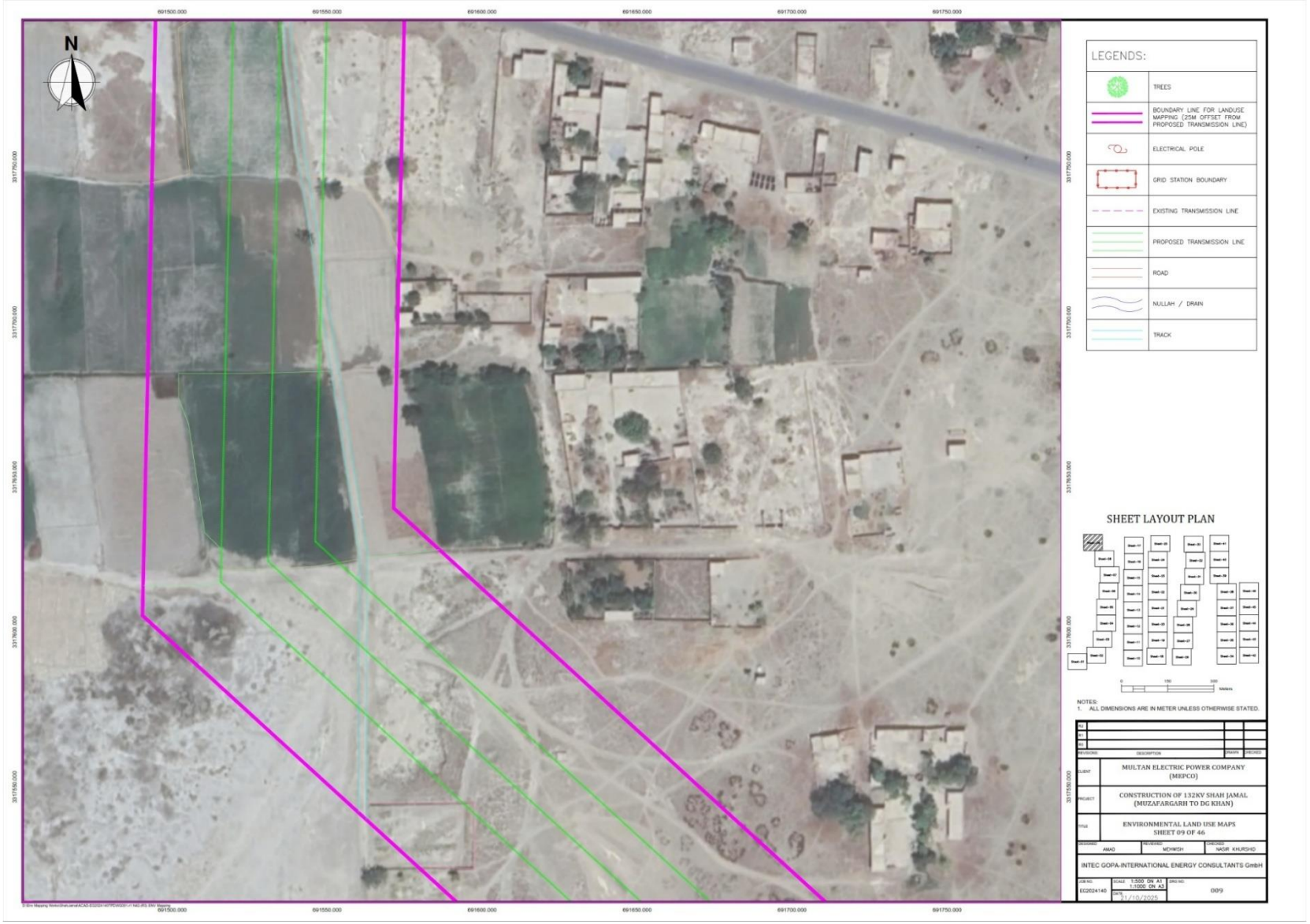

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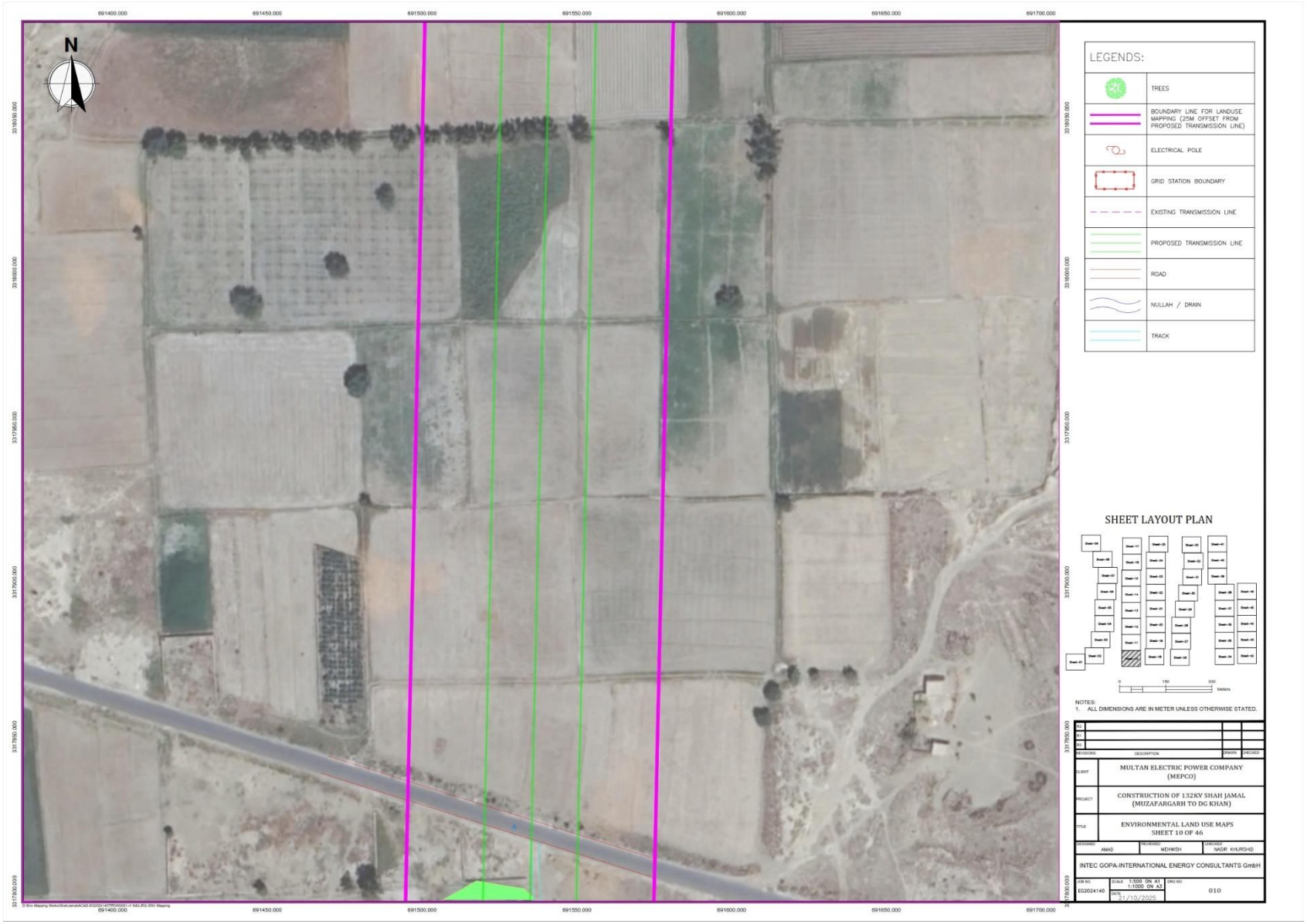

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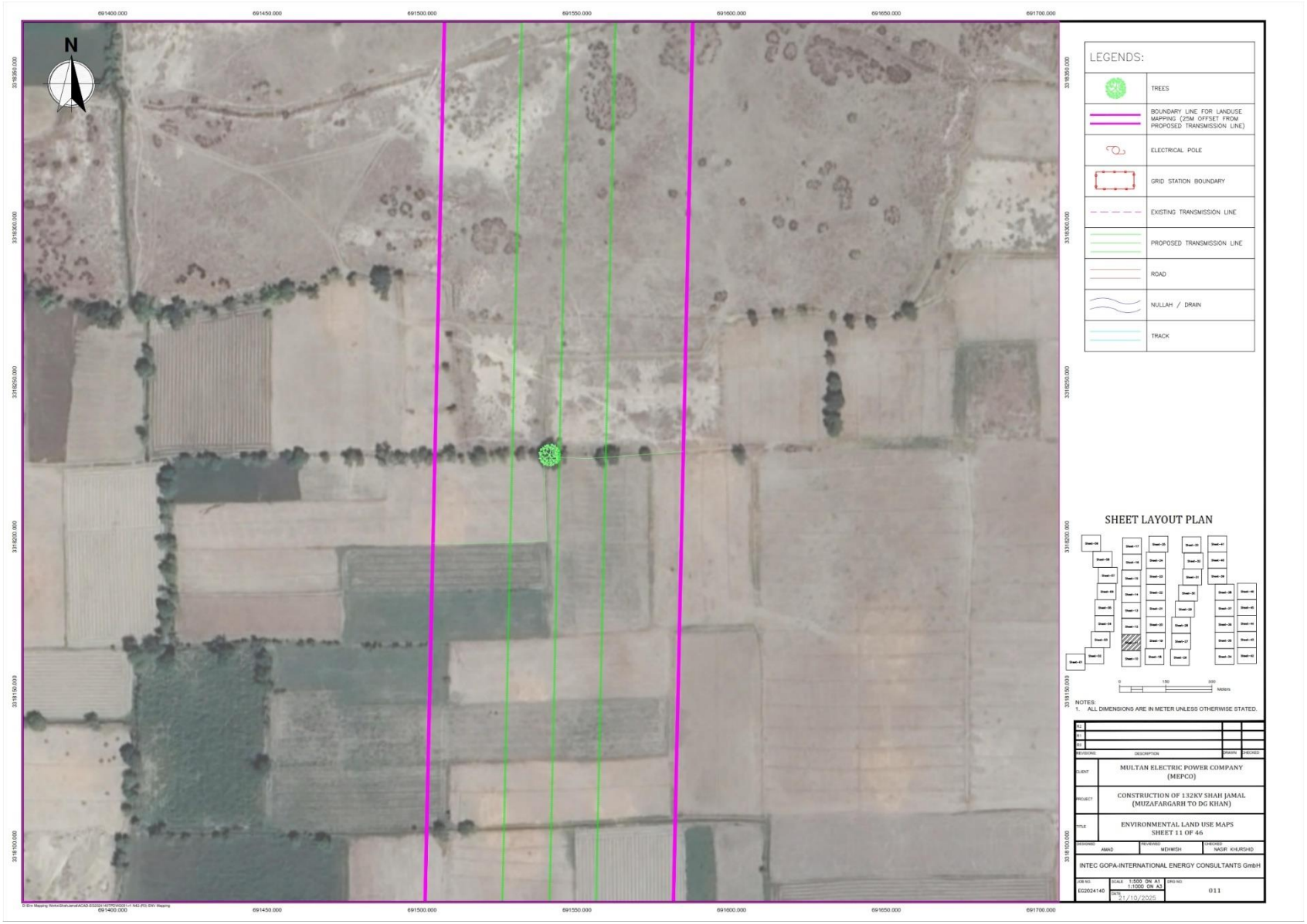

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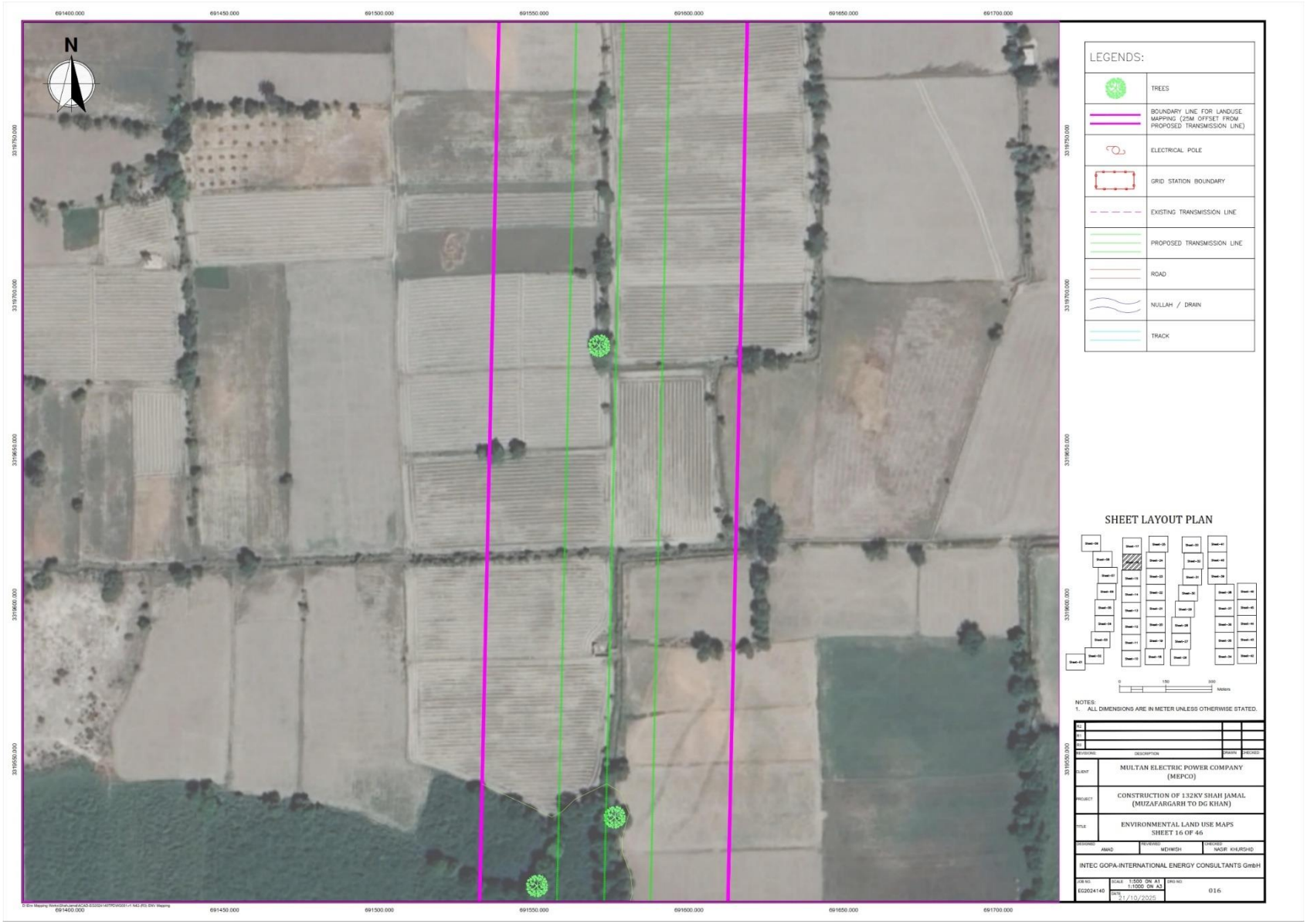

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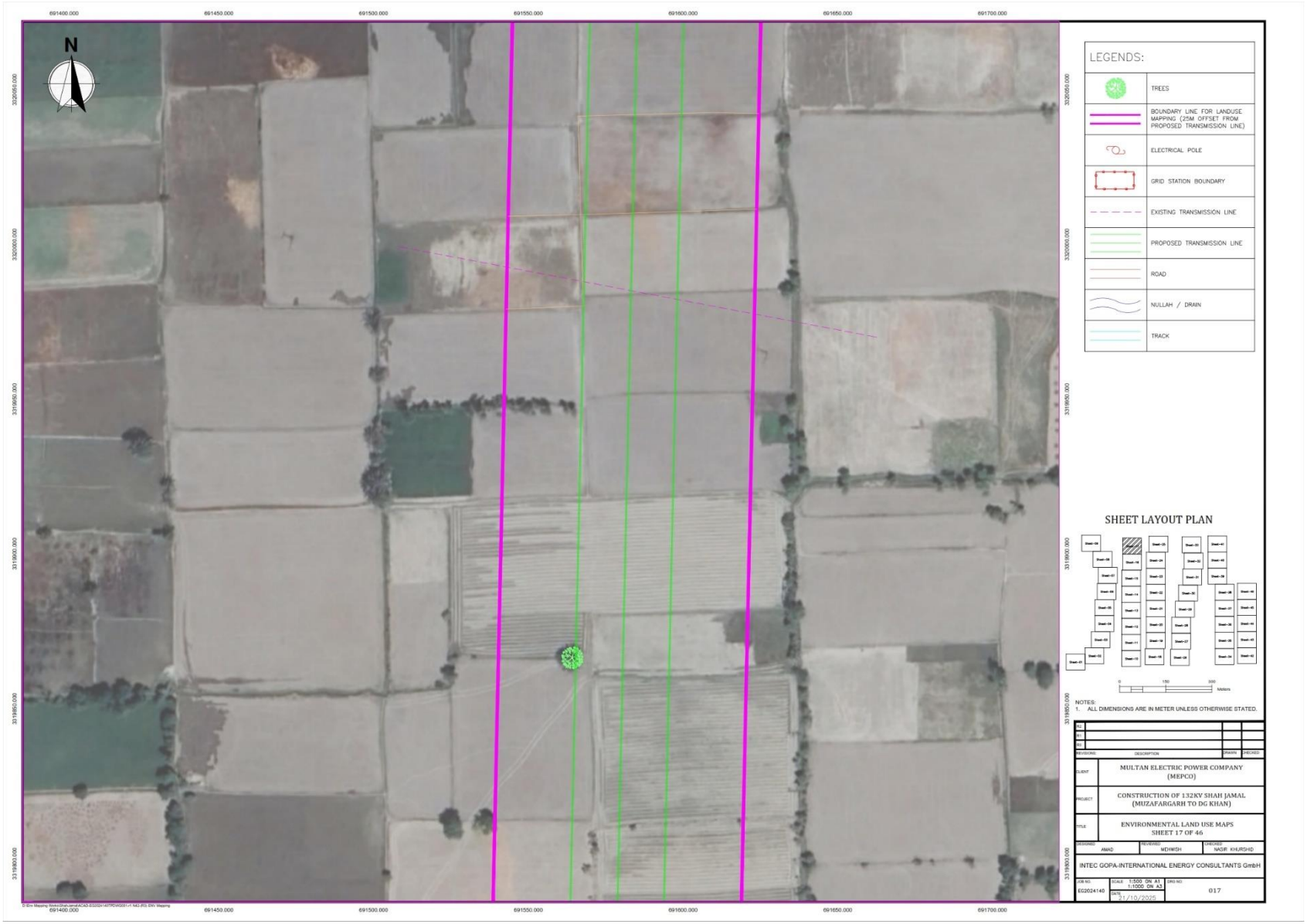

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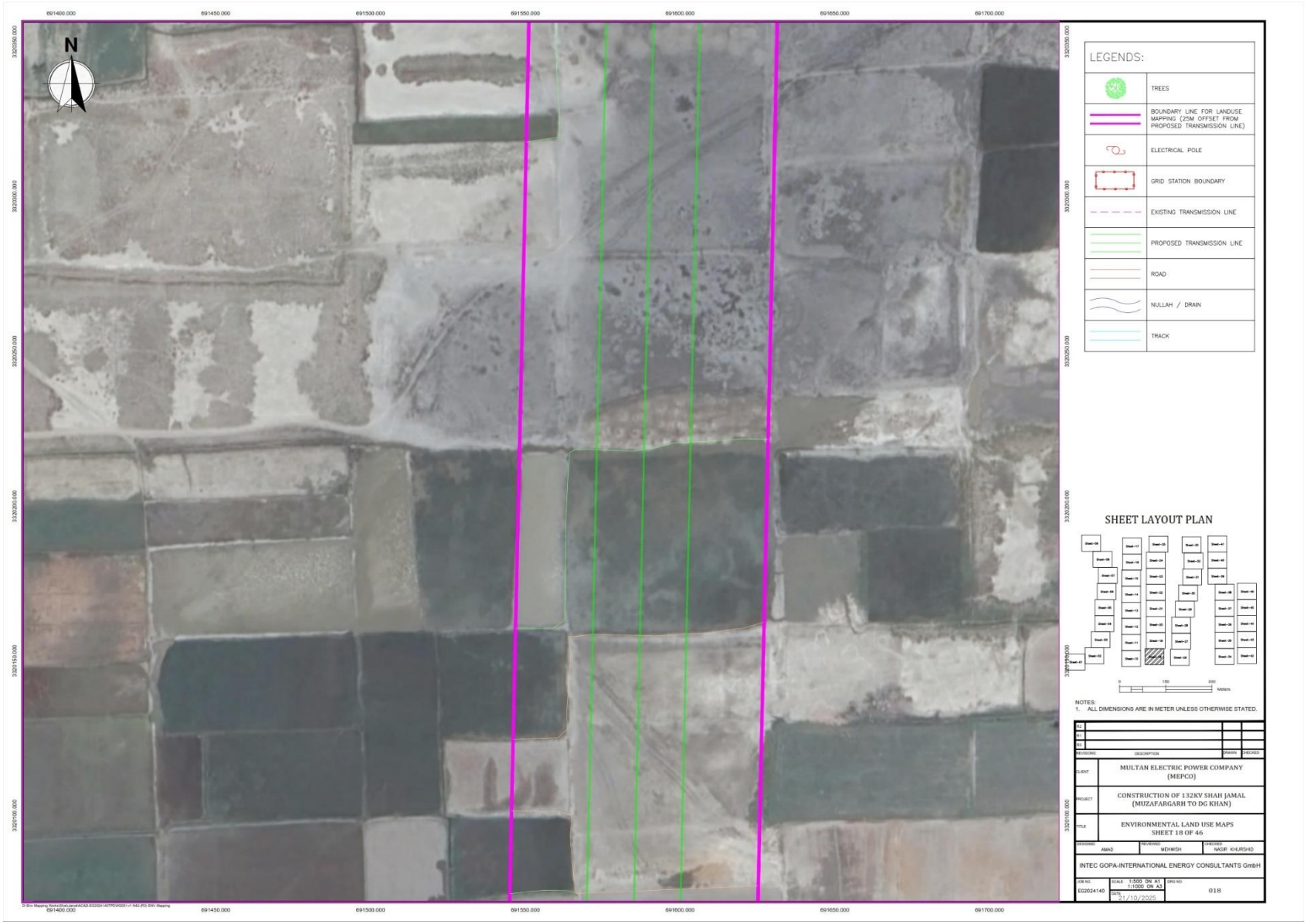

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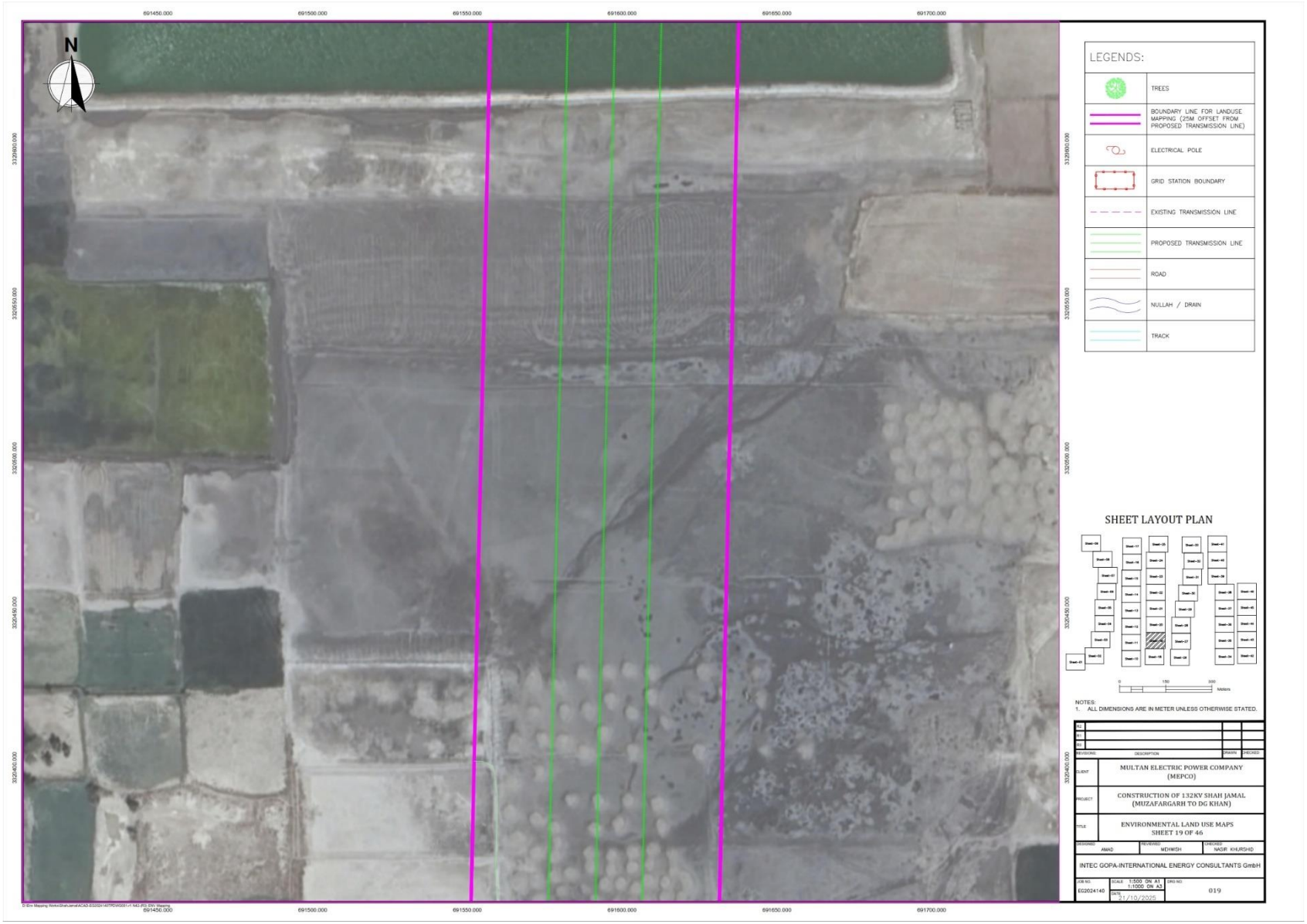

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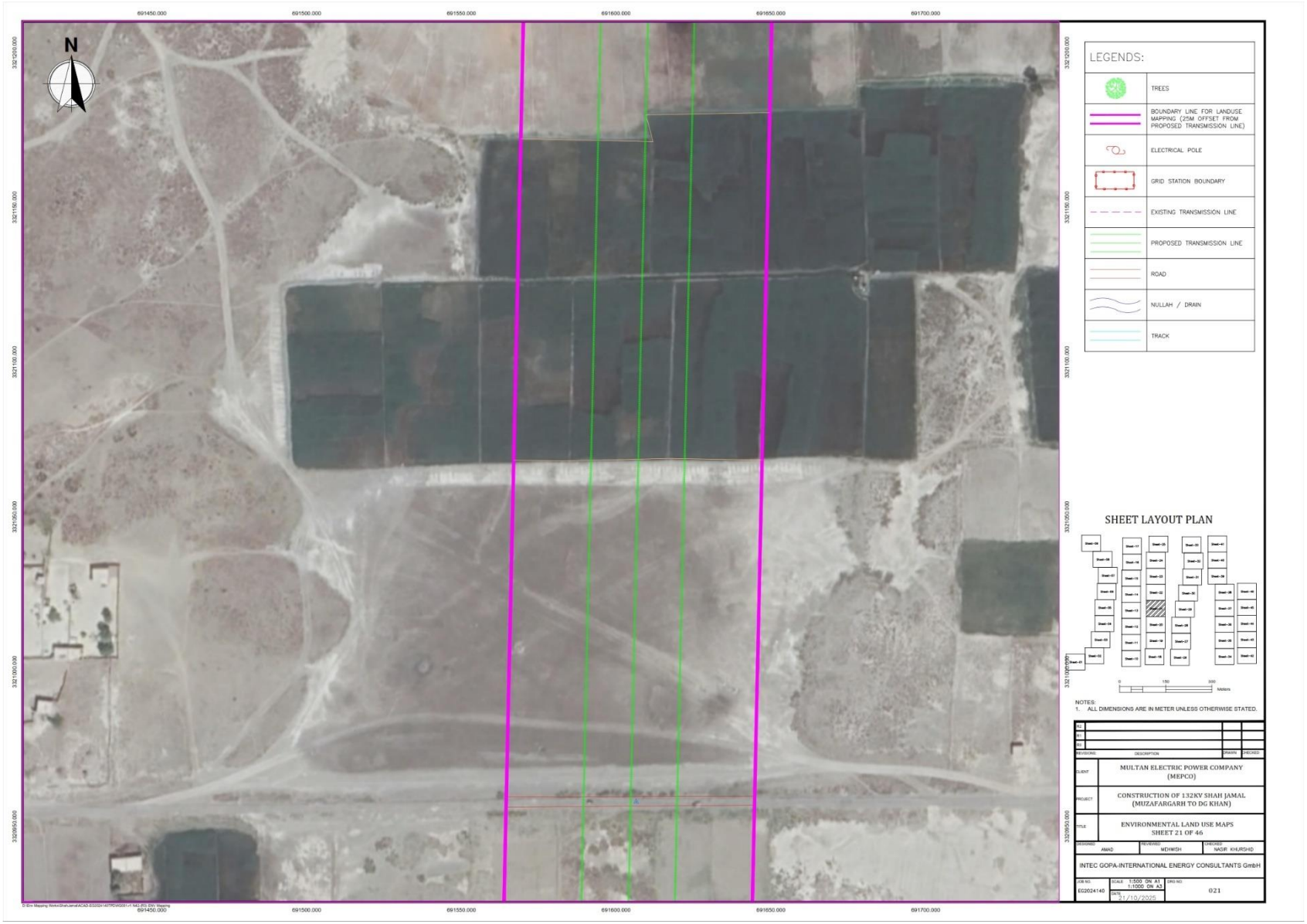

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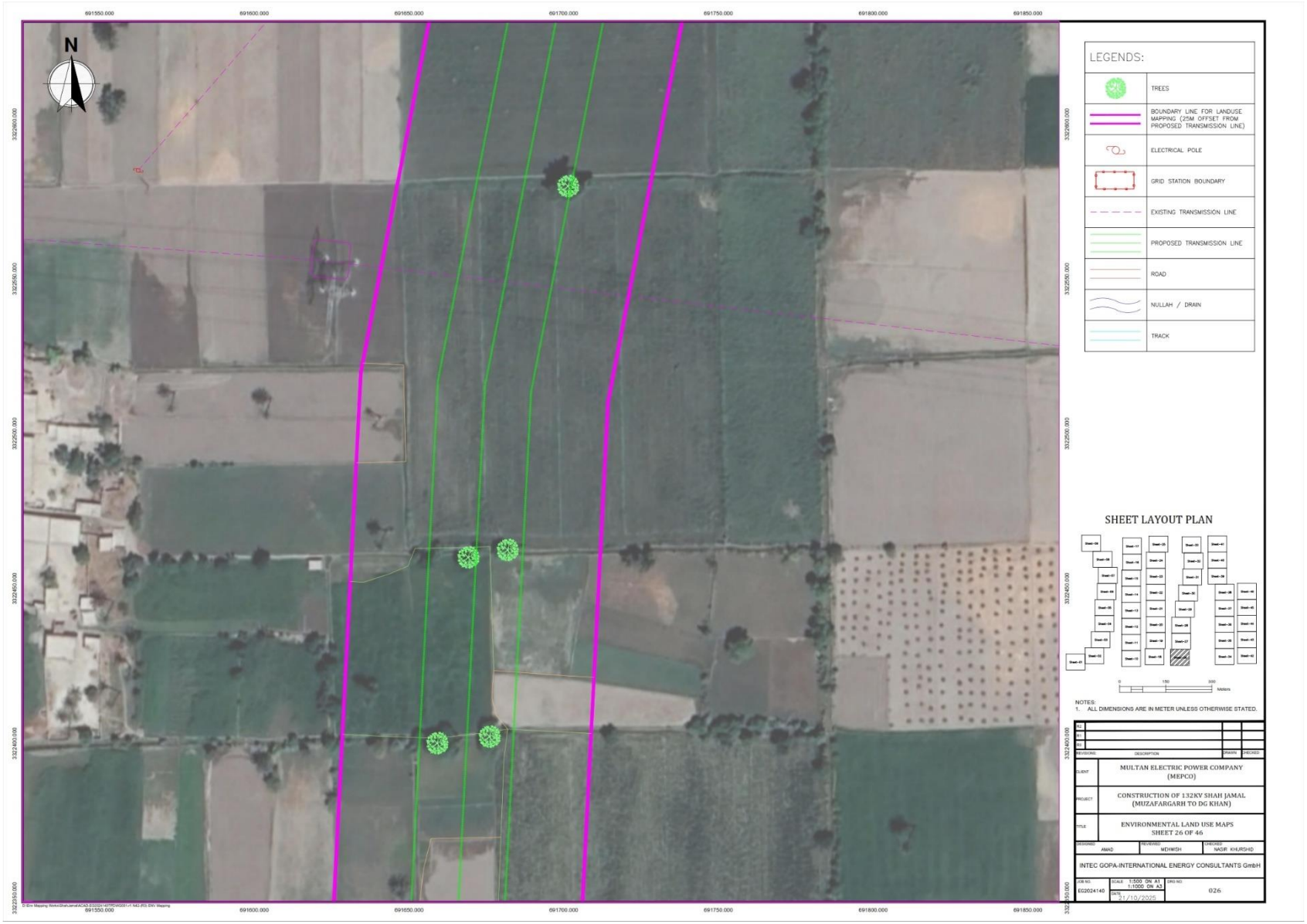

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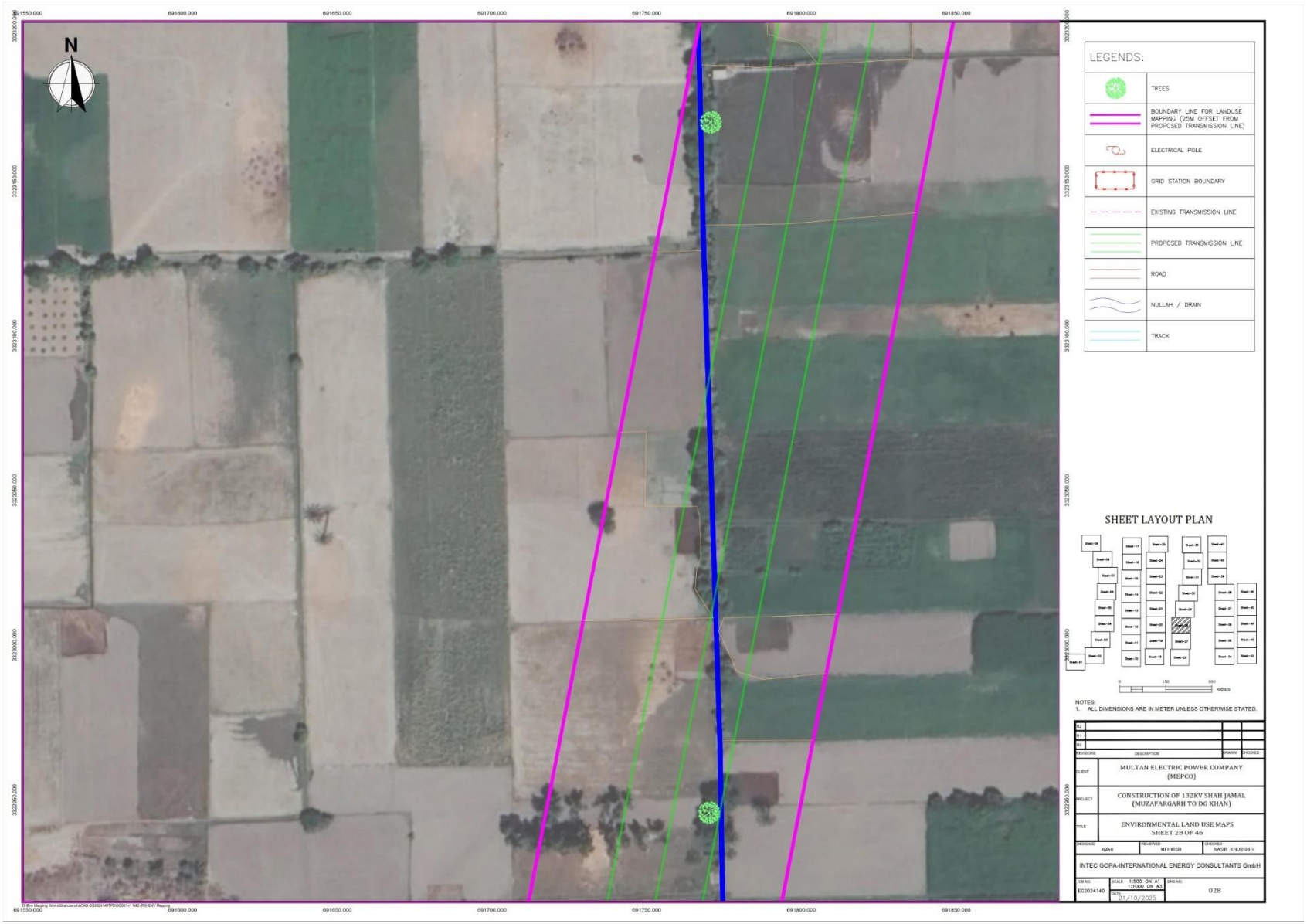

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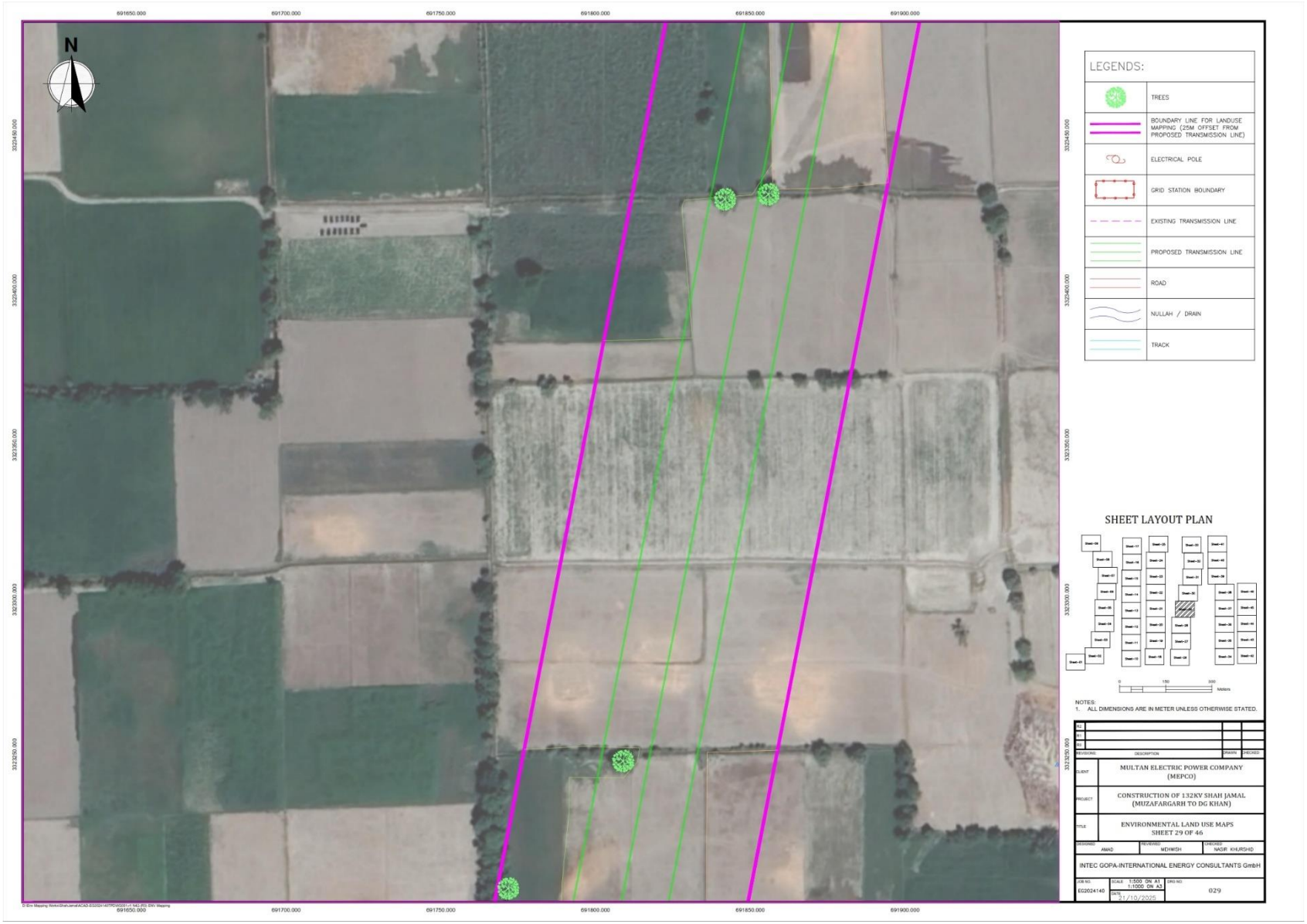

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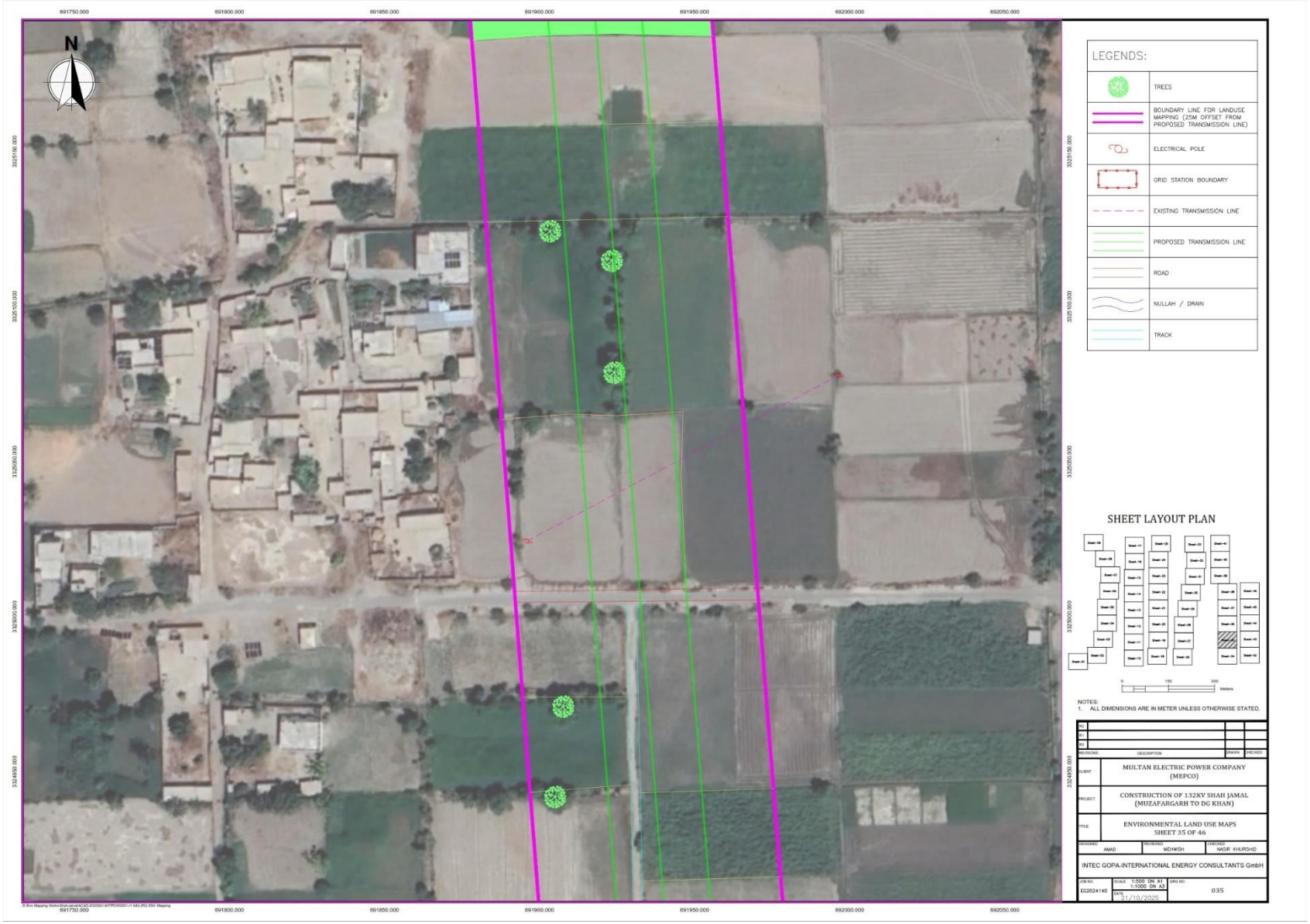

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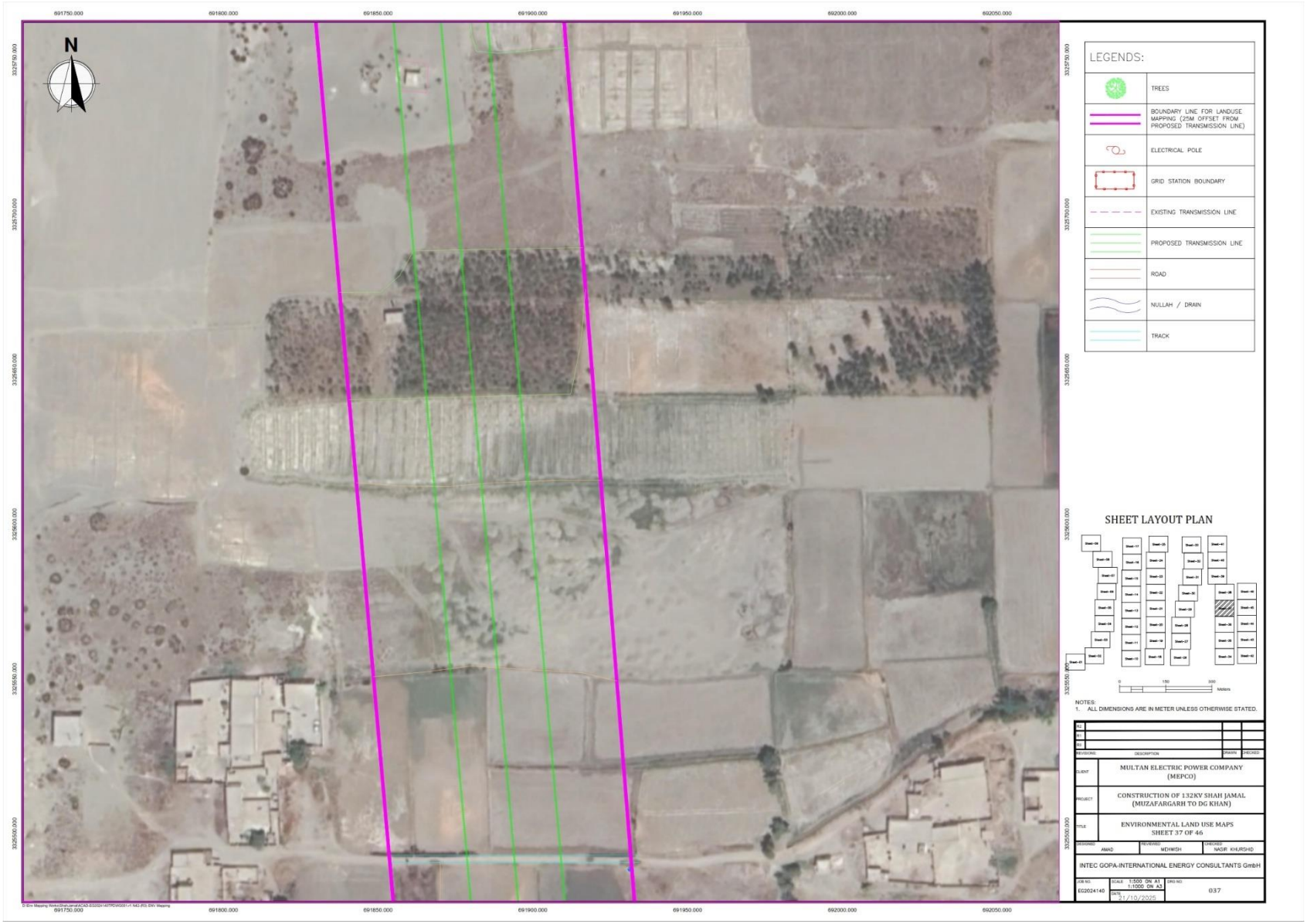

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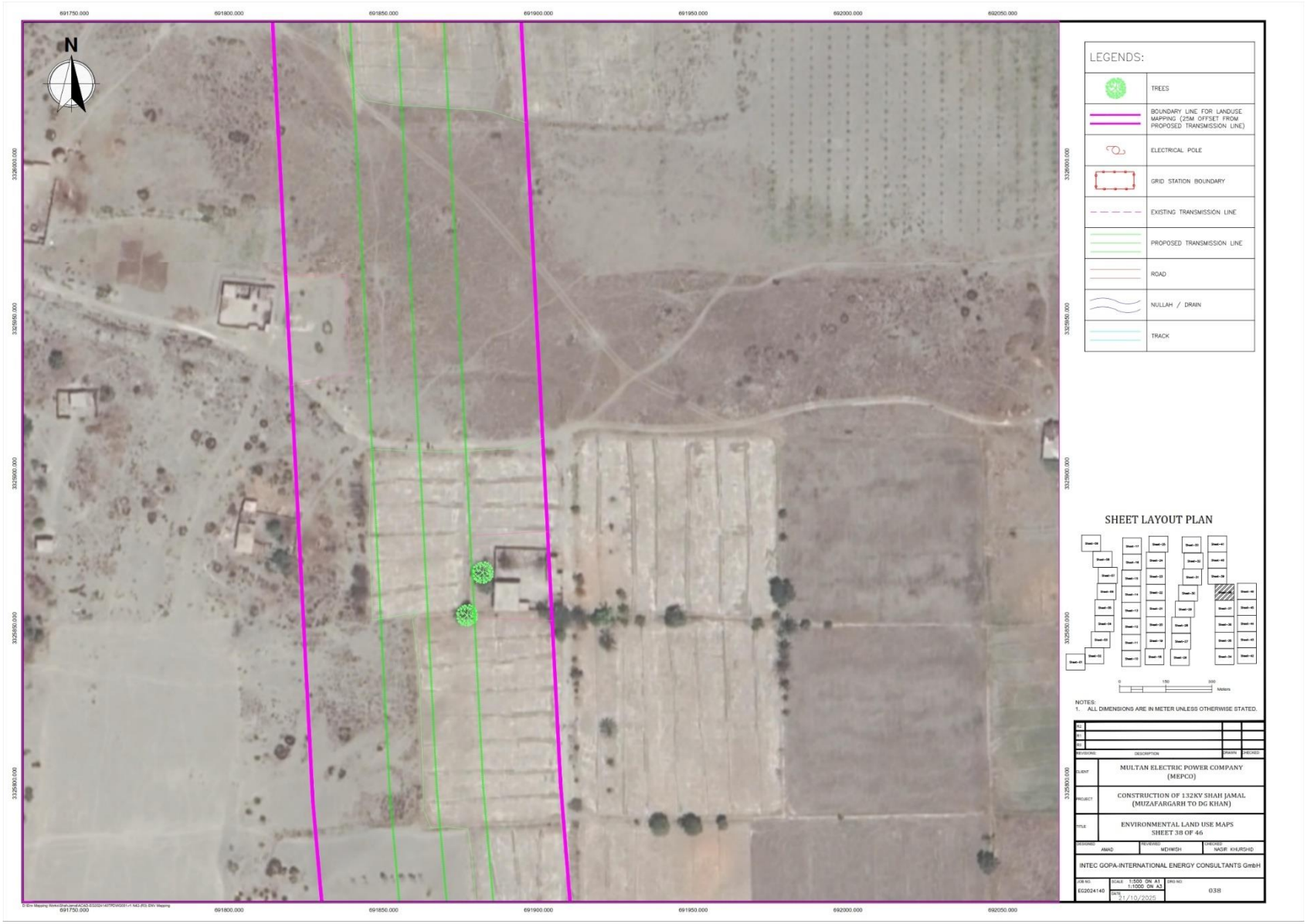

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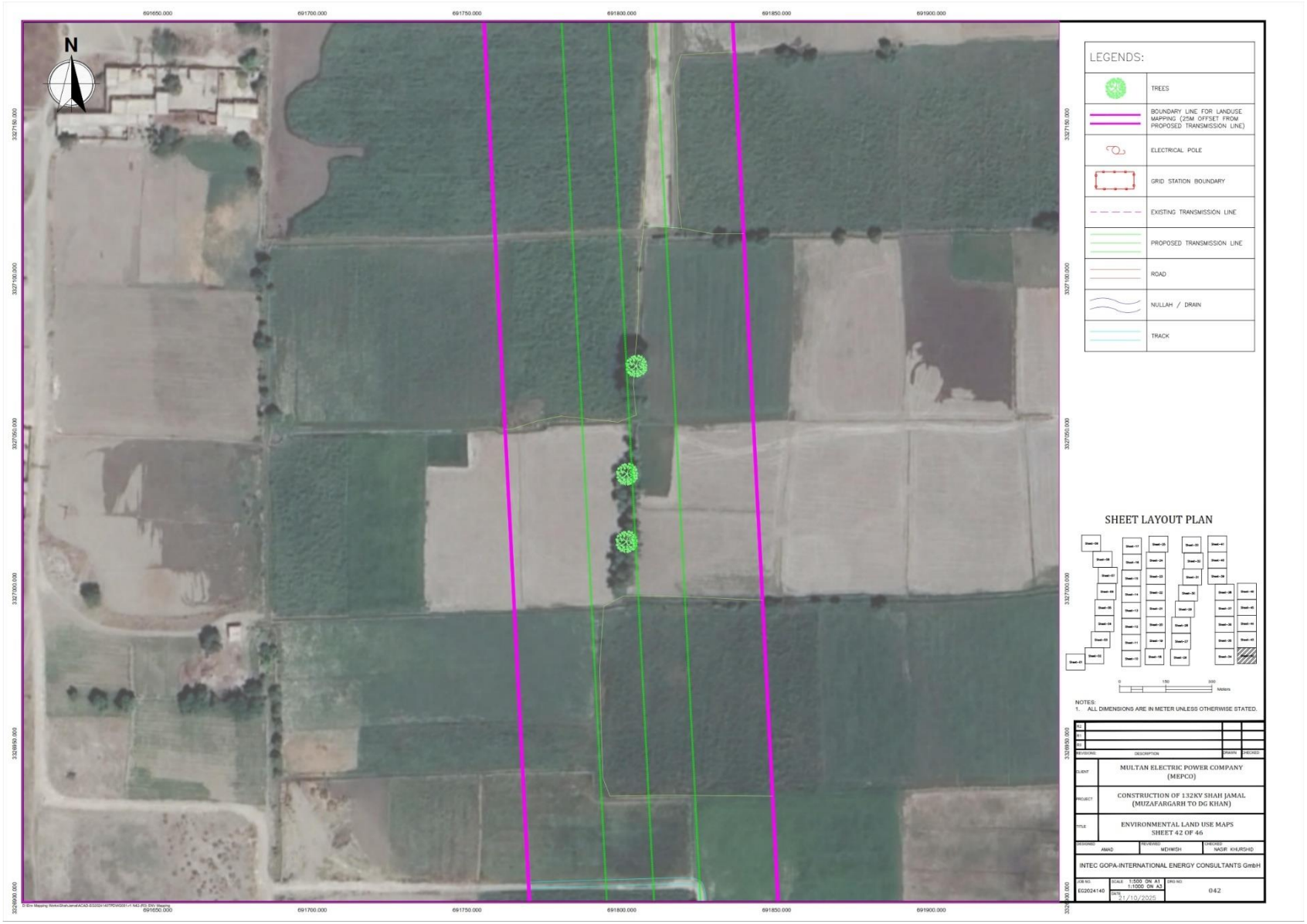

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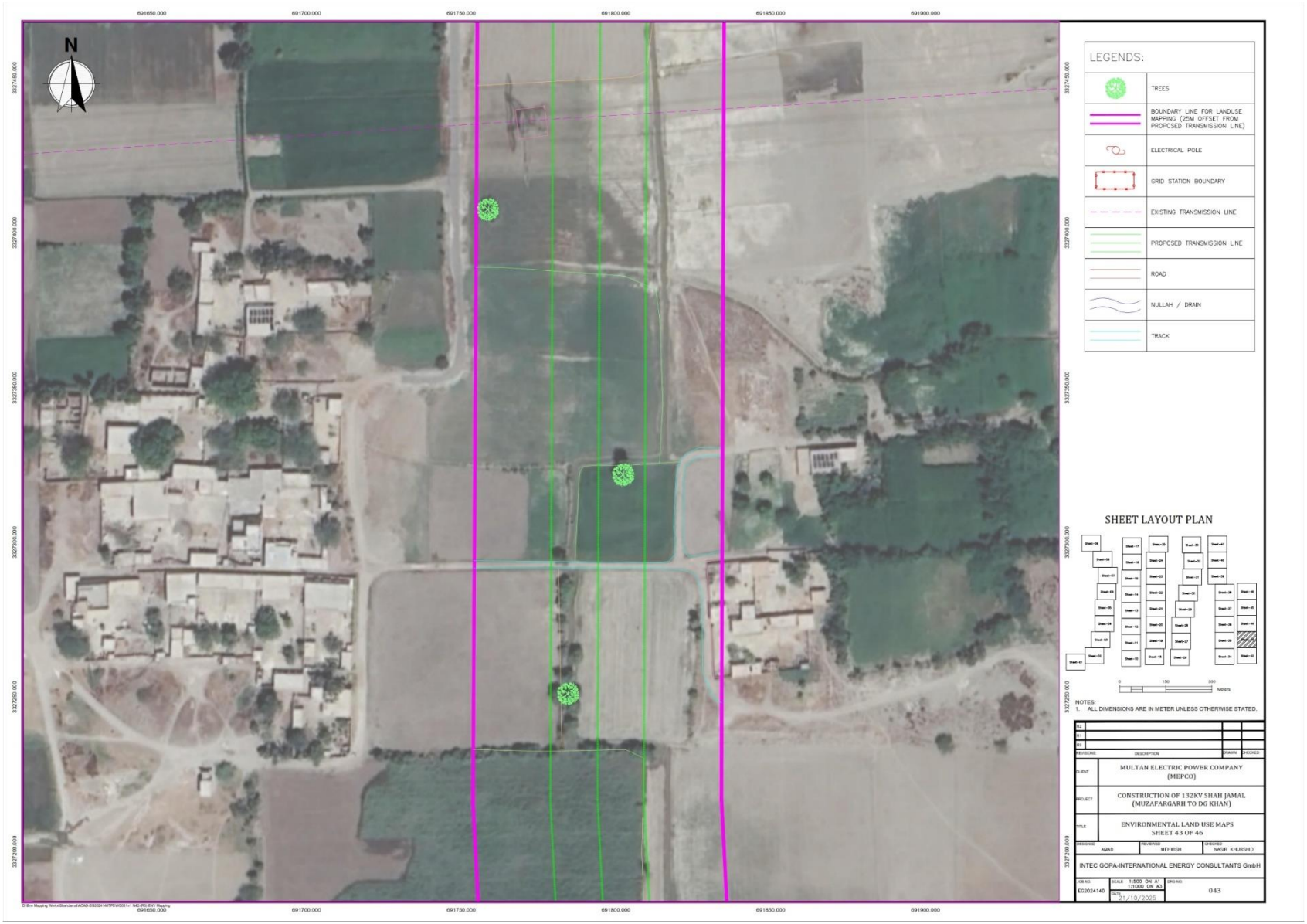

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Annex B – Laboratory Reports

ENVIRONMENTAL MONITORING, SAMPLING AND TESTING REPORT

FOR

Electricity Distribution Efficiency Improvement Project (EDEIP) for the Construction of 132 kV Grid Station and 27 Km Transmission Line (MEPCO)

(District Arifwala)

Reference Number: GCEC-PK-PU-320/2024

Contact Details of Client	
Client Name	Multan Electric Power Company (MEPCO)
Consultant Name	GOPA Intec-Multitech Consulting Engineers
Project Name	Electricity Distribution Efficiency Improvement Project (EDEIP) for the Construction of 132 kV Grid Station and 27 Km Transmission Line
Contact Person	Mr. Hassan Raza
Designation	Managing Director
Contact Number	0321-4553805
Email ID	Hassan@mcepak.com
Address	121J, Johar Town, Lahore, Pakistan
Contact Details of GCEC-Pakistan	
Director:	Mr. Mian Khurram Usman
Telephone:	+92 42 35962885
Fax:	+92 42 35962884
Email:	manager.operations@gcee.ae
Address	House No. 368-B Block B, Canal View, Lahore

Approved By:

Zara Yousaf
Coordination Department

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LIST OF ABBREVIATIONS

AA	Ambient Air
DW	Drinking Water
SPL	Sound Pressure Level
dB	Decibels
mg/m3	Milligram per Cubic meter
mg/l	Milligram per Liter
µg/m³	Micrograms per Cubic Meter
CO	Carbon Monoxide
SO_2	Sulfur Dioxide
NOx	Oxides of nitrogen
O_2	Oxygen
SPM	Suspended Particulate Matter
LDL	Lowest Detection Limit
PEQS	Punjab Environmental Quality Standards
LOR	Limit of Reporting
PM	Particulate Matter
SOPs	Standard Operating Procedures
TSS	Total Suspended Solids
APHA	American Public Health Association

SECTION 1: OBJECTIVES & SCOPE

1.1 STUDY OBJECTIVES

Followings were the main objectives of the study:

- To assess the current conditions of the environment in the surroundings of project area.

- To help the consultant and contractor to develop the strategies for the protection and betterment of environment.

1.2 SCOPE OF SERVICES

Scope of services covered following main components:

- Ambient Air Quality Monitoring
- Noise Level Monitoring
- Drinking Water Sampling & Analysis

MONITORING TEAM

Monitoring team of Green Crescent Environmental Consultants involved in the monitoring and sampling is given in below table:

Table 1-1 Monitoring Team

Sr. No.	Name of The Employee	Designation
1.	Muhammad Ilyas Durrani	Executive Field Officer

SECTION 2: ENVIRONMENTAL MONITORING, SAMPLING & TESTING SCHEDULE

Detailed Environmental monitoring was conducted at the mutually agreed sites of project area. The monitoring and sampling was conducted from 2nd Dec to 3rd Dec. 2024.

Table 2-1 Environmental Monitoring, Sampling & Testing Schedule

Sr. #	Intervention Date	Activity	Monitoring Location

1.	02-12-2024 to 03-12-2024	• Ambient Air Quality Monitoring • Meteorological Monitoring	Road Point Near Grid Station
2.	03-12-2024	Drinking Water	Tube well Point Near Site Location

SECTION 3: ENVIRONMENTAL MONITORING, SAMPLING & TESTING LOCATIONS

Environmental monitoring, sampling & testing locations are as per shown in the following figure.

Figure 3-1: Map Showing Ambient Air Monitoring Locations (2nd Dec. to 3rd Dec.2024)

Figure 3-2: Map Showing Drinking Water Sampling Location (3rd Dec. 2024)

SECTION 4: ENVIRONMENTAL MONITORING, SAMPLING & TESTING METHODOLOGY

Following is a brief description of the methodology adopted for this Environmental Monitoring, Sampling & Testing including Ambient Air, Metrological Data, Noise and Water Analysis:

4.1 Onsite Monitoring

Among the environmental parameters selected by the client;

- Ambient Air
- Temperature and pH of water samples

Were monitored onsite. Ambient air monitoring including metrological monitoring and noise level monitoring was conducted using portable digital instruments while temperature and pH of the water samples were monitored manually using thermometer and pH strips. A brief description of each digital instrument used for onsite monitoring is given below;

4.1.1 Vantage Pro2, Davis

The Davis 6152 Wireless Vantage Pro2 Weather Station which was made in 2018 in America which consists of a console unit and an innovative integrated sensor suite that includes a rain collector with self-emptying bucket, temperature and humidity sensors and an anemometer. The sensor suite is housed inside a radiation shield, protecting the sensors against solar radiation and additional sources of reflected and/or radiated heat. It provides accurate weather data in a sophisticated yet easy-to-read format. With Wireless Vantage Pro2 Weather Station we can continuously measure metrological parameters including;

- Temperature
- Wind Direction
- Wind Velocity
- Humidity

x-1 of this report.

- Atmospheric Pressure

Davis wireless weather station Vintage Pro2 was used for the assessment of these parameters according to standard operating procedures and obtained results are

4.1.2

The Dust Trak II Aerosol Monitor 8530 is a desktop battery -operated, data -logging, light-scattering laser photomet er which was manufactured in 2014 , that gives you real -

It uses a sheath air system that isolates the aerosol in the optics chamber to keep the optics clean for improved reliability and low maintenance. Using th is instrument,

- PM_{10}
- $PM_{2.5}$
- TSP

Figure 4-1: View of Davis Vintage Pro at Site

Dust Trak II Aerosol Monitor 8530, TSI

time aerosol mass readings.

particulate matter was monitored including;

Figure 4-2: DustTrak II aerosol monitor 8530

4.1.3 Model 407730 Digital Sound Level Meter, Extech

It is a noise measuring instrument used to assess sound levels by measuring sound pressure. Often referred to as a sound pressure level (SPL) meter, decibel (dB) meter, noise meter or noise dosimeter, a sound level meter uses a microphone to capture sound. The sound is then evaluated within the device and acoustic measurement values are displayed. The most common unit of acoustic measurement for sound is the decibel (dBA). Hourly noise

level monitoring was done for 24 hours at each point of selected location. Digital Sound meter was manufactured in 2014.

Noise level using portable digital sound meter was monitored at client's mutually agreed monitoring points. Noise level measurement was performed according to standard operating procedures and obtained results are presented in **Annex-1** of this report.

Figure 4-3: View of Digital Sound Level Meter

4.1.4 HORIBA

HORIBA, was manufactured in 2017, a Japanese brand which consists of ambient air analyzers and sampling systems for the measurement of regulatory pollutants and air quality control. It offers complete tailored or individual air quality monitoring solutions, in order to meet the requirements and regulatory needs of environmental monitoring.

4.1.4.1 AC32M. NITROGEN OXIDES ANALYZER (NO, NOX, NO2)

Chemiluminescence technology based, TÜV & US EPA approved. It is single chambered chemiluminescence technology with ultra-compact and lightweight – rackable 19"/3U. On board web server compatible with any internet browser and user interface with online help for the display, configuration, maintenance, diagnostics or software updating of the analyzer, remotely. It is capable to detect low levels of nitrogen oxides (NO-NO_2-NO_X) with standard ranges: 0-0.1/0.2/0.5/1.0 ppm

4.1.4.2 AF22E. NEW E-SERIES SO2 ANALYZER

UV Fluorescent sulfur dioxide analyzer AF22e, TUV certified and US-EPA approved for compliance with ISO 10498, 2008/50/EC, en 14212, EN 15267, 40 CFR part 53 SUB B and SUB C.

It is a light weight eco-friendly & eco-innovative conception unit which detects early signs of trouble, allows predictive maintenance, identifies the service needed and guides the service operations step by step.

It provides real-time calibration graph, animated synoptic, auto-diagnostic, control and maintenance data screens can be displayed while the instrument is operating. It provides superior metrological presentations for SO_2 measurements in the range as low as 0.05 ppm F.S.

4.1.4.3 CO12E. NEW E-SERIES CO ANALYZER

Non dispersive Infra-Red carbon monoxide analyzer CO12e, TUV certified and US-EPA approved for compliance with ISO 4224, EN 14626, EN 15267, 40 CFR part 53 SUB B and SUB C.

It is a light weight eco-friendly & eco-innovative conception unit with breakthrough mechanical design for weight and power saving as well as thermal insulation & reliability. It has automatic or programmable response time adjustment, ensuring efficient monitoring of low concentration levels of carbon monoxide. It provides superior metrological presentations for CO measurements in the range 0-100 ppm.

4.2 Water Sample Collection and Preservation

Water samples were collected from mutually agreed sampling points according to the SOPs based on American Public Health Association (APHA) for water sampling and analysis. Decontaminated Plastic bottles were used to collect the samples. To prevent air bubbles from being trapped in the bottles, they were filled to the brim. The lids of the sampling bottles were then replaced tightly. The bottles were then labeled and chain of custody forms were filled out and signed to keep track of the collected samples. Collected samples were then preserved in appropriate containers as per APHA Preservation Guidelines. A shipping container containing ice packs with maintained temperature was used for transporting the samples from sampling location to GCEC Lahore Branch for testing.

4.2.1 Drinking Water Sampling & Analysis

Sampling for drinking water was carried out at mutually agreed sampling points. Physical and chemical parameters were analyzed afterwards in GCEC labs for drinking water sample. Analytical methods used during the laboratory testing were in line with the American Public Health Association's Standard Methods for the Examination of Water. Analysis Results are presented in **Annex 1** of this report.

4.3 Sample Tagging and Chain of Custody

In GCEC Lahore Branch, samples and chain of custody form were handed over by Field Monitoring Staff to the Coordination Staff for in-house tagging and logging according to the company's policy and handed over to the Laboratory Staff for further physical, chemical and microbiological testing. A brief description of each sampling type and further proceedings are also discussed in following section.

SECTION 5: RESULTS & DISCUSSIONS

This section of the report presents the Environmental testing results of noise-level monitoring, ambient air quality & drinking water analysis

5.1 Background Noise Level Monitoring

The Noise monitoring activity was carried at different locations. Monitoring schedule is presented in Table 2-1. While a brief description of monitoring session is as below.

Hourly noise monitoring was conducted at four selected locations. The results of monitoring locations were compared with commercial noise standards for Punjab Environmental Quality Standards i.e., 65.0 dB (A) for Day Time and 55.0 dB (A) for Night Time.

Discussion on Noise Results

Noise level Monitoring was conducted for 24 hours at four monitoring locations. The monitoring results obtained are not complying with the commercial noise standards of PEQS. Day and Night Time averages for monitoring points are presented in figures below.

(2nd Dec. to 3rd Dec.2024)

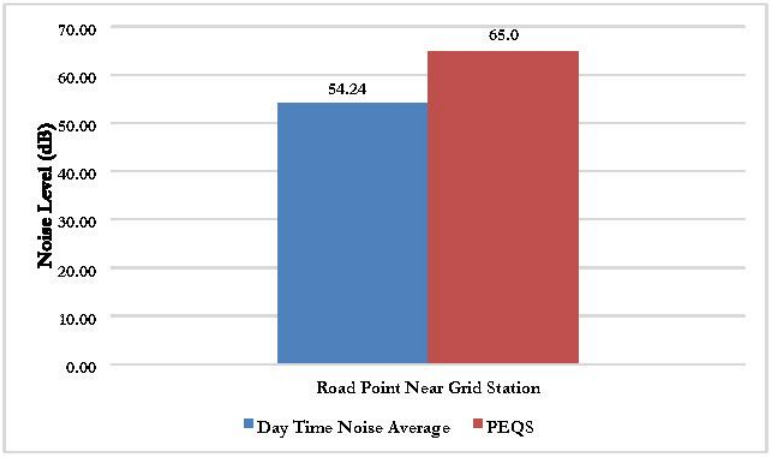


Figure 5-1: Day Time Average Noise Level Value Compared with Respective PEQS Standards

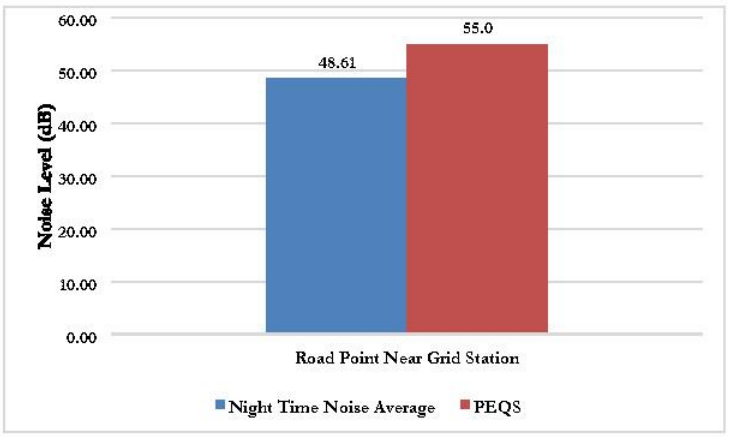


Figure 5-2: Night Time Average Noise Level Value Compared with Respective PEQS Standards

(2nd Dec. to 3rd Dec.2024)

5.2 Ambient Air Quality Monitoring

The activity for monitoring the ambient air conditions was carried out at the agreed sites and its vicinity, for 24 hours at two monitoring locations starting from **(2nd Dec. to 3rd Dec.2024).** To assess the current quality of ambient air, Carbon Monoxide, Oxides of Nitrogen, Sulphur Dioxide, Ozone, Lead and Particulate Matter were monitored. Summary of monitoring results is presented in Table 5-1. Detailed result reports are also attached as **Annex 1**.

Discussion of NOx Measurements

The readings of NO, NO_2 and NOx for the project site and its surroundings comply with the Punjab Environmental Quality Standards i.e, 40 $\mu g/m^3$, 80 $\mu g/m^3$ and 120 $\mu g/m^3$ respectively. Sum of NO and NO_2 is termed as NOx. NOx results found at the monitoring location were within the PEQS limits. Monitoring results, compared with PEQS Standards, are graphically presented in figure below and in Summary Table below.

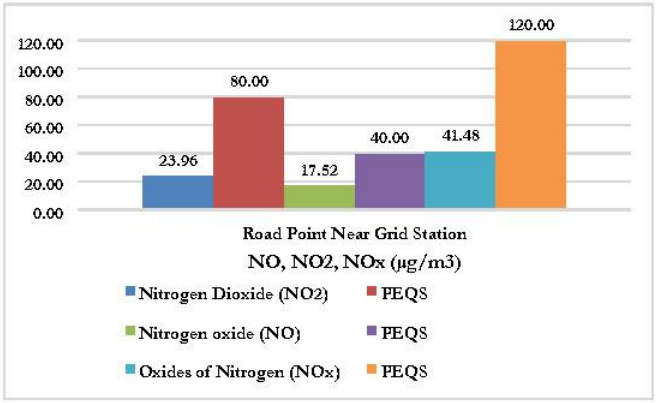


Figure 5-3: Daily Average NOx Measurements Compared with Respective PEQS Standards (2nd Dec. to 3rd Dec.2024)

Discussion of SO_2 Measurements

The SO_2 reading for both monitoring locations is presented in the summary table which depicts that the monitoring results are within the prescribed limits of PEQS i.e. 120 µg/m³. SO_2 results found at all two monitoring locations are within the PEQS limits.

Monitoring results, compared with PEQS Standards, are also graphically presented in figure below and in Summary Table 5-1 and 5-2.

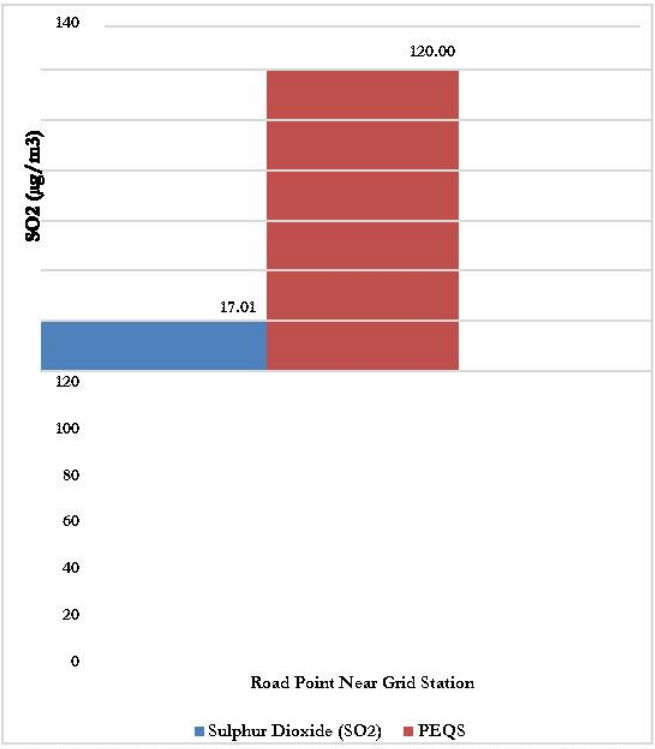


Figure 5-4: Daily Average SO_2 Measurement Compared with Respective PEQS Standards (2nd Dec. to 3rd Dec.2024)

Discussion of CO Measurements

Carbon Monoxide (CO) was monitored for 24 hours at two monitoring locations. The CO values detected at monitoring locations are within the permissible limit of PEQS i.e., 5.0

mg/m³. Monitoring results, compared with PEQS Standards, are graphically presented in figure below and in Summary Table below.

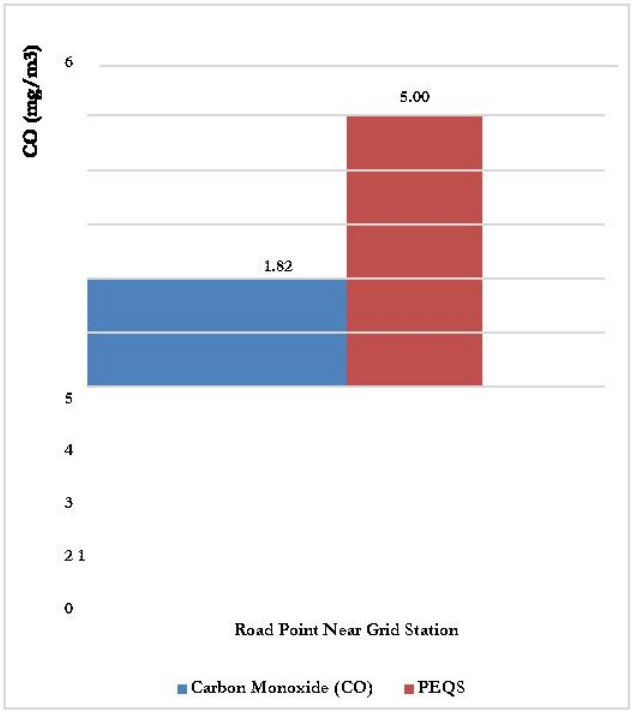


Figure 5-5: Daily Average CO Measurement Compared with Respective PEQS Standards (2nd Dec. to 3rd Dec.2024)

Discussion of Lead Measurements

Lead was monitored for 24 hours at two monitoring locations. The values detected at monitoring locations are within the permissible limit of PEQS i.e., 1.50 ug/m³. Monitoring results, compared with PEQS, are graphically presented in figure below and in Summary Table 5-1.

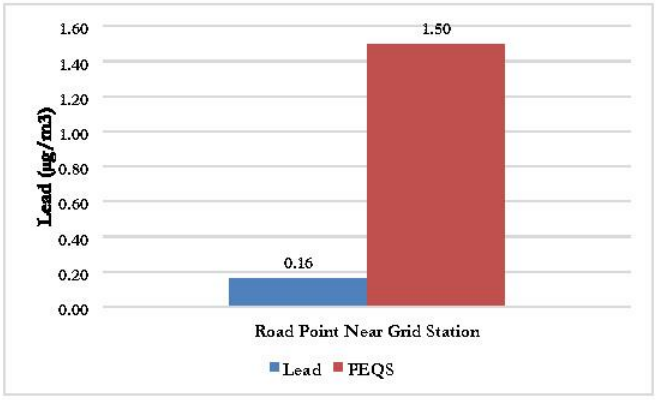


Figure 5-6: Daily Average Lead Measurement Compared with Respective PEQS Standards (2nd Dec. to 3rd Dec.2024)

Discussion of Ozone (O_3) Measurements

Ozone was monitored for 24 hours at two monitoring locations. The values detected at all two monitoring locations are within the permissible limit of PEQS i.e., 130 ug/m³. Monitoring results, compared with PEQS Standards, are graphically presented in figure below and in Summary Table below.

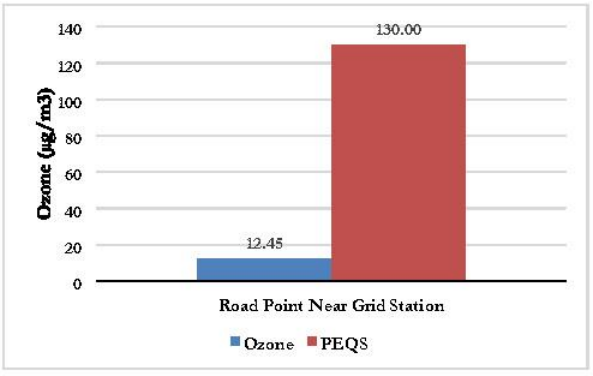


Figure 5-7: Daily Average Ozone Measurement Compared with Respective PEQS Standards (2nd Dec. to 3rd Dec.2024)

Discussion on Particulate Matter (PM_{10}, $PM_{2.5}$, TSP)

The monitoring results of *PM_{10}, $PM_{2.5}$* and *TSP* for all sites are compared with Punjab Environmental Quality Standard i.e., 150 µg/m³. The values of *PM_{10}, $PM_{2.5}$* and *TSP* were found falling within the prescribed limits of PEQS Limits, except for *$PM_{2.5}$* and *PM_{10}* in CB-I Construction Site. Monitoring result, compared with PEQS Standards, is graphically presented in figure below and in Summary Table below.

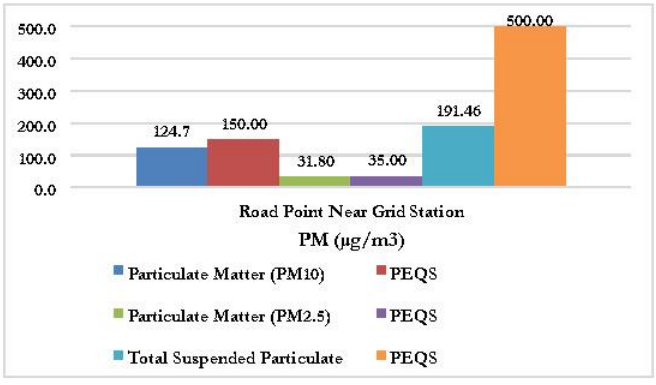


Figure 5-8: Daily Average TSP Measurements Compared with Respective PEQS Standards

(2nd Dec. to 3rd Dec.2024)

Table 5-1 Summary of Ambient Air Quality Monitoring Results

Location Identification	
Monitoring Site:	01
Monitoring Location:	Road Point Near Grid Station
Date:	02-Dec-2024 to 03-Dec-2024
Coordinates:	30°17'01.7"N 73°02'27.0"E

Parameter	Unit	Monitoring Duration	LDL	Average Obtained Concentration	PEQS
				01	
Nitrogen Dioxide (NO_2)	µg/m³	24 Hours	1.00	23.96	80.0
Nitrogen oxide (NO)	µg/m³	24 Hours	1.00	17.52	40.0
NO_X	µg/m³	24 Hours	1.00	41.48	120.0
Sulphur Dioxide (SO_2)	µg/m³	24 Hours	1.00	17.01	120.0
Carbon Monoxide (CO)	mg/m³	24 Hours	0.01	1.82	5.0
Ozone (O_3)	µg/m³	24 Hours	-	12.45	130.0**
Lead	µg/m³	24 Hours	0.05	0.16	1.50
Particulate Matter (PM_{10})	µg/m³	24 Hours	1.00	124.66	150.0
Particulate Matter ($PM_{2.5}$)	µg/m³	24 Hours	1.00	31.80	35.0

Total Suspended Particulate (TSP)	µg/m³	24 Hours	1.00	191.46	500.0

Abbreviations:
LDL= Lowest Detection Limit
PEQS= Punjab Environmental Quality Standards
*(24 Hours Standard for all the parameters Except O_3 and CO)
**(1 Hour Standard for O_3)
*(24 Hours Standard for all the parameters Except O_3) **µg/m³**= Micrograms per Cubic Meter **mg/m³**= Milligrams per Cubic Meter

5.3 Drinking Water Analysis

Drinking water sample were collected from one location on 03-12-2024 which were preserved and submitted in GCEC-Laboratory according to the standard methods. Summary of Analysis Results are given below in **Table 5-3**.

Discussion on Results

The laboratory test results of drinking water samples are summarized in the table below. It is obvious from the analysis results that the drinking water meets the permissible limits of Punjab Environmental Quality Standards for all tested parameters

Reference Number: GCEC-PK-PU-320/2024

Table 5-2 Summary of Drinking Water Analysis Results

Sample Marking & Identification			
01	Tube Well Point Near Site Location	Sampling Coordinates:	30°17'01.1"N 73°02'30.0"E

Parameters	Analysis Method	Unit	LOR	Result	PEQS
				01	
PHYSICAL & CHEMICAL ANALYSIS					
pH**	APHA-4500H+ B	-	0.01	6.91	6.5-8.5
Odor	In-house	-	-	Odorless	Non-Objectionable
Taste	In-house	-	-	Salty	Non-Objectionable
Color	APHA-2120 B/C	Pt/Co	1.0	<1.0	≤15 TCU
Turbidity**	APHA-2130 B	NTU	-	<0.1	<5 NTU
Total Hardness**	APHA-2340 B & C	mg/l	0.1	632.0	< 500 mg/l
Total Dissolved Solid (TDS)**	APHA-2540 C	mg/l	1.0	1236.0	< 1000
Ammonia	APHA-4500-NH_3-B	mg/l	0.002	<0.002	-
Chloride (Cl)**	APHA-4500Cl- B	mg/l	0.24	91.97	< 250
Cyanide (CN)	APHA-4500CN E	mg/l	0.01	<0.01	≤ 0.05
Fluoride (F)**	APHA-4500F- D	mg/l	0.01	<0.01	≤ 1.5
Nitrite	APHA-4500NO2 B	mg/l	0.01	0.27	≤ 3 (P)
Nitrate**	APHA-4500NO3 C	mg/l	0.1	1.51	≤ 50
Phenolic Compound	APHA-5530 D	mg/l	0.01	<0.01	-
Residual Chlorine	APHA-4500Cl G	mg/l	0.1	<0.1	0.2-0.5
Aluminum (Al)	APHA-3111Al B	mg/l	0.028	<0.028	≤ 0.2
Cadmium**	APHA-3111Cd B	mg/l	0.0028	<0.0028	0.01
Copper**	APHA-3111Cu B	mg/l	0.0045	<0.0045	2
Chromium**	APHA-3111Cr B	mg/l	0.0054	<0.0054	≤ 0.05 (P)
Mercury	APHA-3112Hg B	mg/l	0.0008	<0.0008	≤ 0.001
Antimony (Sb)**	APHA-3111Sb B	mg/l	-	ND	≤ 0.005 (P)
Nickel**	APHA-3111Ni C	mg/l	0.008	<0.008	≤ 0.02
Zinc**	APHA-3111Zn B	mg/l	0.0033	<0.0033	5.0
Arsenic	APHA-3111As B	mg/l	0.01	<0.01	≤ 0.05 (P)
Barium	APHA-3111Ba B	mg/l	0.031	<0.031	0.7
Manganese**	APHA-3111Mn B	mg/l	0.0016	<0.0016	≤ 0.5
Iron**	APHA-3111Fe B	mg/l	0.1	<0.1	-
Boron	APHA-4500-B (C)	mg/l	0.1	<0.1	0.3
Lead**	APHA-3111Pb B	mg/l	0.013	<0.013	≤ 0.05
Selenium	APHA-3111Se B	mg/l	-	ND	0.01 (P)
MICROBIOLOGICAL ANALYSIS					
Total Coliforms	APHA:9222 B	CFU/100ml		01	0/100ml
Faecal Coliforms (Ecoli)	APHA:9222 D	CFU/100ml		Absent	0/100ml

Page 24 of 21

Abbreviations:
ND: Not Detected **LOR:** Limit of Reporting **PEQS:** Punjab Environmental Quality Standards
Note:
** Uncertainty of all the parameters and laboratory conditions at the time of analysis will be provided as per client's requirement. The lab environmental conditions are maintained at 25±5C° and humidity at 50±20%.*
Disclaimer: *The results are solely of the sample provided. **All the starred parameters are PNAC accredited.*

SECTION 6: CONCLUSION

Environmental monitoring was performed at mutually agreed sites to assess the environmental conditions of its surroundings.

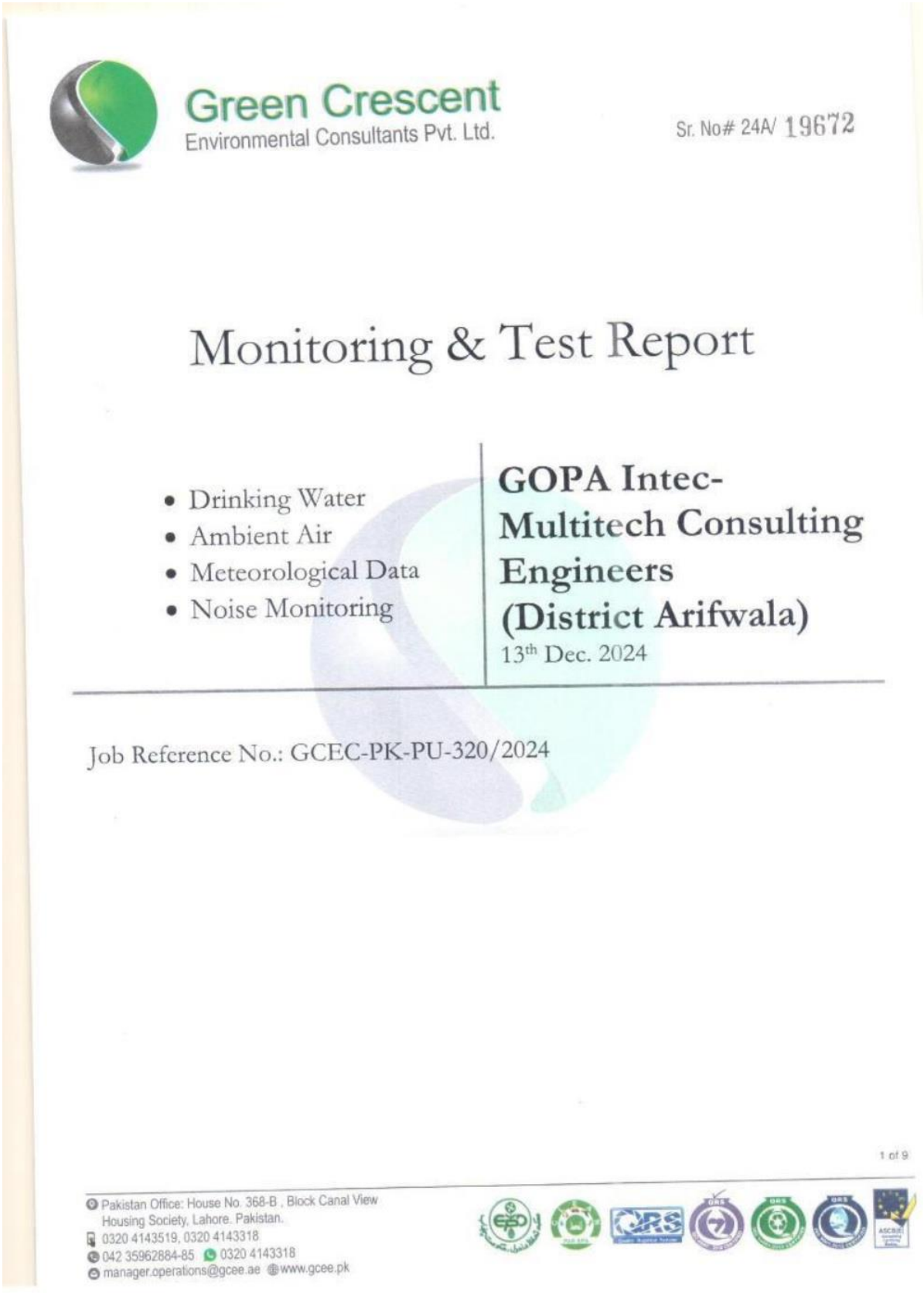
The results of ambient air monitoring depict that all the tested parameters for air quality were within the permissible limits of Punjab Environmental Quality Standards.

Noise monitoring results of both sites were in compliance with the prescribed limits for commercial noise of Punjab Environmental Quality Standards.

Results of drinking water sample showed compliance with permissible limits of Punjab Environmental Quality Standards except Total Coliform.

Reference Number: GCEC-PK-PU-320/2024

Environmental Monitoring, Sampling & Testing Analysis Reports



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Environmental Consultants Pvt. Ltd.

Sr. No# 24A/ 19672

Monitoring & Test Report

- Drinking Water
- Ambient Air
- Meteorological Data
- Noise Monitoring

GOPA Intec-Multitech Consulting Engineers (District Arifwala)

13th Dec. 2024

Job Reference No.: GCEC-PK-PU-320/2024

1 of 9

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Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 24A/ 19673

Client Detail:	
Client Name:	Multan Electric Power Company (MEPCO)
Consultant Name:	GOPA Intec-Multitech Consulting Engineers
Project Name:	Electricity Distribution Efficiency Improvement Project (EDEIP) for the Construction of 132 kV Grid Station and 27 Km Transmission Line
Name of Contact Person:	Mr. Hassan Raza
Designation:	Managing Director
Contact Number:	0321-4553805
Email:	Hassan@mecpak.com
Address:	121J, Johar Town, Lahore, Pakistan

GCEC Details:	
Director:	Mr. Mian Khurram Usman
Telephone:	+92 42 35962885
Fax:	+92 42 35962884
Email:	manager.operations@gcee.ae
Address	House No. 368-B Block B, Canal View, Lahore

Signatories:

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Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 24A/ 19674

CHEMICAL ANALYSIS TEST REPORT (DRINKING WATER)

Sample Details			
Job Ref. No:	GCEC-PK-PU-320/2024	Client Name:	Multan Electric Power Company (MEPCO)
Telephone No.	0337-9820818	Consultant Name:	GOPA Intec- Multitech Consulting Engineers
Sample Date:	03-12-2024	Sample Matrix:	Drinking Water Sample
Sample Receipt Date:	04-12-2024	Sampled By:	GCEC
Grab/Composite:	Grab Sampling	Date of Completion of Analysis:	13-12-2024
Address:	121J, Johar Town, Lahore, Pakistan		
Project Name:	Electricity Distribution Efficiency Improvement Project (EDEIP) for the Construction of 132 kV Grid Station and 27 Km Transmission Line (MEPCO)		
Sample Identification			
01	Tube Well Point Near Site Location		

Parameters	Analysis Method	Unit	LOR	Result 01	PEQS
PHYSICAL & CHEMICAL ANALYSIS					
pH**	APHA-4500H+ B	-	0.01	6.91	6.5-8.5
Odor	In-house	-	-	Odorless	Non-Objectionable
Taste	In-house	-	-	Salty	Non-Objectionable
Color	APHA-2120 B/C	Pt/Co	1.0	<1.0	≤15 TCU
Turbidity**	APHA-2130 B	NTU	0.1	<0.1	<5 NTU
Total Hardness**	APHA-2340 B & C	mg/l	0.1	632.0	< 500 mg/l
Total Dissolved Solid (TDS)**	APHA-2540 C	mg/l	1.0	1236.0	< 1000
Ammonia	APHA-4500-NH_3-B	mg/l	0.002	<0.002	-
Chloride**	APHA-4500Cl- B	mg/l	0.24	91.97	< 250
Cyanide (CN)	APHA-4500CN- E	mg/l	0.01	<0.01	≤ 0.05
Fluoride (F)**	APHA-4500F- D	mg/l	0.01	<0.01	≤ 1.5
Nitrite	APHA-4500NO2 B	mg/l	0.01	0.27	≤ 3 (P)
Nitrate**	APHA-4500NO3 C	mg/l	0.1	1.51	≤ 50
Phenolic Compound	APHA-5530 D	mg/l	0.01	<0.01	-
Residual Chlorine	APHA-4500Cl G	mg/l	0.1	<0.1	0.2-0.5
Aluminum (Al)	APHA-3111Al B	mg/l	0.028	<0.028	≤ 0.2
Cadmium**	APHA-3111Cd B	mg/l	0.0028	<0.0028	0.01
Copper**	APHA-3111Cu B	mg/l	0.0045	<0.0045	2
Chromium**	APHA-3111Cr B	mg/l	0.0054	<0.0054	≤ 0.05 (P)
Mercury	APHA-3112Hg B	mg/l	0.0008	<0.0008	≤ 0.001
Antimony (Sb)**	APHA-3111Sb B	mg/l	-	ND	≤ 0.005 (P)
Nickel**	APHA-3111Ni C	mg/l	0.008	<0.008	≤ 0.02
Zinc**	APHA-3111Zn B	mg/l	0.0033	<0.0033	5.0
Arsenic	APHA-3111As B	mg/l	0.01	<0.01	≤ 0.05 (P)
Barium	APHA-3111Ba B	mg/l	0.031	<0.031	0.7
Manganese**	APHA-3111Mn B	mg/l	0.0016	<0.0016	≤ 0.5
Iron**	APHA-3111Fe B	mg/l	0.1	<0.1	-
Boron	APHA-4500-B (C)	mg/l	0.1	<0.1	0.3
Lead**	APHA-3111Pb B	mg/l	0.013	<0.013	≤ 0.05
Selenium	APHA-3111Se B	mg/l	-	ND	0.01 (P)
MICROBIOLOGICAL ANALYSIS					
Total Coliforms	APHA:9222 B	CFU/100ml		01	0/100ml
Faecal Coliforms (Ecoli)	APHA:9222 D	CFU/100ml		Absent	0/100ml

Abbreviations:
ND: Not Detected **LOR:** Limit of Reporting **PEQS:** Punjab Environmental Quality Standards

Note:
*Uncertainty of all the parameters and laboratory conditions at the time of analysis will be provided as per client's requirement. The lab environmental conditions are maintained at 25±5C° and humidity at 50±20%. **Disclaimer:** The results are solely of the sample provided. **All the starred parameters are PNAC accredited.

Sample Analyzed By:
Analyst
Mr. Idrees Zaman

Name of Chief Analyst with Seal:
Mr. Usman Raza Jasvi

3 of 9

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Sr. No# 24A/ 19675

Ambient Air Monitoring Location

ROAD POINT NEAR GRID STATION

(Arifwala)

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Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 24A/ 19676

Ambient Air Quality Monitoring

Job Reference Number	GCEC-PK-PU-320/2024
Monitoring Point	Road Point Near Grid Station
Date of Intervention	02-Dec-2024 to 03-Dec-2024
Monitoring Coordinates	30°17'01.7"N 73°02'27.0"E

Sr. #	Time	CO (mg/m³)	NO (µg/m³)	NO_2 (µg/m³)	NO_x (µg/m³)	SO_2 (µg/m³)
1.	11:12	1.31	17.44	22.71	40.16	15.46
2.	12:12	1.24	18.64	23.92	42.55	17.53
3.	13:12	1.27	17.04	22.93	39.97	15.45
4.	14:12	1.21	17.56	26.09	43.65	16.65
5.	15:12	1.27	17.38	24.46	41.84	15.19
6.	16:12	1.30	18.13	23.55	41.69	16.18
7.	17:12	1.26	18.30	23.88	42.17	17.89
8.	18:12	1.20	16.91	25.39	42.30	15.10
9.	19:12	1.18	18.41	24.21	42.62	16.33
10.	20:12	1.23	16.95	25.51	42.46	18.14
11.	21:12	1.16	17.21	24.27	41.48	18.98
12.	22:12	1.24	18.64	22.69	41.33	16.11
13.	23:12	1.14	17.96	21.30	39.26	15.82
14.	00:12	1.19	18.75	21.73	40.48	16.53
15.	01:12	1.14	18.16	23.61	41.77	15.83
16.	02:12	1.14	16.97	24.97	41.94	16.92
17.	03:12	1.12	17.87	23.57	41.44	15.36
18.	04:12	2.20	18.65	22.10	40.75	15.70
19.	05:12	2.25	17.90	24.60	42.50	17.42
20.	06:12	2.19	19.36	24.08	43.44	15.09
21.	07:12	2.23	19.54	24.73	44.28	17.69
22.	08:12	2.17	19.01	26.20	45.21	15.19
23.	09:12	2.23	17.51	24.02	41.53	16.49
24.	10:12	2.32	17.59	25.22	42.81	18.56
Average Concentration		1.82	17.52	23.96	41.48	17.01

Monitoring Performed By:
Deputy Analyst
Muhammad Ilyas

Name of Chief Analyst with Seal:
Mr. Usman Raza Jaswal

Green Crescent Environmental Consultants Pvt. Ltd. ★ PAKISTAN ★

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Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 24A/ 19677

Ambient Air Quality Monitoring

Job Reference Number	GCEC-PK-PU-320/2024
Monitoring Point	Road Point Near Grid Station
Date of Intervention	02-Dec-2024 to 03-Dec-2024
Monitoring Coordinates	30°17'01.7"N 73°02'27.0"E

Parameter	Unit	Monitoring Duration	LDL	Average Obtained Concentration	PEQS
Nitrogen Dioxide (NO_2)	µg/m³	24 Hours	1.00	23.96	80.0
Nitrogen Oxide (NO)	µg/m³	24 Hours	1.00	17.52	40.0
NO_X	µg/m³	24 Hours	1.00	41.48	120.0
Sulphur Dioxide (SO_2)	µg/m³	24 Hours	1.00	17.01	120.0
Carbon Monoxide (CO)	mg/m³	24 Hours	0.01	1.82	5.0*
Ozone (O_3)	µg/m³	24 Hours	-	12.45	130.0**
Particulate Matter ($PM_{2.5}$)	µg/m³	24 Hours	1.00	31.80	35.0
Particulate Matter (PM_{10})	µg/m³	24 Hours	1.00	124.66	150.0
Suspended Particulate Matter (SPM)	µg/m³	24 Hours	1.00	191.46	500.0
Lead Airborne Particles	µg/m³	24 Hours	-	0.16	1.5

Abbreviations:
µg/m³= Micrograms per Cubic Meter
mg/m³= Milligrams per Cubic Meter
LDL= Lowest Detection Limit
PEQS= Punjab Environmental Quality Standards
*08 hour standard for CO
**01 hour standard for O_3

Monitoring Performed By:
Deputy Analyst
Muhammad Ilyas

Name of Chief Analyst with Seal:
Mr. Usman Raza Jaswal

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6 of 9

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Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 24A/ 19678

Meteorological Data

Job Reference Number	GCEC-PK-PU-320/2024
Monitoring Point	Road Point Near Grid Station
Date of Intervention	02-Dec-2024 to 03-Dec-2024
Monitoring Coordinates	30°17'01.7"N 73°02'27.0"E

Time	Ambient Temperature °C	Wind Direction	Wind Velocity m/s	Humidity %	Pressure (mm of Hg)
11:12	24	NE	5.4	48	755.6
12:12	24	N	5.5	45	756.3
13:12	24	N	5.3	45	755.0
14:12	24	N	6.5	45	755.1
15:12	24	N	5.3	48	756.8
16:12	24	N	4.7	54	755.2
17:12	23	N	5.6	62	756.0
18:12	21	N	5.5	72	757.2
19:12	19	NE	6.0	77	758.3
20:12	18	NE	4.4	81	757.6
21:12	17	NE	4.3	83	755.6
22:12	17	NE	4.7	86	754.5
23:12	16	NE	5.0	87	753.4
00:12	16	NE	3.6	88	755.4
01:12	16	Nw	4.5	92	755.4
02:12	16	NW	4.3	91	755.1
03:12	15	NW	4.5	94	754.4
04:12	15	NW	5.8	95	754.2
05:12	14	NW	4.4	97	756.4
06:12	14	N	5.3	90	755.4
07:12	14	N	5.8	78	756.8
08:12	14	N	4.4	63	755.4
09:12	16	N	4.1	58	755.4
10:12	18	N	5.2	58	757.6

Monitoring Performed By:
Deputy Analyst
Muhammad Ilyas

Name of Chief Analyst with Seal:
Mr. Usman Raza Jaswal

Green Crescent Environmental Consultants Pvt. Ltd. * PAKISTAN *

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042 35962884-85 0320 4143318
manager.operations@gcee.ae @www.gcee.pk

Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 24A/ 19679

Noise Level Monitoring Report

Job Reference Number	GCEC-PK-PU-320/2024
Monitoring Point	Road Point Near Grid Station
Date of Intervention	02-Dec-2024 to 03-Dec-2024
Monitoring Coordinates	30°17'01.7"N 73°02'27.0"E

Sr. #	Time	Method/Technique	Unit	Results LAavg	PEQS (Commercial)
		Night Time			
1.	23:12	Noise Meter	dB	47.2	
2.	00:12	Noise Meter	dB	48.5	
3.	01:12	Noise Meter	dB	46.9	
4.	02:12	Noise Meter	dB	47.2	
5.	03:12	Noise Meter	dB	49.2	55.0
6.	04:12	Noise Meter	dB	48.8	
7.	05:12	Noise Meter	dB	47.9	
8.	06:12	Noise Meter	dB	53.2	
	Night Time Average		dB	48.61	55.0
		Day Time			
9.	07:12	Noise Meter	dB	53.4	
10.	08:12	Noise Meter	dB	56.7	
11.	09:12	Noise Meter	dB	56.6	
12.	10:12	Noise Meter	dB	57.9	
13.	11:12	Noise Meter	dB	57.7	
14.	12:12	Noise Meter	dB	56.3	
15.	13:12	Noise Meter	dB	55.4	
16.	14:12	Noise Meter	dB	57.9	
17.	15:12	Noise Meter	dB	58.3	65.0
18.	16:12	Noise Meter	dB	54.4	
19.	17:12	Noise Meter	dB	53.2	
20.	18:12	Noise Meter	dB	52.4	
21.	19:12	Noise Meter	dB	50.2	
22.	20:12	Noise Meter	dB	49.9	
23.	21:12	Noise Meter	dB	48.3	
24.	22:12	Noise Meter	dB	49.2	
	Day Time Average		dB	54.24	65.0

Monitoring Performed By:
Deputy Analyst
Muhammad Ilyas

Name of Chief Analyst with Seal:
Mr. Usman Raza Jaswal

Green Crescent Environmental Consultants Pvt. Ltd. * PAKISTAN *

8 of 9

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Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 24A/ 19680

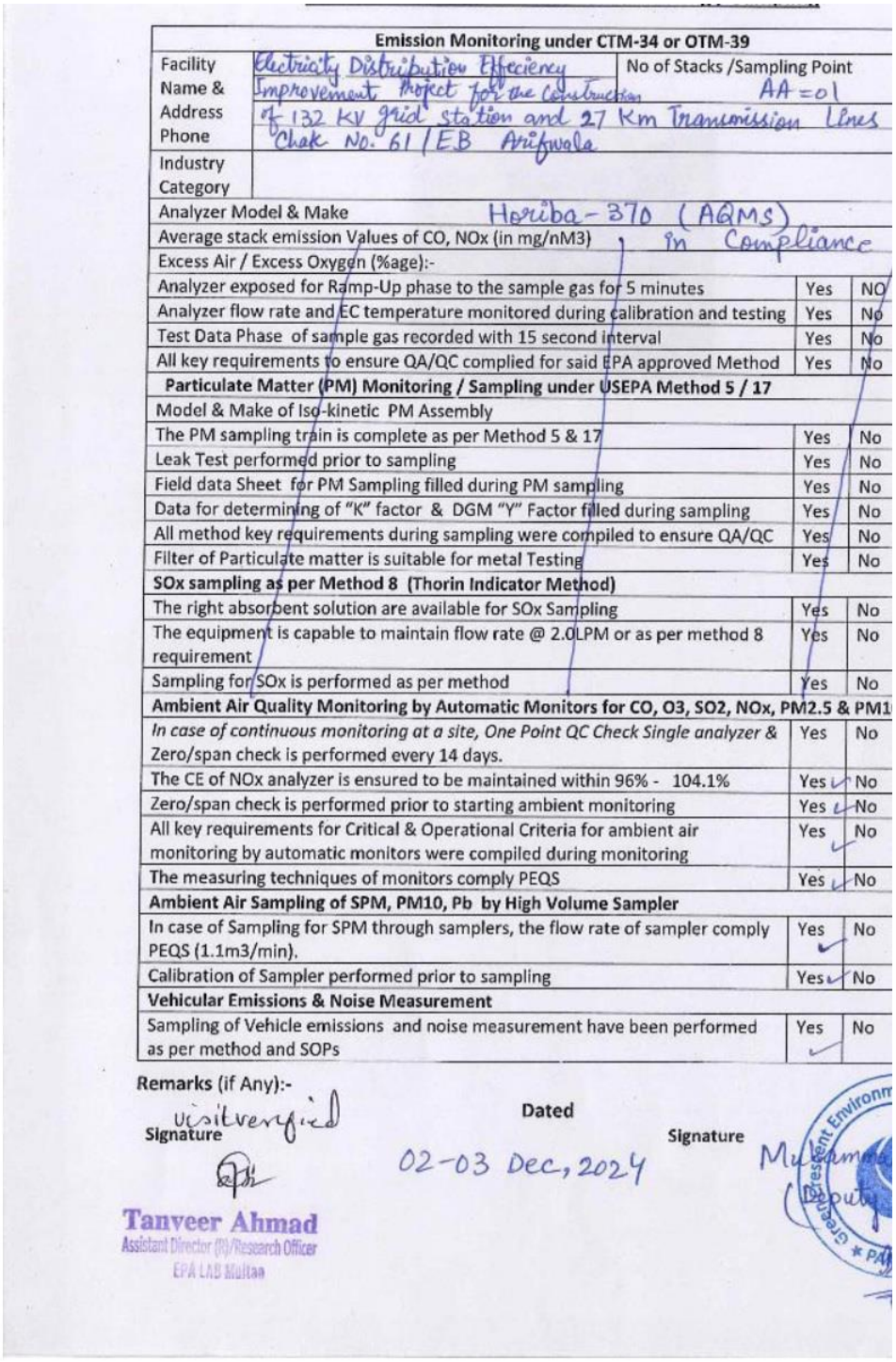
Pictorial Evidence for Drinking Water Sampling & Ambient Air Monitoring

Figure 1: Drinking Water Sampling from Tube well Point Near Site Location

Figure 2: Ambient Air Monitoring of Road Point Near Grid Station

End of Report

Pakistan Office: House No. 368-B , Block Canal View Housing Society, Lahore. Pakistan.
0320 4143519, 0320 4143318
042 35962884-85 0320 4143318
manager.operations@gcee.ae www.gcee.pk

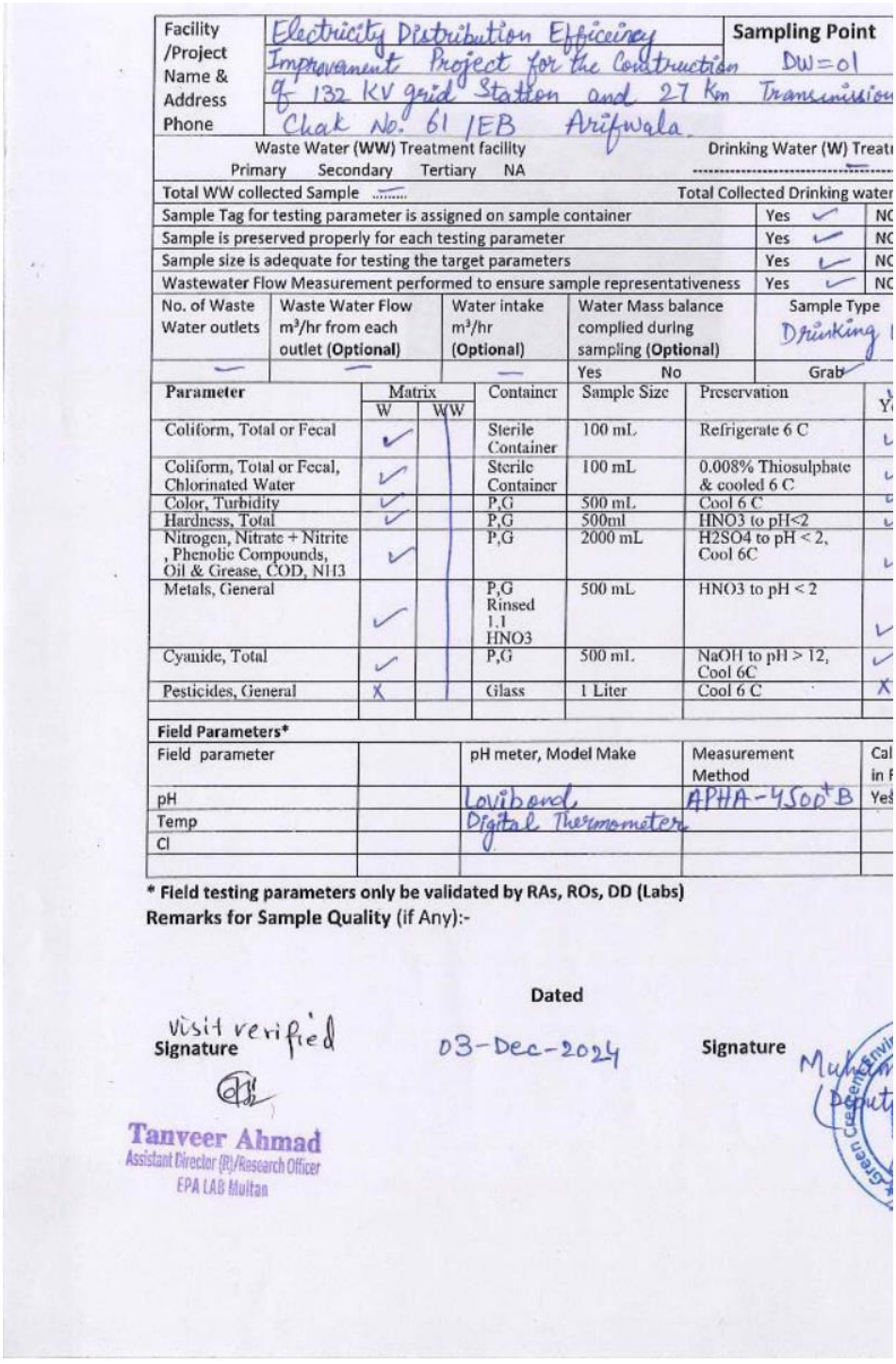


Emission Monitoring under CTM-34 or OTM-39		
Facility Name & Address Phone	Electricity Distribution Effecieney Improvement Project for the Construction of 132 KV grid station and 27 Km Transmission lines Chak No. 61/EB Arifwala	No of Stacks /Sampling Point AA=01
Industry Category		
Analyzer Model & Make	Horiba-370 (AQMS)	
Average stack emission Values of CO, NOx (in mg/nM3)	In Compliance	
Excess Air / Excess Oxygen (%age):-		
Analyzer exposed for Ramp-Up phase to the sample gas for 5 minutes	Yes	NO
Analyzer flow rate and EC temperature monitored during calibration and testing	Yes	No
Test Data Phase of sample gas recorded with 15 second interval	Yes	No
All key requirements to ensure QA/QC complied for said EPA approved Method	Yes	No
Particulate Matter (PM) Monitoring / Sampling under USEPA Method 5 / 17		
Model & Make of Iso-kinetic PM Assembly		
The PM sampling train is complete as per Method 5 & 17	Yes	No
Leak Test performed prior to sampling	Yes	No
Field data Sheet for PM Sampling filled during PM sampling	Yes	No
Data for determining of "K" factor & DGM "Y" Factor filled during sampling	Yes	No
All method key requirements during sampling were compiled to ensure QA/QC	Yes	No
Filter of Particulate matter is suitable for metal Testing	Yes	No
SOx sampling as per Method 8 (Thorin Indicator Method)		
The right absorbent solution are available for SOx Sampling	Yes	No
The equipment is capable to maintain flow rate @ 2.0LPM or as per method 8 requirement	Yes	No
Sampling for SOx is performed as per method	Yes	No
Ambient Air Quality Monitoring by Automatic Monitors for CO, O3, SO2, NOx, PM2.5 & PM1		
In case of continuous monitoring at a site, One Point QC Check Single analyzer & Zero/span check is performed every 14 days.	Yes	No
The CE of NOx analyzer is ensured to be maintained within 96% - 104.1%	Yes	No
Zero/span check is performed prior to starting ambient monitoring	Yes	No
All key requirements for Critical & Operational Criteria for ambient air monitoring by automatic monitors were compiled during monitoring	Yes	No
The measuring techniques of monitors comply PEQS	Yes	No
Ambient Air Sampling of SPM, PM10, Pb by High Volume Sampler		
In case of Sampling for SPM through samplers, the flow rate of sampler comply PEQS (1.1m3/min).	Yes	No
Calibration of Sampler performed prior to sampling	Yes	No
Vehicular Emissions & Noise Measurement		
Sampling of Vehicle emissions and noise measurement have been performed as per method and SOPs	Yes	No

Remarks (if Any):- Visit verified

Signature **Dated** 02-03 Dec, 2024 **Signature**

Tanveer Ahmad
Assistant Director (R)/Research Officer
EPA LAB Multan



Facility /Project Name & Address Phone	Electricity Distribution Efficiency Improvement Project for the Construction of 132 KV grid Station and 27 Km Transmission Chak No. 61/EB Arifwala.	Sampling Point DW=01

Waste Water (WW) Treatment facility: Primary Secondary Tertiary NA — Drinking Water (W) Treat

Total WW collected Sample ..... — Total Collected Drinking water

Sample Tag for testing parameter is assigned on sample container	Yes ✓	NO
Sample is preserved properly for each testing parameter	Yes ✓	NO
Sample size is adequate for testing the target parameters	Yes ✓	NO
Wastewater Flow Measurement performed to ensure sample representativeness	Yes ✓	NO

No. of Waste Water outlets	Waste Water Flow m^3/hr from each outlet (Optional)	Water intake m^3/hr (Optional)	Water Mass balance complied during sampling (Optional)	Sample Type
—	—	—	Yes No	Drinking / Grab ✓

Parameter	Matrix W	Matrix WW	Container	Sample Size	Preservation	Y
Coliform, Total or Fecal	✓		Sterile Container	100 mL	Refrigerate 6 C	✓
Coliform, Total or Fecal, Chlorinated Water	✓		Sterile Container	100 mL	0.008% Thiosulphate & cooled 6 C	✓
Color, Turbidity	✓		P,G	500 mL	Cool 6 C	✓
Hardness, Total	✓		P,G	500ml	HNO3 to pH<2	✓
Nitrogen, Nitrate + Nitrite , Phenolic Compounds, Oil & Grease, COD, NH3	✓		P,G	2000 mL	H2SO4 to pH < 2, Cool 6C	✓
Metals, General	✓		P,G Rinsed 1.1 HNO3	500 mL	HNO3 to pH < 2	✓
Cyanide, Total	✓		P,G	500 mL	NaOH to pH > 12, Cool 6C	✓
Pesticides, General	X		Glass	1 Liter	Cool 6 C	X

Field Parameters*

Field parameter		pH meter, Model Make	Measurement Method	Cal in F
pH		Lovibond,	APHA-4500+B	Yes
Temp		Digital Thermometer		
Cl				

*** Field testing parameters only be validated by RAs, ROs, DD (Labs)**

Remarks for Sample Quality (if Any):-

Dated 03-Dec-2024

Signature visit verified

Tanveer Ahmad
Assistant Director (R)/Research Officer
EPA LAB Multan

Signature

ENVIRONMENTAL MONITORING, SAMPLING AND TESTING REPORT

FOR

Electricity Distribution Efficiency Improvement Project (EDEIP) for the Construction of 132 kV Grid Station and 27 Km Transmission Line

(District DG Khan)

MULTITECH CONSULTING ENGINEERS

Prepared by: Green Crescent Environmental Consultants Pvt. Ltd

Reference Number: GCEC-PK-PU-320/2024

Contact Details of Client	
Client Name	Multan Electric Power Company (MEPCO)
Consultant Name	GOPA Intec-Multitech Consulting Engineers
Project Name	Electricity Distribution Efficiency Improvement Project (EDEIP) for the Construction of 132 kV Grid Station and 27 Km Transmission Line
Contact Person	Mr. Hassan Raza
Designation	Managing Director
Contact Number	0321-4553805
Email ID	Hassan@mcepak.com
Address	121J, Johar Town, Lahore, Pakistan
Contact Details of GCEC-Pakistan	
Director:	Mr. Mian Khurram Usman
Telephone:	+92 42 35962885
Fax:	+92 42 35962884
Email:	manager.operations@gcee.ae
Address	House No. 368-B Block B, Canal View, Lahore

Approved By:

Zara Yousaf
Coordination Department

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LIST OF ABBREVIATIONS

AA	Ambient Air
DW	Drinking Water
SPL	Sound Pressure Level
dB	Decibels
mg/m3	Milligram per Cubic meter
mg/l	Milligram per Liter
µg/m³	Micrograms per Cubic Meter
CO	Carbon Monoxide
SO_2	Sulfur Dioxide
NOx	Oxides of nitrogen
O_2	Oxygen
SPM	Suspended Particulate Matter
LDL	Lowest Detection Limit
PEQS	Punjab Environmental Quality Standards
LOR	Limit of Reporting
PM	Particulate Matter
SOPs	Standard Operating Procedures
TSS	Total Suspended Solids
APHA	American Public Health Association

SECTION 1: OBJECTIVES & SCOPE

1.1 STUDY OBJECTIVES

Followings were the main objectives of the study:

- To assess the current conditions of the environment in the surroundings of project area.
- To help the consultant and contractor to develop the strategies for the protection and betterment of environment.

1.2 SCOPE OF SERVICES

Scope of services covered following main components:

- Ambient Air Quality Monitoring
- Noise Level Monitoring
- Drinking Water Sampling & Analysis

MONITORING TEAM

Monitoring team of Green Crescent Environmental Consultants involved in the monitoring and sampling is given in below table:

Table 1-1 Monitoring Team

Sr. No.	Name of The Employee	Designation
1.	Muhammad Ilyas Durrani	Executive Field Officer

SECTION 2: ENVIRONMENTAL MONITORING, SAMPLING & TESTING SCHEDULE

Detailed Environmental monitoring was conducted at the mutually agreed sites of project area. The monitoring and sampling was conducted from 8th Dec to 9th Dec. 2024.

Table 2-1 Environmental Monitoring, Sampling & Testing Schedule

Sr. #	Intervention Date	Activity	Monitoring Location
1.	08-12-2024 to 09-12-2024	• Ambient Air Quality Monitoring • Meteorological Monitoring	Site Area
2.	09-12-2024	Drinking Water	Water Pump Near Site Location

SECTION 3: ENVIRONMENTAL MONITORING, SAMPLING & TESTING LOCATIONS

Environmental monitoring, sampling & testing locations are as per shown in the following figure.

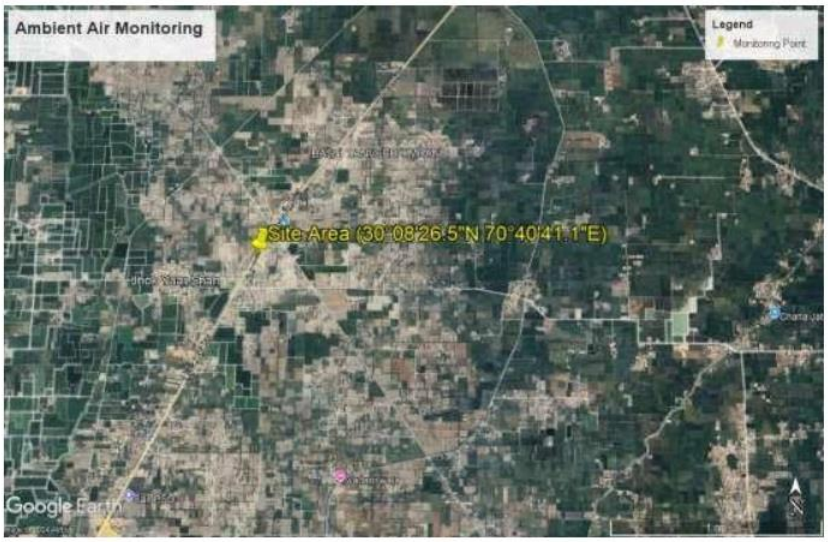

Figure 3-1: Map Showing Ambient Air Monitoring Locations (8th Dec. to 9th Dec.2024)

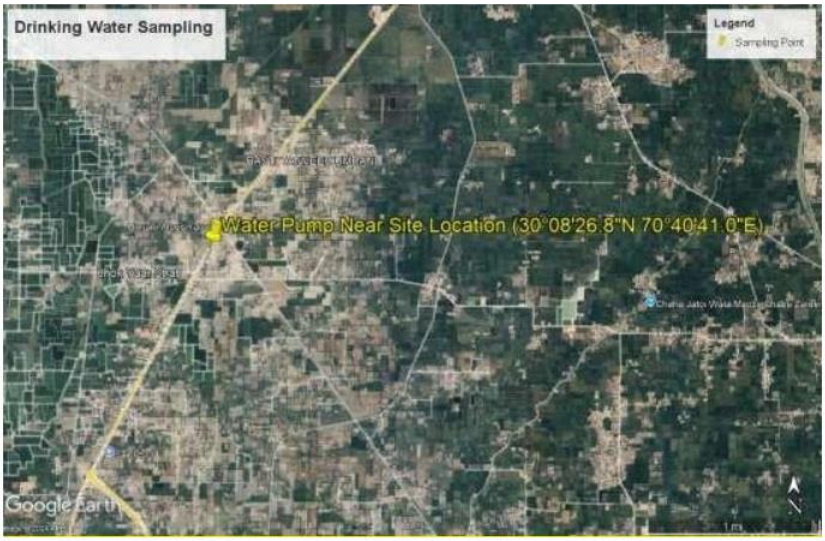

Figure 3-2: Map Showing Drinking Water Sampling Location (9th Dec. 2024)

SECTION 4: ENVIRONMENTAL MONITORING, SAMPLING & TESTING METHODOLOGY

Following is a brief description of the methodology adopted for this Environmental Monitoring, Sampling & Testing including Ambient Air, Metrological Data, Noise and Water Analysis:

4.1 Onsite Monitoring

Among the environmental parameters selected by the client;

- Ambient Air
- Temperature and pH of water samples

Were monitored onsite. Ambient air monitoring including metrological monitoring and noise level monitoring was conducted using portable digital instruments while temperature and pH of the water samples were monitored manually using thermometer and pH strips. A brief description of each digital instrument used for onsite monitoring is given below;

4.1.1 Vantage Pro2, Davis

The Davis 6152 Wireless Vantage Pro2 Weather Station which was made in 2018 in America which consists of a console unit and an innovative integrated sensor suite that includes a rain collector with self-emptying bucket, temperature and humidity sensors and an anemometer. The sensor suite is housed inside a radiation shield, protecting the sensors against solar radiation and additional sources of reflected and/or radiated heat. It provides accurate weather data in a sophisticated yet easy-to-read format. With Wireless Vantage Pro2 Weather Station we can continuously measure metrological parameters including;

- Temperature
- Wind Direction
- Wind Velocity
- Humidity

eric Pressure

Figure 4-1: View of Davis Vintage Pro at Site

4.1.2

- PM_{10}
- $PM_{2.5}$
- TSP

Davis wireless weather station Vintage Pro2 was used for the assessment of these parameters according to standard operating procedures and obtained results are presented in **Annex-1** of this report.

Dust Trak II Aerosol Monitor 8530, TSI

The Dust Trak II Aerosol Monitor 8530 is a desktop battery-operated, data-logging, light-scattering laser photometer which was manufactured in 2014, that gives you realtime aerosol mass readings.

It uses a sheath air system that isolates the aerosol in the optics chamber to keep the optics clean for improved reliability and low maintenance. Using this instrument, particulate matter was monitored including;

Figure 4-2: DustTrak II aerosol monitor 8530

4.1.3 Model 407730 Digital Sound Level Meter, Extech

It is a noise measuring instrument used to assess sound levels by measuring sound pressure. Often referred to as a sound pressure level (SPL) meter, decibel (dB) meter, noise meter or noise dosimeter, a sound level meter uses a microphone to capture sound. The sound is then evaluated within the device and acoustic measurement values are displayed. The most common unit of acoustic measurement for sound is the decibel (dBA). Hourly noise level

monitoring was done for 24 hours at each point of selected location. Digital Sound meter was manufactured in 2014.

Noise level using portable digital sound meter was monitored at client's mutually agreed monitoring points. Noise level measurement was performed according to standard operating procedures and obtained results are presented in **Annex-1** of this report.

Figure 4-3: View of Digital Sound Level Meter

4.1.4 HORIBA

HORIBA, was manufactured in 2017, a Japanese brand which consists of ambient air analyzers and sampling systems for the measurement of regulatory pollutants and air quality control. It offers complete tailored or individual air quality monitoring solutions, in order to meet the requirements and regulatory needs of environmental monitoring.

4.1.4.1 AC32M. NITROGEN OXIDES ANALYZER (NO, NOX, NO2)

Chemiluminescence technology based, TÜV & US EPA approved. It is single chambered chemiluminescence technology with ultra-compact and lightweight – rackable 19"/3U. On board web server compatible with any internet browser and user interface with online help for the display, configuration, maintenance, diagnostics or software updating of the analyzer, remotely. It is capable to detect low levels of nitrogen oxides (NO-NO_2-NO_X) with standard ranges: 0-0.1/0.2/0.5/1.0 ppm

4.1.4.2 AF22E. NEW E-SERIES SO2 ANALYZER

UV Fluorescent sulfur dioxide analyzer AF22e, TUV certified and US-EPA approved for compliance with ISO 10498, 2008/50/EC, en 14212, EN 15267, 40 CFR part 53 SUB B and SUB C.

It is a light weight eco-friendly & eco-innovative conception unit which detects early signs of trouble, allows predictive maintenance, identifies the service needed and guides the service operations step by step.

It provides real-time calibration graph, animated synoptic, auto-diagnostic, control and maintenance data screens can be displayed while the instrument is operating. It provides superior metrological presentations for SO_2 measurements in the range as low as 0.05 ppm F.S.

4.1.4.3 CO12E. NEW E-SERIES CO ANALYZER

Non dispersive Infra-Red carbon monoxide analyzer CO12e, TUV certified and US-EPA approved for compliance with ISO 4224, EN 14626, EN 15267, 40 CFR part 53 SUB B and SUB C.

It is a light weight eco-friendly & eco-innovative conception unit with breakthrough mechanical design for weight and power saving as well as thermal insulation & reliability. It has automatic or programmable response time adjustment, ensuring efficient monitoring of low concentration levels of carbon monoxide. It provides superior metrological presentations for CO measurements in the range 0-100 ppm.

4.2 Water Sample Collection and Preservation

Water samples were collected from mutually agreed sampling points according to the SOPs based on American Public Health Association (APHA) for water sampling and analysis. Decontaminated Plastic bottles were used to collect the samples. To prevent air bubbles from being trapped in the bottles, they were filled to the brim. The lids of the sampling bottles were then replaced tightly. The bottles were then labeled and chain of custody forms were filled out and signed to keep track of the collected samples. Collected samples were

then preserved in appropriate containers as per APHA Preservation Guidelines. A shipping container containing ice packs with maintained temperature was used for transporting the samples from sampling location to GCEC Lahore Branch for testing.

4.2.1 Drinking Water Sampling & Analysis

Sampling for drinking water was carried out at mutually agreed sampling points. Physical and chemical parameters were analyzed afterwards in GCEC labs for drinking water sample. Analytical methods used during the laboratory testing were in line with the American Public Health Association's Standard Methods for the Examination of Water. Analysis Results are presented in **Annex 1** of this report.

4.3 Sample Tagging and Chain of Custody

In GCEC Lahore Branch, samples and chain of custody form were handed over by Field Monitoring Staff to the Coordination Staff for in-house tagging and logging according to the company's policy and handed over to the Laboratory Staff for further physical, chemical and microbiological testing. A brief description of each sampling type and further proceedings are also discussed in following section.

SECTION 5: RESULTS & DISCUSSIONS

This section of the report presents the Environmental testing results of noise-level monitoring, ambient air quality & drinking water analysis

5.1 Background Noise Level Monitoring

The Noise monitoring activity was carried at different locations. Monitoring schedule is presented in Table 2-1. While a brief description of monitoring session is as below.

Hourly noise monitoring was conducted at four selected locations. The results of monitoring locations were compared with commercial noise standards for Punjab Environmental Quality Standards i.e., 65.0 dB (A) for Day Time and 55.0 dB (A) for Night Time.

Discussion on Noise Results

Noise level Monitoring was conducted for 24 hours at four monitoring locations. The monitoring results obtained are not complying with the commercial noise standards of PEQS. Day and Night Time averages for monitoring points are presented in figures below.

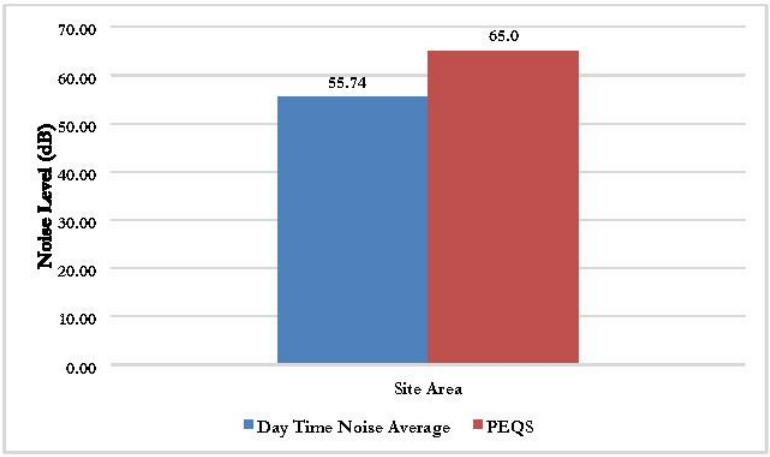

Figure 5-1: Day Time Average Noise Level Value Compared with Respective PEQS Standards (8th Dec. to 9th Dec.2024)

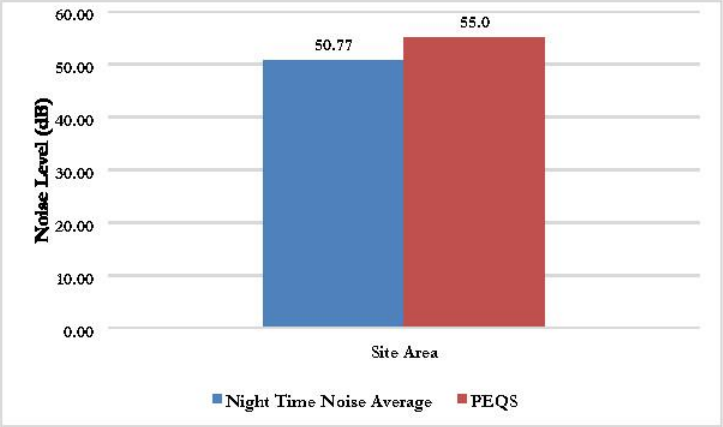

Figure 5-2: Night Time Average Noise Level Value Compared with Respective PEQS Standards (8th Dec. to 9th Dec.2024)

5.2 Ambient Air Quality Monitoring

The activity for monitoring the ambient air conditions was carried out at the agreed sites and its vicinity, for 24 hours at two monitoring locations starting from **(8th Dec. to 9th Dec.2024).** To assess the current quality of ambient air, Carbon Monoxide, Oxides of Nitrogen, Sulphur Dioxide, Ozone, Lead and Particulate Matter were monitored. Summary of monitoring results is presented in Table 5-1. Detailed result reports are also attached as **Annex 1.**

Discussion of NOx Measurements

The readings of NO, NO_2 and NOx for the project site and its surroundings comply with the Punjab Environmental Quality Standards i.e, 40 µg/m³, 80 µg/m³ and 120 µg/m³ respectively. Sum of NO and NO_2 is termed as NOx. NOx results found at the monitoring location were within the PEQS limits. Monitoring results, compared with PEQS Standards, are graphically presented in figure below and in Summary Table below.

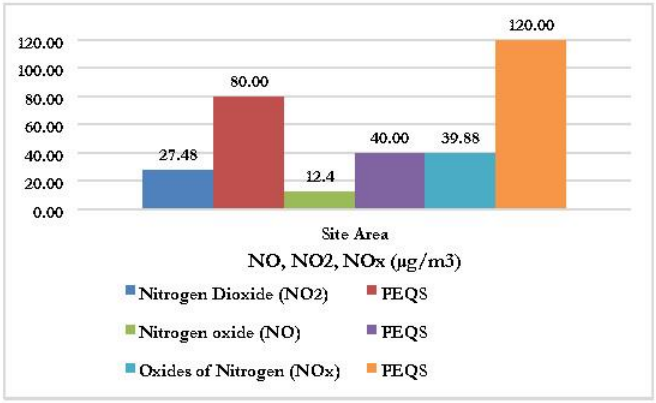

Figure 5-3: Daily Average NOx Measurements Compared with Respective PEQS Standards (8th Dec. to 9th Dec.2024)

Discussion of SO_2 Measurements

The SO_2 reading for both monitoring locations is presented in the summary table which depicts that the monitoring results are within the prescribed limits of PEQS i.e. 120 µg/m³. SO_2 results found at all two monitoring locations are within the PEQS limits.

Monitoring results, compared with PEQS Standards, are also graphically presented in figure below and in Summary Table 5-1 and 5-2.

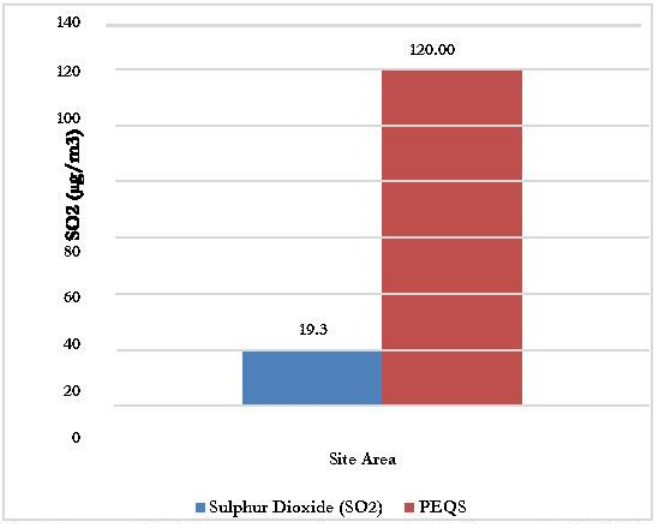

Figure 5-4: Daily Average SO_2 Measurement Compared with Respective PEQS Standards (8th Dec. to 9th Dec.2024)

Discussion of CO Measurements

Carbon Monoxide (CO) was monitored for 24 hours at two monitoring locations. The CO values detected at monitoring locations are within the permissible limit of PEQS i.e., 5.0 mg/m³. Monitoring results, compared with PEQS Standards, are graphically presented in figure below and in Summary Table below.

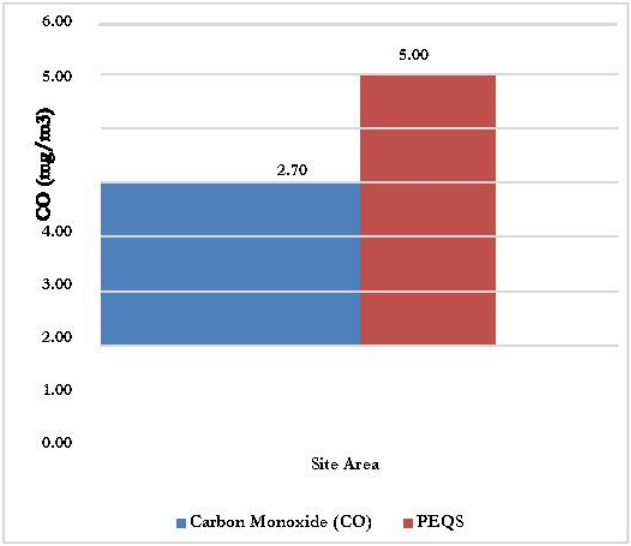

Figure 5-5: Daily Average CO Measurement Compared with Respective PEQS Standards (8th Dec. to 9th Dec.2024)

Discussion of Lead Measurements

Lead was monitored for 24 hours at two monitoring locations. The values detected at monitoring locations are within the permissible limit of PEQS i.e., 1.50 ug/m³. Monitoring results, compared with PEQS, are graphically presented in figure below and in Summary Table 5-1.

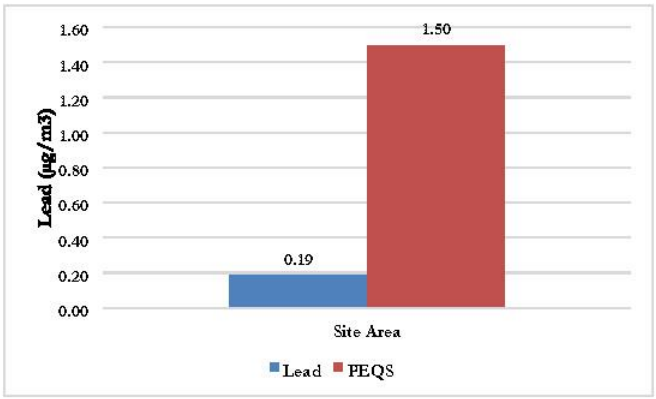

Figure 5-6: Daily Average Lead Measurement Compared with Respective PEQS Standards (8th Dec. to 9th Dec.2024)

Discussion of Ozone (O_3) Measurements

Ozone was monitored for 24 hours at two monitoring locations. The values detected at all two monitoring locations are within the permissible limit of PEQS i.e., 130 ug/m³. Monitoring results, compared with PEQS Standards, are graphically presented in figure below and in Summary Table below.

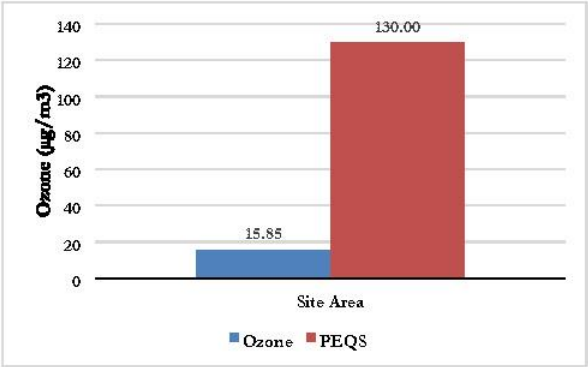

Figure 5-7: Daily Average Ozone Measurement Compared with Respective PEQS Standards (8th Dec. to 9th Dec.2024)

Discussion on Particulate Matter (PM_{10}, $PM_{2.5}$, TSP)

The monitoring results of *PM_{10}, $PM_{2.5}$* and *TSP* for all sites are compared with Punjab Environmental Quality Standard i.e., 150 µg/m³. The values of *PM_{10}, $PM_{2.5}$* and *TSP* were found falling within the prescribed limits of PEQS Limits, except for *$PM_{2.5}$* and *PM_{10}* in CB-I Construction Site. Monitoring result, compared with PEQS Standards, is graphically presented in figure below and in Summary Table below.

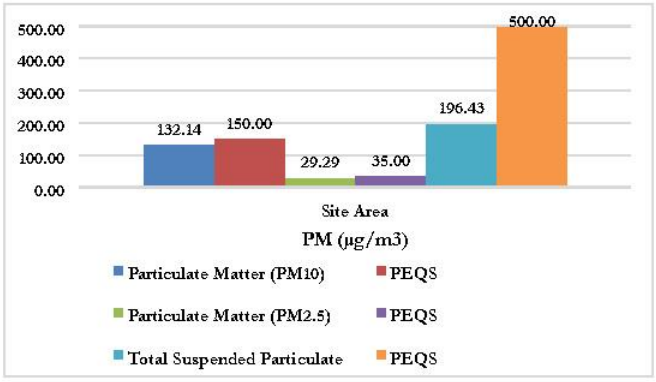

Figure 5-8: Daily Average TSP Measurements Compared with Respective PEQS Standards (8th Dec. to 9th Dec.2024)

Table 5-1 Summary of Ambient Air Quality Monitoring Results

Location Identification	
Monitoring Site:	01
Monitoring Location:	Site Area
Date:	08-Dec-2024 to 09-Dec-2024
Coordinates:	30°08'26.5"N 70°40'41.1"E

Parameter	Unit	Monitoring Duration	LDL	Average Obtained Concentration	PEQS
				01	
Nitrogen Dioxide (NO_2)	µg/m³	24 Hours	1.00	27.48	80.0
Nitrogen oxide (NO)	µg/m³	24 Hours	1.00	12.40	40.0
NO_X	µg/m³	24 Hours	1.00	39.88	120.0
Sulphur Dioxide (SO_2)	µg/m³	24 Hours	1.00	19.30	120.0
Carbon Monoxide (CO)	mg/m³	24 Hours	0.01	2.70	5.0
Ozone (O_3)	µg/m³	24 Hours	-	15.85	130.0**
Lead	µg/m³	24 Hours	0.05	0.19	1.50
Particulate Matter (PM_{10})	µg/m³	24 Hours	1.00	132.14	150.0
Particulate Matter ($PM_{2.5}$)	µg/m³	24 Hours	1.00	29.29	35.0
Total Suspended Particulate (TSP)	µg/m³	24 Hours	1.00	196.43	500.0

Abbreviations:
LDL= Lowest Detection Limit
PEQS= Punjab Environmental Quality Standards
*(24 Hours Standard for all the parameters Except O_3 and CO)
**(1 Hour Standard for O_3)
*(24 Hours Standard for all the parameters Except O_3) µg/m³= Micrograms per Cubic Meter mg/m³= Milligrams per Cubic Meter

5.3 Drinking Water Analysis

Drinking water sample were collected from one location on 09-12-2024 which were preserved and submitted in GCEC-Laboratory according to the standard methods. Summary of Analysis Results are given below in **Table 5-3**.

Discussion on Results

The laboratory test results of drinking water samples are summarized in the table below. It is obvious from the analysis results that the drinking water meets the permissible limits of Punjab Environmental Quality Standards for all tested parameters

Reference Number: GCEC-PK-PU-320/2024

Table 5-2 Summary of Drinking Water Analysis Results

Sample Marking & Identification			
01	Water Pump Near Site Location	Sampling Coordinates:	30°08'26.8"N 70°40'41.0"E

Parameters	Analysis Method	Unit	LOR	Result	PEQS
				01	
PHYSICAL & CHEMICAL ANALYSIS					
pH**	APHA-4500H+ B	-	0.01	7.13	6.5-8.5
Odor	In-house	-	-	Odorless	Non-Objectionable
Taste	In-house	-	-	Salty	Non-Objectionable
Color	APHA-2120 B/C	Pt/Co	1.0	<1.0	≤15 TCU
Turbidity**	APHA-2130 B	NTU	-	<0.1	<5 NTU
Total Hardness**	APHA-2340 B & C	mg/l	0.1	716.0	< 500 mg/l
Total Dissolved Solid (TDS)**	APHA-2540 C	mg/l	1.0	2120.0	< 1000
Ammonia	APHA-4500-NH_3-B	mg/l	0.002	<0.002	-
Chloride (Cl)**	APHA-4500Cl- B	mg/l	0.24	189.81	< 250
Cyanide (CN)	APHA-4500CN E	mg/l	0.01	<0.01	≤ 0.05
Fluoride (F)**	APHA-4500F- D	mg/l	0.01	<0.01	≤ 1.5
Nitrite	APHA-4500NO2 B	mg/l	0.01	<0.01	≤ 3 (P)
Nitrate**	APHA-4500NO3 C	mg/l	0.1	0.15	≤ 50
Phenolic Compound	APHA-5530 D	mg/l	0.01	<0.01	-
Residual Chlorine	APHA-4500Cl G	mg/l	0.1	<0.1	0.2-0.5
Aluminum (Al)	APHA-3111Al B	mg/l	0.028	<0.028	≤ 0.2
Cadmium**	APHA-3111Cd B	mg/l	0.0028	<0.0028	0.01
Copper**	APHA-3111Cu B	mg/l	0.0045	<0.0045	2
Chromium**	APHA-3111Cr B	mg/l	0.0054	<0.0054	≤ 0.05 (P)
Mercury	APHA-3112Hg B	mg/l	0.0008	<0.0008	≤ 0.001
Antimony (Sb)**	APHA-3111Sb B	mg/l	-	ND	≤ 0.005 (P)
Nickel**	APHA-3111Ni C	mg/l	0.008	<0.008	≤ 0.02
Zinc**	APHA-3111Zn B	mg/l	0.0033	<0.0033	5.0
Arsenic	APHA-3111As B	mg/l	0.01	<0.01	≤ 0.05 (P)
Barium	APHA-3111Ba B	mg/l	0.031	<0.031	0.7
Manganese**	APHA-3111Mn B	mg/l	0.0016	<0.0016	≤ 0.5
Iron**	APHA-3111Fe B	mg/l	0.1	<0.1	-
Boron	APHA-4500-B (C)	mg/l	0.1	<0.1	0.3
Lead**	APHA-3111Pb B	mg/l	0.013	<0.013	≤ 0.05
Selenium	APHA-3111Se B	mg/l	-	ND	0.01 (P)
MICROBIOLOGICAL ANALYSIS					
Total Coliforms	APHA:9222 B	CFU/100ml		Absent	0/100ml
Faecal Coliforms (Ecoli)	APHA:9222 D	CFU/100ml		Absent	0/100ml

Page 21 of 21

Abbreviations:
ND: Not Detected **LOR:** Limit of Reporting **PEQS:** Punjab Environmental Quality Standards
Note:
** Uncertainty of all the parameters and laboratory conditions at the time of analysis will be provided as per client's requirement. The lab environmental conditions are maintained at 25±5C° and humidity at 50±20%.*
Disclaimer: *The results are solely of the sample provided. **All the starred parameters are PNAC accredited.*

SECTION 6: CONCLUSION

Environmental monitoring was performed at mutually agreed sites to assess the environmental conditions of its surroundings.

The results of ambient air monitoring depict that all the tested parameters for air quality were within the permissible limits of Punjab Environmental Quality Standards.

Noise monitoring results of both sites were in compliance with the prescribed limits for commercial noise of Punjab Environmental Quality Standards.

Results of drinking water sample showed compliance with permissible limits of Punjab Environmental Quality Standards.

Reference Number: GCEC-PK-PU-320/2024

Environmental Monitoring, Sampling & Testing Analysis Reports

Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 24A/ 19717

Monitoring & Test Report

- Drinking Water
- Ambient Air
- Meteorological Data
- Noise Monitoring

GOPA Intec-Multitech Consulting Engineers (District DG Khan)

14th Dec. 2024

Job Reference No.: GCEC-PK-PU-320/2024

1 of 9

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Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 24A/ 19718

Client Detail:	
Client Name:	Multan Electric Power Company (MEPCO)
Consultant Name:	GOPA Intec-Multitech Consulting Engineers
Project Name:	Electricity Distribution Efficiency Improvement Project (EDEIP) for the Construction of 132 kV Grid Station and 27 Km Transmission Line
Name of Contact Person:	Mr. Hassan Raza
Designation:	Managing Director
Contact Number:	0321-4553805
Email:	Hassan@mcepak.com
Address:	121J, Johar Town, Lahore, Pakistan

GCEC Details:	
Director:	Mr. Mian Khurram Usman
Telephone:	+92 42 35962885
Fax:	+92 42 35962884
Email:	manager.operations@gcee.ae
Address	House No. 368-B Block B, Canal View, Lahore

Signatories:

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Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 24A/ 19719

CHEMICAL ANALYSIS TEST REPORT (DRINKING WATER)

Sample Details			
Job Ref. No:	GCEC-PK-PU-320/2024	Client Name:	Multan Electric Power Company (MEPCO)
Telephone No.	0337-9820818	Consultant Name:	GOPA Intec- Multitech Consulting Engineers
Sample Date:	09-12-2024	Sample Matrix:	Drinking Water Sample
Sample Receipt Date:	10-12-2024	Sampled By:	GCEC
Grab/Composite:	Grab Sampling	Date of Completion of Analysis:	13-12-2024
Address:	121J, Johar Town, Lahore, Pakistan		
Project Name:	Electricity Distribution Efficiency Improvement Project (EDEIP) for the Construction of 132 kV Grid Station and 27 Km Transmission Line		
Sample Identification			
01	Water Pump Near Site Location		

Parameters	Analysis Method	Unit	LOR	Result 01	PEQS
PHYSICAL & CHEMICAL ANALYSIS					
pH**	APHA-4500H+ B	-	0.01	7.13	6.5-8.5
Odor	In-house	-	-	Odorless	Non-Objectionable
Taste	In-house	-	-	Salty	Non-Objectionable
Color	APHA-2120 B/C	Pt/Co	1.0	<1.0	≤15 TCU
Turbidity**	APHA-2130 B	NTU	0.1	<0.1	<5 NTU
Total Hardness**	APHA-2340 B & C	mg/l	0.1	716.0	< 500 mg/l
Total Dissolved Solid (TDS)**	APHA-2540 C	mg/l	1.0	2120.0	< 1000
Ammonia	APHA-4500-NH_3 B	mg/l	0.002	<0.002	-
Chloride**	APHA-4500Cl- B	mg/l	0.24	189.81	< 250
Cyanide (CN)	APHA-4500CN- E	mg/l	0.01	<0.01	≤ 0.05
Fluoride (F)**	APHA-4500F- D	mg/l	0.01	<0.01	≤ 1.5
Nitrite	APHA-4500NO2 B	mg/l	0.01	<0.01	≤ 3 (P)
Nitrate**	APHA-4500NO3 C	mg/l	0.1	0.15	≤ 50
Phenolic Compound	APHA-5530 D	mg/l	0.01	<0.01	-
Residual Chlorine	APHA-4500Cl G	mg/l	0.1	<0.1	0.2-0.5
Aluminum (Al)	APHA-3111Al B	mg/l	0.028	<0.028	≤ 0.2
Cadmium**	APHA-3111Cd B	mg/l	0.0028	<0.0028	0.01
Copper**	APHA-3111Cu B	mg/l	0.0045	<0.0045	2
Chromium**	APHA-3111Cr B	mg/l	0.0054	<0.0054	≤ 0.05 (P)
Mercury	APHA-3112Hg B	mg/l	0.0008	<0.0008	≤ 0.001
Antimony (Sb)**	APHA-3111Sb B	mg/l	-	ND	≤ 0.005 (P)
Nickel**	APHA-3111Ni C	mg/l	0.008	<0.008	≤ 0.02
Zinc**	APHA-3111Zn B	mg/l	0.0033	<0.0033	5.0
Arsenic	APHA-3111As B	mg/l	0.01	<0.01	≤ 0.05 (P)
Barium	APHA-3111Ba B	mg/l	0.031	<0.031	0.7
Manganese**	APHA-3111Mn B	mg/l	0.0016	<0.0016	≤ 0.5
Iron**	APHA-3111Fe B	mg/l	0.1	<0.1	-
Boron	APHA-4500-B (C)	mg/l	0.1	<0.1	0.3
Lead**	APHA-3111Pb B	mg/l	0.013	<0.013	≤ 0.05
Selenium	APHA-3111Se B	mg/l	-	ND	0.01 (P)
MICROBIOLOGICAL ANALYSIS					
Total Coliforms	APHA-9222 B	CFU/100ml		Absent	0/100ml
Faecal Coliforms (Ecoli)	APHA-9222 D	CFU/100ml		Absent	0/100ml

Abbreviations:
ND: Not Detected LOR: Limit of Reporting PEQS: Punjab Environmental Quality Standards
Note:
*Uncertainty of all the parameters and laboratory conditions at the time of analysis will be provided as per client's requirement. The lab environmental conditions are maintained at 25±5C° and humidity at 50±20%. **Disclaimer:** The results are solely of the sample provided. **All the starred parameters are PNAC accredited.

Sample Analyzed By:
Analyst
Mr. Idrees Zaman

Name of Chemist/Analyst with Seal:
Mr. Usman Raza Jaspal

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Sr. No# 24A/ 19720

Ambient Air Monitoring Location

SITE AREA

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Sr. No# 24A/ 19721

Ambient Air Quality Monitoring

Job Reference Number	GCEC-PK-PU-320/2024
Monitoring Point	Site Area
Date of Intervention	08-Dec-2024 to 09-Dec-2024
Monitoring Coordinates	30°08'26.5"N 70°40'41.1"E

Sr. #	Time	CO (mg/m³)	NO (µg/m³)	NO_2 (µg/m³)	NO_x (µg/m³)	SO_2 (µg/m³)
1.	13:00	2.72	11.90	26.25	38.16	20.18
2.	14:00	2.89	11.01	30.37	41.38	17.94
3.	15:00	2.52	11.68	28.70	40.38	13.91
4.	16:00	2.63	12.90	29.59	42.49	16.13
5.	17:00	2.51	12.13	26.14	38.27	17.25
6.	18:00	2.32	12.01	25.59	37.60	18.47
7.	19:00	2.46	12.68	26.81	39.49	19.14
8.	20:00	2.45	13.91	29.81	43.72	20.92
9.	21:00	1.91	12.90	26.14	39.05	22.92
10.	22:00	1.62	12.01	27.48	39.49	23.92
11.	23:00	1.58	11.01	26.25	37.27	20.92
12.	00:00	1.64	11.12	28.48	39.60	19.47
13.	01:00	1.67	9.46	29.81	39.27	24.03
14.	02:00	1.58	10.90	31.26	42.16	21.58
15.	03:00	1.65	10.35	29.59	39.94	20.25
16.	04:00	1.81	13.13	28.81	41.94	19.25
17.	05:00	1.80	12.79	30.92	43.72	19.69
18.	06:00	1.82	13.79	28.70	42.49	23.81
19.	07:00	1.79	12.01	29.48	41.49	22.92
20.	08:00	1.85	13.02	28.59	41.60	21.70
21.	09:00	2.88	12.24	26.14	38.38	20.47
22.	10:00	2.84	12.13	28.48	40.60	19.03
23.	11:00	2.73	12.01	29.59	41.60	19.80
24.	12:00	2.67	12.90	28.70	41.60	18.42
	Average Concentration	2.70	12.40	27.48	39.88	19.30

Monitoring Performed By:
Deputy Analyst
Muhammad Ilyas

Name of Chief Analyst with Seal:
Mr. Usman Raza Jaswal

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Environmental Consultants Pvt. Ltd.

Sr. No# 24A/ 19722

Ambient Air Quality Monitoring

Job Reference Number	GCEC-PK-PU-320/2024
Monitoring Point	Site Area
Date of Intervention	08-Dec-2024 to 09-Dec-2024
Monitoring Coordinates	30°08'26.5"N 70°40'41.1"E

Parameter	Unit	Monitoring Duration	LDL	Average Obtained Concentration	PEQS
Nitrogen Dioxide (NO_2)	µg/m³	24 Hours	1.00	27.48	80.0
Nitrogen Oxide (NO)	µg/m³	24 Hours	1.00	12.40	40.0
NO_x	µg/m³	24 Hours	1.00	39.88	120.0
Sulphur Dioxide (SO_2)	µg/m³	24 Hours	1.00	19.30	120.0
Carbon Monoxide (CO)	mg/m³	24 Hours	0.01	2.70	5.0*
Ozone (O_3)	µg/m³	24 Hours	-	15.85	130.0**
Particulate Matter ($PM_{2.5}$)	µg/m³	24 Hours	1.00	29.29	35.0
Particulate Matter (PM_{10})	µg/m³	24 Hours	1.00	132.14	150.0
Suspended Particulate Matter (SPM)	µg/m³	24 Hours	1.00	196.43	500.0
Lead Airborne Particles	µg/m³	24 Hours	-	0.19	1.5

Abbreviations:
µg/m³= Micrograms per Cubic Meter
mg/m³= Milligrams per Cubic Meter
LDL= Lowest Detection Limit
PEQS= Punjab Environmental Quality Standards
*08 hour standard for CO
**01 hour standard for O_3

Monitoring Performed By:
Deputy Analyst
Muhammad Ilyas

Name of Chief Analyst with Seal:
Mr. Usman Raza Jaswal

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Sr. No# 24A/ 19723

Meteorological Data

Job Reference Number	GCEC-PK-PU-320/2024
Monitoring Point	Site Area
Date of Intervention	08-Dec-2024 to 09-Dec-2024
Monitoring Coordinates	30°08'26.5"N 70°40'41.1"E

Time	Ambient Temperature °C	Wind Direction	Wind Velocity m/s	Humidity %	Pressure (mm of Hg)
13:00	20	NE	6.6	35	753.4
14:00	20	NE	6.7	30	754.1
15:00	20	NE	6.5	30	752.8
16:00	19	NE	6.7	32	752.9
17:00	13	NE	6.5	35	754.6
18:00	12	NW	6.9	40	753.0
19:00	11	NW	6.8	50	753.8
20:00	11	NW	6.7	60	755.0
21:00	9	NW	6.2	63	756.3
22:00	9	NW	6.6	65	755.5
23:00	8	NW	6.5	70	753.4
00:00	8	NW	5.9	70	752.2
01:00	8	N	6.2	70	751.1
02:00	7	N	6.8	69	753.2
03:00	6	N	6.7	64	753.2
04:00	6	N	6.5	62	752.9
05:00	6	N	6.7	59	752.1
06:00	8	N	7.0	59	751.9
07:00	12	NE	6.6	57	754.2
08:00	15	NE	6.5	54	753.2
09:00	17	NE	7.0	49	754.6
10:00	19	NE	6.6	45	753.2
11:00	19	NE	6.3	34	753.2
12:00	20	NE	6.4	25	755.5

Monitoring Performed By:
Deputy Analyst
Muhammad Ilyas

Name of Chief Analyst with Seal:
Mr. Usman Raza Jaswal

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Noise Level Monitoring Report

Job Reference Number	GCEC-PK-PU-320/2024
Monitoring Point	Site Area
Date of Intervention	08-Dec-2024 to 09-Dec-2024
Monitoring Coordinates	30°08'26.5"N 70°40'41.1"E

Sr. #	Time	Method/Technique	Unit	Results LAavg	PEQS (Commercial)
		Night Time			
1.	23:00	Noise Meter	dB	47.5	
2.	00:00	Noise Meter	dB	51.6	
3.	01:00	Noise Meter	dB	49.8	
4.	02:00	Noise Meter	dB	49.2	
5.	03:00	Noise Meter	dB	51.9	55.0
6.	04:00	Noise Meter	dB	51.0	
7.	05:00	Noise Meter	dB	51.4	
8.	06:00	Noise Meter	dB	53.6	
	Night Time Average		dB	50.77	55.0
		Day Time			
9.	07:00	Noise Meter	dB	50.1	
10.	08:00	Noise Meter	dB	56.9	
11.	09:00	Noise Meter	dB	54.5	
12.	10:00	Noise Meter	dB	57.3	
13.	11:00	Noise Meter	dB	56.8	
14.	12:00	Noise Meter	dB	54.2	
15.	13:00	Noise Meter	dB	57.9	
16.	14:00	Noise Meter	dB	58.1	
17.	15:00	Noise Meter	dB	53.5	65.0
18.	16:00	Noise Meter	dB	57.5	
19.	17:00	Noise Meter	dB	55.6	
20.	18:00	Noise Meter	dB	56.5	
21.	19:00	Noise Meter	dB	56.3	
22.	20:00	Noise Meter	dB	53.4	
23.	21:00	Noise Meter	dB	58.5	
24.	22:00	Noise Meter	dB	54.8	
	Day Time Average		dB	55.74	65.0

Monitoring Performed By:
Deputy Analyst
Muhammad Ilyas

Name of Chief Analyst with Seal:
MD Esmail Raza Jaswal

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Pictorial Evidence for Drinking Water Sampling & Ambient Air Monitoring

Figure 1: Drinking Water Sampling from Water Pump Near Site Location

Figure 2: Ambient Air Monitoring of Site Area

End of Report

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Validation for Stack & Ambient Monitoring / Sampling

Emission Monitoring under CTM-34 or OTM-39			
Facility Name & Address Phone	Electricity Distribution Efficiency Improvement Project for the Construction of 132kV Grid station and 27 Km Transmiss Basti Jhok Yar Shah, Taunsa Road, DG Khan	No of Stacks /Sampling Point	AA=01
Industry Category			
Analyzer Model & Make	Horiba – 370 (AAMS)		
Average stack emission Values of CO, NOx (in mg/nM3)			
Excess Air / Excess Oxygen (%age):-			
Analyzer exposed for Ramp-Up phase to the sample gas for 5 minutes		Yes	NO
Analyzer flow rate and EC temperature monitored during calibration and testing		Yes	No
Test Data Phase of sample gas recorded with 15 second interval		Yes	No
All key requirements to ensure QA/QC complied for said EPA approved Method		Yes	No
Particulate Matter (PM) Monitoring / Sampling under USEPA Method 5 / 17			
Model & Make of Iso-kinetic PM Assembly			
The PM sampling train is complete as per Method 5 & 17		Yes	No
Leak Test performed prior to sampling		Yes	No
Field data Sheet for PM Sampling filled during PM sampling		Yes	No
Data for determining of "K" factor & DGM "Y" Factor filled during sampling		Yes	No
All method key requirements during sampling were compiled to ensure QA/QC		Yes	No
Filter of Particulate matter is suitable for metal Testing		Yes	No
SOx sampling as per Method 8 (Thorin Indicator Method)			
The right absorbent solution are available for SOx Sampling		Yes	No
The equipment is capable to maintain flow rate @ 2.0LPM or as per method 8 requirement		Yes	No
Sampling for SOx is performed as per method		Yes	No
Ambient Air Quality Monitoring by Automatic Monitors for CO, O3, SO2, NOx, PM2.5 & PM1			
In case of continuous monitoring at a site, One Point QC Check Single analyzer & Zero/span check is performed every 14 days.		Yes	No
The CE of NOx analyzer is ensured to be maintained within 96% - 104.1%		Yes ✓	No
Zero/span check is performed prior to starting ambient monitoring		Yes ✓	No
All key requirements for Critical & Operational Criteria for ambient air monitoring by automatic monitors were compiled during monitoring		Yes ✓	No
The measuring techniques of monitors comply PEQS		Yes ✓	No
Ambient Air Sampling of SPM, PM10, Pb by High Volume Sampler			
In case of Sampling for SPM through samplers, the flow rate of sampler comply PEQS (1.1m3/min).		Yes ✓	No
Calibration of Sampler performed prior to sampling		Yes ✓	No
Vehicular Emissions & Noise Measurement			
Sampling of Vehicle emissions and noise measurement have been performed as per method and SOPs		Yes ✓	No

Remarks (if Any):-

Visit verified

Signature

Tanveer Ahmad
Assistant Director (R)/Research Officer
EPA LAB Multan

Dated 08-09 Dec, 2024

Signature

Muhammad
Deputy

Facility /Project Name & Address Phone	Electricity Distribution Efficiency Improvements Project for the Construction of 132 KV grid station and 27 Km Tra... Basti Jhok Yar Shah, Taunsa Road DG Kh...	Sampling Point DW=01

Waste Water (WW) Treatment facility — Primary Secondary Tertiary NA

Drinking Water (W) Treatr...

Total WW collected Sample .....

Total Collected Drinking water

Sample Tag for testing parameter is assigned on sample container	Yes ✓	NO
Sample is preserved properly for each testing parameter	Yes ✓	NO
Sample size is adequate for testing the target parameters	Yes ✓	NO
Wastewater Flow Measurement performed to ensure sample representativeness	Yes ✓	NO

No. of Waste Water outlets	Waste Water Flow m^3/hr from each outlet (Optional)	Water intake m^3/hr (Optional)	Water Mass balance complied during sampling (Optional)	Sample Type
—	—	—	Yes No	Drinking / Grab

Parameter	Matrix W	Matrix WW	Container	Sample Size	Preservation	Y
Coliform, Total or Fecal	✓		Sterile Container	100 mL	Refrigerate 6 C	
Coliform, Total or Fecal, Chlorinated Water	✓		Sterile Container	100 mL	0.008% Thiosulphate & cooled 6 C	
Color, Turbidity	✓		P,G	500 mL	Cool 6 C	
Hardness, Total	✓		P,G	500ml	HNO3 to pH<2	
Nitrogen, Nitrate + Nitrite, Phenolic Compounds, Oil & Grease, COD, NH3	✓		P,G	2000 mL	H2SO4 to pH < 2, Cool 6C	
Metals, General	✓		P,G Rinsed 1.1 HNO3	500 mL	HNO3 to pH < 2	
Cyanide, Total	✓		P,G	500 mL	NaOH to pH > 12, Cool 6C	
Pesticides, General	X		Glass	1 Liter	Cool 6 C	X

Field Parameters*

Field parameter		pH meter, Model Make	Measurement Method	Cal in F
pH		Lovibond	APHA-4500+ B	Yes
Temp		Digital Thermometer		
Cl				

*** Field testing parameters only be validated by RAs, ROs, DD (Labs)**

Remarks for Sample Quality (if Any):-

Visit verified

Dated 09-Dec-2024

Signature

Tanveer Ahmad
Assistant Director (R)/Research Officer
EPA LAB Multan

Signature Mukam... Deputy...

ENVIRONMENTAL MONITORING, SAMPLING AND TESTING REPORT

FOR

Electricity Distribution Efficiency Improvement Project (EDEIP) for the Construction of 132 kV Grid Station and 27 Km Transmission Line

(District Khanewal)

MULTITECH CONSULTING ENGINEERS

Prepared by: Green Crescent Environmental Consultants Pvt. Ltd

Reference Number: GCEC-PK-PU-320/2024

Contact Details of Client	
Client Name	Multan Electric Power Company (MEPCO)
Consultant Name	GOPA Intec-Multitech Consulting Engineers
Project Name	Electricity Distribution Efficiency Improvement Project (EDEIP) for the Construction of 132 kV Grid Station and 27 Km Transmission Line
Contact Person	Mr. Hassan Raza
Designation	Managing Director
Contact Number	0321-4553805
Email ID	Hassan@mcepak.com
Address	121J, Johar Town, Lahore, Pakistan
Contact Details of GCEC-Pakistan	
Director:	Mr. Mian Khurram Usman
Telephone:	+92 42 35962885
Fax:	+92 42 35962884
Email:	manager.operations@gcee.ae
Address	House No. 368-B Block B, Canal View, Lahore

Reference Number: GCEC-PK-PU-320/2024

Approved By:

Zara Yousaf
Coordination Department

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LIST OF ABBREVIATIONS

AA	Ambient Air
DW	Drinking Water
SPL	Sound Pressure Level
dB	Decibels
mg/m3	Milligram per Cubic meter
mg/l	Milligram per Liter
µg/m³	Micrograms per Cubic Meter
CO	Carbon Monoxide
SO_2	Sulfur Dioxide
NOx	Oxides of nitrogen
O_2	Oxygen
SPM	Suspended Particulate Matter
LDL	Lowest Detection Limit
PEQS	Punjab Environmental Quality Standards
LOR	Limit of Reporting
PM	Particulate Matter
SOPs	Standard Operating Procedures
TSS	Total Suspended Solids
APHA	American Public Health Association

SECTION 1: OBJECTIVES & SCOPE

1.1 STUDY OBJECTIVES

Followings were the main objectives of the study:

- To assess the current conditions of the environment in the surroundings of project area.
- To help the consultant and contractor to develop the strategies for the protection and betterment of environment.

1.2 SCOPE OF SERVICES

Scope of services covered following main components:

- Ambient Air Quality Monitoring
- Noise Level Monitoring
- Drinking Water Sampling & Analysis

MONITORING TEAM

Monitoring team of Green Crescent Environmental Consultants involved in the monitoring and sampling is given in below table:

Table 1-1 Monitoring Team

Sr. No.	Name of The Employee	Designation
1.	Muhammad Ilyas Durrani	Executive Field Officer

SECTION 2: ENVIRONMENTAL MONITORING, SAMPLING & TESTING SCHEDULE

Detailed Environmental monitoring was conducted at the mutually agreed sites of project area. The monitoring and sampling was conducted from 3rd Dec to 4th Dec. 2024.

Table 2-1 Environmental Monitoring, Sampling & Testing Schedule

Sr. #	Intervention Date	Activity	Monitoring Location
1.	03-12-2024 to 04-12-2024	• Ambient Air Quality Monitoring • Meteorological Monitoring	Site Area
2.	04-12-2024	Drinking Water	Masha Allah TV Shop Near Site Location

SECTION 3: ENVIRONMENTAL MONITORING, SAMPLING & TESTING LOCATIONS

Environmental monitoring, sampling & testing locations are as per shown in the following figure.

Figure 3-1: Map Showing Ambient Air Monitoring Locations (3rd Dec. to 4th Dec.2024)

Figure 3-2: Map Showing Drinking Water Sampling Location (4th Dec. 2024)

SECTION 4: ENVIRONMENTAL MONITORING, SAMPLING & TESTING METHODOLOGY

Following is a brief description of the methodology adopted for this Environmental Monitoring, Sampling & Testing including Ambient Air, Metrological Data, Noise and Water Analysis:

4.1 Onsite Monitoring

Among the environmental parameters selected by the client;

- Ambient Air
- Temperature and pH of water samples

Were monitored onsite. Ambient air monitoring including metrological monitoring and noise level monitoring was conducted using portable digital instruments while temperature and pH of the water samples were monitored manually using thermometer and pH strips. A brief description of each digital instrument used for onsite monitoring is given below;

4.1.1 Vantage Pro2, Davis

The Davis 6152 Wireless Vantage Pro2 Weather Station which was made in 2018 in America which consists of a console unit and an innovative integrated sensor suite that includes a rain collector with self-emptying bucket, temperature and humidity sensors and an anemometer. The sensor suite is housed inside a radiation shield, protecting the sensors against solar radiation and additional sources of reflected and/or radiated heat. It provides accurate weather data in a sophisticated yet easy-to-read format. With Wireless Vantage Pro2 Weather Station we can continuously measure metrological parameters including;

- Temperature
- Wind Direction
- Wind Velocity
- Humidity

Atmospheric Pressure

Figure 4-1: View of Davis Vintage Pro at Site

4.1.2

- PM_{10}
- $PM_{2.5}$
- TSP

Davis wireless weather station Vintage Pro2 was used for the assessment of these parameters according to standard operating procedures and obtained results are presented in **Annex-1** of this report.

Dust Trak II Aerosol Monitor 8530, TSI

The Dust Trak II Aerosol Monitor 8530 is a desktop battery-operated, data-logging, light-scattering laser photometer which was manufactured in 2014, that gives you realtime aerosol mass readings.

It uses a sheath air system that isolates the aerosol in the optics chamber to keep the optics clean for improved reliability and low maintenance. Using this instrument, particulate matter was monitored including;

4.1.3

Model 407730 Digital Sound Level Meter, Extech

It is a noise measuring instrument used to assess sound levels by measuring sound pressure. Often referred to as a sound pressure level (SPL) meter, decibel (dB) meter, noise meter or noise dosimeter, a sound level meter uses a microphone to capture sound. The sound is then evaluated within the device and acoustic measurement values are displayed. The most common unit of acoustic measurement for sound is the decibel (dBA). Hourly noise level monitoring was done for 24 hours at each point of selected location. Digital Sound meter was manufactured in 2014.

Noise level using portable digital sound meter was monitored at client's mutually agreed monitoring points. Noise level measurement was performed according to standard operating procedures and obtained results are presented in **Annex-1** of this report.

Figure 4-3: View of Digital Sound Level Meter

4.1.4 HORIBA

HORIBA, was manufactured in 2017, a Japanese brand which consists of ambient air analyzers and sampling systems for the measurement of regulatory pollutants and air quality control. It offers complete tailored or individual air quality monitoring solutions, in order to meet the requirements and regulatory needs of environmental monitoring.

4.1.4.1 AC32M. NITROGEN OXIDES ANALYZER (NO, NOX, NO2)

Chemiluminescence technology based, TÜV & US EPA approved. It is single chambered chemiluminescence technology with ultra-compact and lightweight – rackable 19"/3U. On board web server compatible with any internet browser and user interface with online help for the display, configuration, maintenance, diagnostics or software updating of the analyzer, remotely. It is capable to detect low levels of nitrogen oxides (NO-NO_2-NO_X) with standard ranges: 0-0.1/0.2/0.5/1.0 ppm

4.1.4.2 AF22E. NEW E-SERIES SO2 ANALYZER

UV Fluorescent sulfur dioxide analyzer AF22e, TUV certified and US-EPA approved for compliance with ISO 10498, 2008/50/EC, en 14212, EN 15267, 40 CFR part 53 SUB B and SUB C.

It is a light weight eco-friendly & eco-innovative conception unit which detects early signs of trouble, allows predictive maintenance, identifies the service needed and guides the service operations step by step.

It provides real-time calibration graph, animated synoptic, auto-diagnostic, control and maintenance data screens can be displayed while the instrument is operating. It provides superior metrological presentations for SO_2 measurements in the range as low as 0.05 ppm F.S.

4.1.4.3 CO12E. NEW E-SERIES CO ANALYZER

Non dispersive Infra-Red carbon monoxide analyzer CO12e, TUV certified and US-EPA approved for compliance with ISO 4224, EN 14626, EN 15267, 40 CFR part 53 SUB B and SUB C.

It is a light weight eco-friendly & eco-innovative conception unit with breakthrough mechanical design for weight and power saving as well as thermal insulation & reliability. It has automatic or programmable response time adjustment, ensuring efficient monitoring of low concentration levels of carbon monoxide. It provides superior metrological presentations for CO measurements in the range 0-100 ppm.

4.2 Water Sample Collection and Preservation

Water samples were collected from mutually agreed sampling points according to the SOPs based on American Public Health Association (APHA) for water sampling and analysis. Decontaminated Plastic bottles were used to collect the samples. To prevent air bubbles from being trapped in the bottles, they were filled to the brim. The lids of the sampling bottles were then replaced tightly. The bottles were then labeled and chain of custody forms were filled out and signed to keep track of the collected samples. Collected samples were then preserved in appropriate containers as per APHA Preservation Guidelines. A shipping container containing ice packs with maintained temperature was used for transporting the samples from sampling location to GCEC Lahore Branch for testing.

4.2.1 Drinking Water Sampling & Analysis

Sampling for drinking water was carried out at mutually agreed sampling points. Physical and chemical parameters were analyzed afterwards in GCEC labs for drinking water sample. Analytical methods used during the laboratory testing were in line with the American Public Health Association's Standard Methods for the Examination of Water. Analysis Results are presented in **Annex 1** of this report.

4.3 Sample Tagging and Chain of Custody

In GCEC Lahore Branch, samples and chain of custody form were handed over by Field Monitoring Staff to the Coordination Staff for in-house tagging and logging according to the company's policy and handed over to the Laboratory Staff for further physical, chemical and microbiological testing. A brief description of each sampling type and further proceedings are also discussed in following section.

SECTION 5: RESULTS & DISCUSSIONS

This section of the report presents the Environmental testing results of noise-level monitoring, ambient air quality & drinking water analysis

5.1 Background Noise Level Monitoring

The Noise monitoring activity was carried at different locations. Monitoring schedule is presented in Table 2-1. While a brief description of monitoring session is as below.

Hourly noise monitoring was conducted at four selected locations. The results of monitoring locations were compared with commercial noise standards for Punjab Environmental Quality Standards i.e., 65.0 dB (A) for Day Time and 55.0 dB (A) for Night Time.

Discussion on Noise Results

Noise level Monitoring was conducted for 24 hours at four monitoring locations. The monitoring results obtained are not complying with the commercial noise standards of PEQS. Day and Night Time averages for monitoring points are presented in figures below.

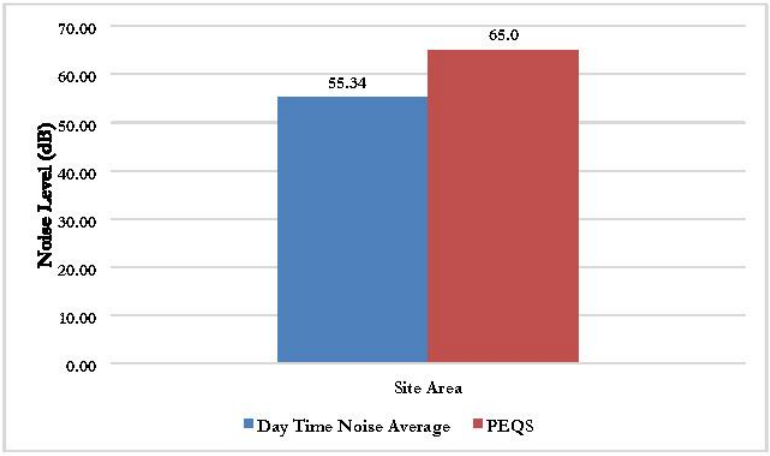

Figure 5-1: Day Time Average Noise Level Value Compared with Respective PEQS Standards (3rd Dec. to 4th Dec.2024)

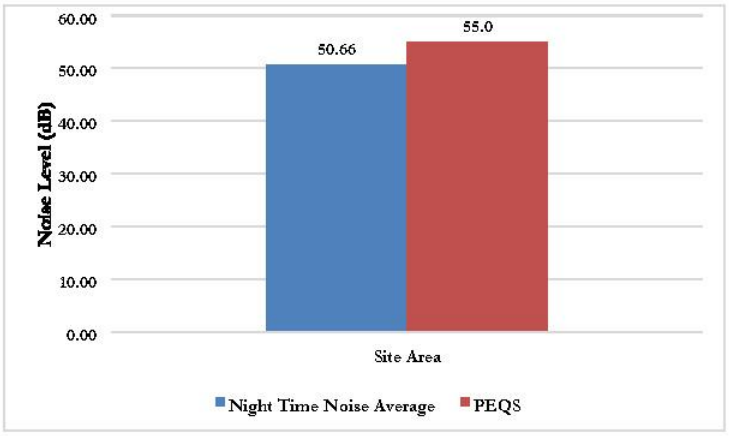

Figure 5-2: Night Time Average Noise Level Value Compared with Respective PEQS Standards (3rd Dec. to 4th Dec.2024)

5.2 Ambient Air Quality Monitoring

The activity for monitoring the ambient air conditions was carried out at the agreed sites and its vicinity, for 24 hours at two monitoring locations starting from **(3rd Dec. to 4th Dec.2024).** To assess the current quality of ambient air, Carbon Monoxide, Oxides of Nitrogen, Sulphur Dioxide, Ozone, Lead and Particulate Matter were monitored. Summary of monitoring results is presented in Table 5-1. Detailed result reports are also attached as **Annex 1.**

Discussion of NOx Measurements

The readings of NO, NO_2 and NOx for the project site and its surroundings comply with the Punjab Environmental Quality Standards i.e, 40 µg/m³, 80 µg/m³ and 120 µg/m³ respectively. Sum of NO and NO_2 is termed as NOx. NOx results found at the monitoring location were within the PEQS limits. Monitoring results, compared with PEQS Standards, are graphically presented in figure below and in Summary Table below.

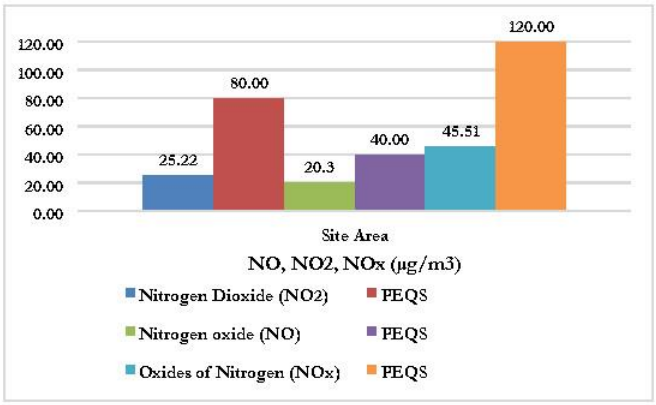

Figure 5-3: Daily Average NOx Measurements Compared with Respective PEQS Standards (3rd Dec. to 4th Dec.2024)

Discussion of SO_2 Measurements

The SO_2 reading for both monitoring locations is presented in the summary table which depicts that the monitoring results are within the prescribed limits of PEQS i.e. 120 µg/m³. SO_2 results found at all two monitoring locations are within the PEQS limits.

Monitoring results, compared with PEQS Standards, are also graphically presented in figure below and in Summary Table 5-1 and 5-2.

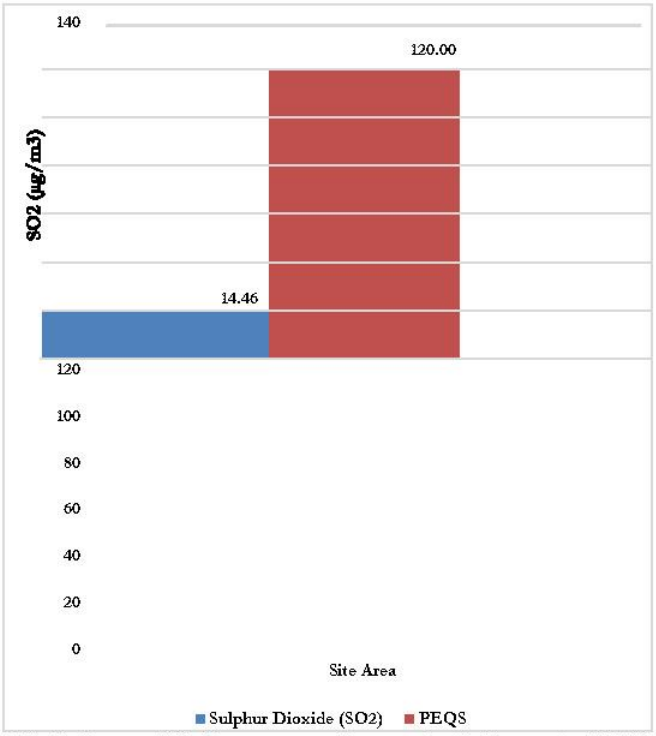

Figure 5-4: Daily Average SO_2 Measurement Compared with Respective PEQS Standards (3rd Dec. to 4th Dec.2024)

Discussion of CO Measurements

Carbon Monoxide (CO) was monitored for 24 hours at two monitoring locations. The CO values detected at monitoring locations are within the permissible limit of PEQS i.e., 5.0 mg/m^3. Monitoring results, compared with PEQS Standards, are graphically presented in figure below and in Summary Table below.

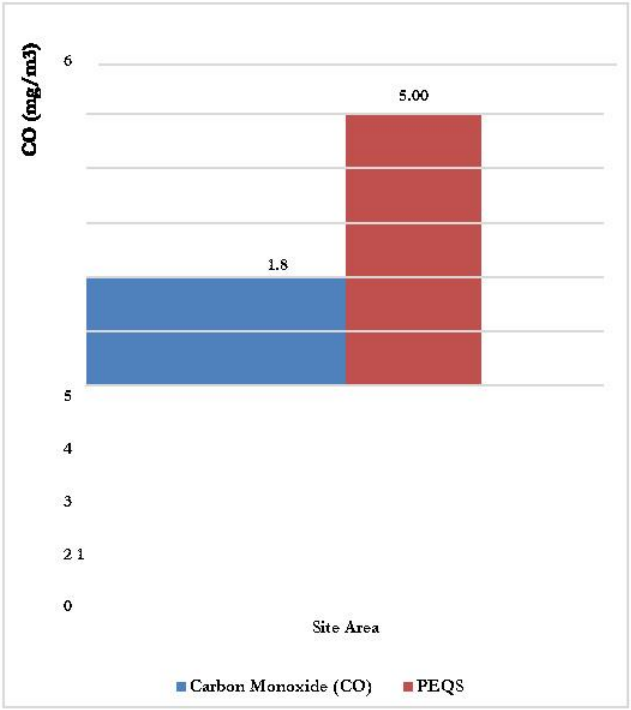

Figure 5-5: Daily Average CO Measurement Compared with Respective PEQS Standards (3rd Dec. to 4th Dec.2024)

Discussion of Lead Measurements

Lead was monitored for 24 hours at two monitoring locations. The values detected at monitoring locations are within the permissible limit of PEQS i.e., 1.50 ug/m³. Monitoring results, compared with PEQS, are graphically presented in figure below and in Summary Table 5-1.

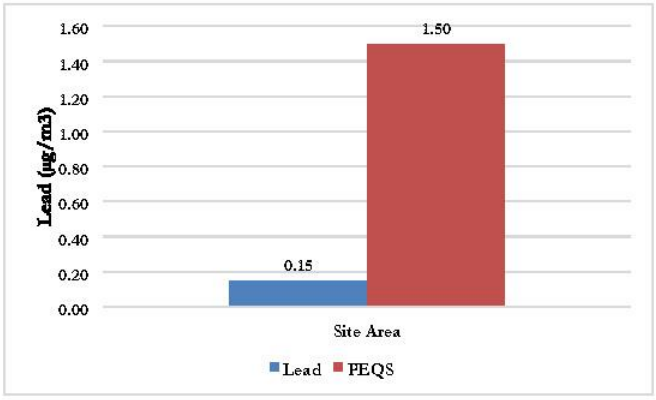

Figure 5-6: Daily Average Lead Measurement Compared with Respective PEQS Standards (3rd Dec. to 4th Dec.2024)

Discussion of Ozone (O_3) Measurements

Ozone was monitored for 24 hours at two monitoring locations. The values detected at all two monitoring locations are within the permissible limit of PEQS i.e., 130 ug/m³. Monitoring results, compared with PEQS Standards, are graphically presented in figure below and in Summary Table below.

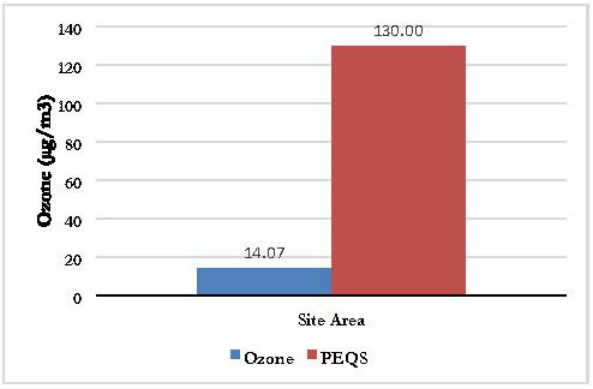

Figure 5-7: Daily Average Ozone Measurement Compared with Respective PEQS Standards (3rd Dec. to 4th Dec.2024)

Discussion on Particulate Matter (PM_{10}, $PM_{2.5}$, TSP)

The monitoring results of *PM_{10}, $PM_{2.5}$* and *TSP* for all sites are compared with Punjab Environmental Quality Standard i.e., 150 µg/m³. The values of *PM_{10}, $PM_{2.5}$* and *TSP* were found falling within the prescribed limits of PEQS Limits, except for *$PM_{2.5}$* and *PM_{10}* in CB-I Construction Site. Monitoring result, compared with PEQS Standards, is graphically presented in figure below and in Summary Table below.

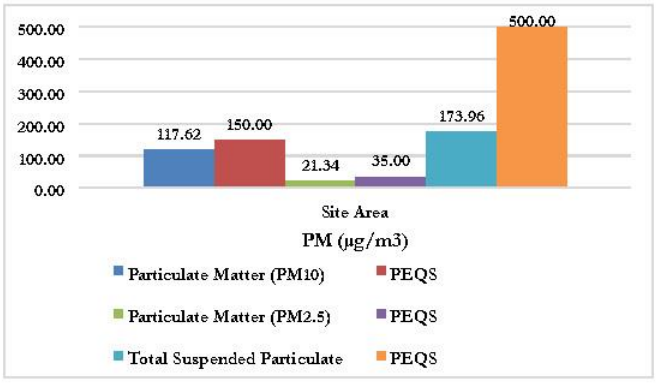

Figure 5-8: Daily Average TSP Measurements Compared with Respective PEQS Standards (3rd Dec. to 4th Dec.2024)

Table 5-1 Summary of Ambient Air Quality Monitoring Results

Location Identification	
Monitoring Site:	01
Monitoring Location:	Site Area
Date:	03-Dec-2024 to 04-Dec-2024
Coordinates:	30°15'46.9"N 71°55'07.8"E

Parameter	Unit	Monitoring Duration	LDL	Average Obtained Concentration	PEQS
				01	
Nitrogen Dioxide (NO_2)	µg/m³	24 Hours	1.00	25.22	80.0
Nitrogen oxide (NO)	µg/m³	24 Hours	1.00	20.30	40.0
NO_X	µg/m³	24 Hours	1.00	45.51	120.0
Sulphur Dioxide (SO_2)	µg/m³	24 Hours	1.00	14.46	120.0
Carbon Monoxide (CO)	mg/m³	24 Hours	0.01	1.80	5.0
Ozone (O_3)	µg/m³	24 Hours	-	14.07	130.0**
Lead	µg/m³	24 Hours	0.05	0.15	1.50
Particulate Matter (PM_{10})	µg/m³	24 Hours	1.00	117.62	150.0
Particulate Matter ($PM_{2.5}$)	µg/m³	24 Hours	1.00	21.34	35.0

Total Suspended Particulate (TSP)	µg/m³	24 Hours	1.00	173.96	500.0

Abbreviations:
LDL= Lowest Detection Limit
PEQS= Punjab Environmental Quality Standards
*(24 Hours Standard for all the parameters Except O_3 and CO)
**(1 Hour Standard for O_3)
*(24 Hours Standard for all the parameters Except O_3) **µg/m³**= Micrograms per Cubic Meter **mg/m³**= Milligrams per Cubic Meter

5.3 Drinking Water Analysis

Drinking water sample were collected from one location on 04-12-2024 which were preserved and submitted in GCEC-Laboratory according to the standard methods. Summary of Analysis Results are given below in **Table 5-3**.

Discussion on Results

The laboratory test results of drinking water samples are summarized in the table below. It is obvious from the analysis results that the drinking water meets the permissible limits of Punjab Environmental Quality Standards for all tested parameters

Reference Number: GCEC-PK-PU-320/2024

Table 5-2 Summary of Drinking Water Analysis Results

Sample Marking & Identification			
01	Masha Allah TV Shop Near Site Location	Sampling Coordinates:	30°15'47.0"N 71°55'07.5"E

Parameters	Analysis Method	Unit	LOR	Result	PEQS
				01	
PHYSICAL & CHEMICAL ANALYSIS					
pH**	APHA-4500H+ B	-	0.01	7.56	6.5-8.5
Odor	In-house	-	-	Odorless	Non-Objectionable
Taste	In-house	-	-	Sweet	Non-Objectionable
Color	APHA-2120 B/C	Pt/Co	1.0	<1.0	≤15 TCU
Turbidity**	APHA-2130 B	NTU	-	<0.1	<5 NTU
Total Hardness**	APHA-2340 B & C	mg/l	0.1	236.0	< 500 mg/l
Total Dissolved Solid (TDS)**	APHA-2540 C	mg/l	1.0	688.0	< 1000
Ammonia	APHA-4500-NH_3-B	mg/l	0.002	<0.002	-
Chloride (Cl)**	APHA-4500Cl- B	mg/l	0.24	48.92	< 250
Cyanide (CN)	APHA-4500CN E	mg/l	0.01	<0.01	≤ 0.05
Fluoride (F)**	APHA-4500F- D	mg/l	0.01	<0.01	≤ 1.5
Nitrite	APHA-4500NO2 B	mg/l	0.01	<0.01	≤ 3 (P)
Nitrate**	APHA-4500NO3 C	mg/l	0.1	<0.1	≤ 50
Phenolic Compound	APHA-5530 D	mg/l	0.01	<0.01	-
Residual Chlorine	APHA-4500Cl G	mg/l	0.1	<0.1	0.2-0.5
Aluminum (Al)	APHA-3111Al B	mg/l	0.028	<0.028	≤ 0.2
Cadmium**	APHA-3111Cd B	mg/l	0.0028	<0.0028	0.01
Copper**	APHA-3111Cu B	mg/l	0.0045	<0.0045	2
Chromium**	APHA-3111Cr B	mg/l	0.0054	<0.0054	≤ 0.05 (P)
Mercury	APHA-3112Hg B	mg/l	0.0008	<0.0008	≤ 0.001
Antimony (Sb)**	APHA-3111Sb B	mg/l	-	ND	≤ 0.005 (P)
Nickel**	APHA-3111Ni C	mg/l	0.008	<0.008	≤ 0.02
Zinc**	APHA-3111Zn B	mg/l	0.0033	<0.0033	5.0
Arsenic	APHA-3111As B	mg/l	0.01	<0.01	≤ 0.05 (P)
Barium	APHA-3111Ba B	mg/l	0.031	<0.031	0.7
Manganese**	APHA-3111Mn B	mg/l	0.0016	<0.0016	≤ 0.5
Iron**	APHA-3111Fe B	mg/l	0.1	<0.1	-
Boron	APHA-4500-B (C)	mg/l	0.1	<0.1	0.3
Lead**	APHA-3111Pb B	mg/l	0.013	<0.013	≤ 0.05
Selenium	APHA-3111Se B	mg/l	-	ND	0.01 (P)
MICROBIOLOGICAL ANALYSIS					
Total Coliforms	APHA:9222 B	CFU/100ml		Absent	0/100ml
Faecal Coliforms (Ecoli)	APHA:9222 D	CFU/100ml		Absent	0/100ml

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Abbreviations:
ND: Not Detected **LOR:** Limit of Reporting **PEQS:** Punjab Environmental Quality Standards
Note:
** Uncertainty of all the parameters and laboratory conditions at the time of analysis will be provided as per client's requirement. The lab environmental conditions are maintained at 25±5C° and humidity at 50±20%.*
Disclaimer: *The results are solely of the sample provided. **All the starred parameters are PNAC accredited.*

SECTION 6: CONCLUSION

Environmental monitoring was performed at mutually agreed sites to assess the environmental conditions of its surroundings.

The results of ambient air monitoring depict that all the tested parameters for air quality were within the permissible limits of Punjab Environmental Quality Standards.

Noise monitoring results of both sites were in compliance with the prescribed limits for commercial noise of Punjab Environmental Quality Standards.

Results of drinking water sample showed compliance with permissible limits of Punjab Environmental Quality Standards.

Reference Number: GCEC-PK-PU-320/2024

Environmental Monitoring, Sampling & Testing Analysis Reports

Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 24A/ 19681

Monitoring & Test Report

- Drinking Water
- Ambient Air
- Meteorological Data
- Noise Monitoring

GOPA Intec-Multitech Consulting Engineers (District Khanewal)

13th Dec. 2024

Job Reference No.: GCEC-PK-PU-320/2024

1 of 9

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manager.operations@gcee.ae www.gcee.pk

Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 24A/ 19682

Client Detail:	
Client Name:	Multan Electric Power Company (MEPCO)
Consultant Name:	GOPA Intec-Multitech Consulting Engineers
Project Name:	Electricity Distribution Efficiency Improvement Project (EDEIP) for the Construction of 132 kV Grid Station and 27 Km Transmission Line
Name of Contact Person:	Mr. Hassan Raza
Designation:	Managing Director
Contact Number:	0321-4553805
Email:	Hassan@mccpak.com
Address:	121J, Johar Town, Lahore, Pakistan

GCEC Details:	
Director:	Mr. Mian Khurram Usman
Telephone:	+92 42 35962885
Fax:	+92 42 35962884
Email:	manager.operations@gcee.ae
Address	House No. 368-B Block B, Canal View, Lahore

Signatories:

Green Crescent Environmental Consultants Pvt Ltd PAKISTAN

Pakistan Office: House No. 368-B , Block Canal View Housing Society, Lahore. Pakistan.
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042 35962884-85 0320 4143318
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Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 24A/ 19683

CHEMICAL ANALYSIS TEST REPORT (DRINKING WATER)

Sample Details			
Job Ref. No:	GCEC-PK-PU-320/2024	Client Name:	Multan Electric Power Company (MEPCO)
Telephone No.	0337-9820818	Consultant Name:	GOPA Intec- Multitech Consulting Engineers
Sample Date:	04-12-2024	Sample Matrix:	Drinking Water Sample
Sample Receipt Date:	05-12-2024	Sampled By:	GCEC
Grab/Composite:	Grab Sampling	Date of Completion of Analysis:	13-12-2024
Address:	121J, Johar Town, Lahore, Pakistan		
Project Name:	Electricity Distribution Efficiency Improvement Project (EDEIP) for the Construction of 132 kV Grid Station and 27 Km Transmission Line		
Sample Identification			
01	Masha Allah TV Shop Near Site Location		

Parameters	Analysis Method	Unit	LOR	Result 01	PEQS
PHYSICAL & CHEMICAL ANALYSIS					
pH**	APHA-4500H+ B	-	0.01	7.56	6.5-8.5
Odor	In-house	-	-	Odorless	Non-Objectionable
Taste	In-house	-	-	Sweet	Non-Objectionable
Color	APHA-2120 B/C	Pt/Co	1.0	<1.0	≤15 TCU
Turbidity**	APHA-2130 B	NTU	0.1	<0.1	<5 NTU
Total Hardness**	APHA-2340 B & C	mg/l	0.1	236.0	< 500 mg/l
Total Dissolved Solid (TDS)**	APHA-2540 C	mg/l	1.0	688.0	< 1000
Ammonia	APHA-4500-NH_3-B	mg/l	0.002	<0.002	-
Chloride**	APHA-4500Cl- B	mg/l	0.24	48.92	< 250
Cyanide (CN)	APHA-4500CN E	mg/l	0.01	<0.01	≤ 0.05
Fluoride (F)**	APHA-4500F- D	mg/l	0.01	<0.01	≤ 1.5
Nitrite	APHA-4500NO2 B	mg/l	0.01	<0.01	≤ 3 (P)
Nitrate**	APHA-4500NO3 C	mg/l	0.1	<0.1	≤ 50
Phenolic Compound	APHA-5530 D	mg/l	0.01	<0.01	-
Residual Chlorine	APHA-4500Cl G	mg/l	0.1	<0.1	0.2-0.5
Aluminum (Al)	APHA-3111Al B	mg/l	0.028	<0.028	≤ 0.2
Cadmium**	APHA-3111Cd B	mg/l	0.0028	<0.0028	0.01
Copper**	APHA-3111Cu B	mg/l	0.0045	<0.0045	2
Chromium**	APHA-3111Cr B	mg/l	0.0054	<0.0054	≤ 0.05 (P)
Mercury	APHA-3112Hg B	mg/l	0.0008	<0.0008	≤ 0.001
Antimony (Sb)**	APHA-3111Sb B	mg/l	-	ND	≤ 0.005 (P)
Nickel**	APHA-3111Ni C	mg/l	0.008	<0.008	≤ 0.02
Zinc**	APHA-3111Zn B	mg/l	0.0033	<0.0033	5.0
Arsenic	APHA-3111As B	mg/l	0.01	<0.01	≤ 0.05 (P)
Barium	APHA-3111Ba B	mg/l	0.031	<0.031	0.7
Manganese**	APHA-3111Mn B	mg/l	0.0016	<0.0016	≤ 0.5
Iron**	APHA-3111Fe B	mg/l	0.1	<0.1	-
Boron	APHA-4500-B (C)	mg/l	0.1	<0.1	0.3
Lead**	APHA-3111Pb B	mg/l	0.013	<0.013	≤ 0.05
Selenium	APHA-3111Se B	mg/l	-	ND	0.01 (P)
MICROBIOLOGICAL ANALYSIS					
Total Coliforms	APHA:9222 B	CFU/100ml		Absent	0/100ml
Faecal Coliforms (Ecoli)	APHA:9222 D	CFU/100ml		Absent	0/100ml

Abbreviations:
ND: Not Detected LOR: Limit of Reporting PEQS: Punjab Environmental Quality Standards

Note:
*Uncertainty of all the parameters and laboratory conditions at the time of analysis will be provided as per client's requirement. The lab environmental conditions are maintained at 25±5C° and humidity at 50±20%. **Disclaimer:** The results are solely of the sample provided. **All the starred parameters are PNAC accredited.

Sample Analyzed By:

Mr. Idrees Zaman

Name of Chief Analyst with Seal:

Mr. Usman Raza Jaswal

Green Crescent Environmental Consultants (Pvt) Ltd. PAKISTAN

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Sr. No# 24A/ 19684

Ambient Air Monitoring Location

SITE AREA

(Khanewal)

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Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 24A/ 19685

Ambient Air Quality Monitoring

Job Reference Number	GCEC-PK-PU-320/2024
Monitoring Point	Site Area
Date of Intervention	03-Dec-2024 to 04-Dec-2024
Monitoring Coordinates	30°15'46.9"N 71°55'07.8"E

Sr. #	Time	CO (mg/m³)	NO (µg/m³)	NO_2 (µg/m³)	NO_x (µg/m³)	SO_2 (µg/m³)
1.	16:13	2.54	23.74	29.64	53.38	14.46
2.	17:13	2.30	23.40	24.89	48.29	14.12
3.	18:13	2.32	21.74	23.87	45.60	14.08
4.	19:13	2.26	22.28	27.15	49.43	13.24
5.	20:13	2.22	23.09	25.46	48.55	14.81
6.	21:13	2.25	21.87	24.52	46.39	12.76
7.	22:13	2.21	23.05	24.85	47.89	13.49
8.	23:13	2.20	21.60	26.43	48.03	13.71
9.	00:13	1.23	20.17	25.19	45.36	14.99
10.	01:13	1.28	18.64	26.55	45.19	12.71
11.	02:13	1.21	19.92	25.26	45.17	12.55
12.	03:13	1.29	19.40	23.62	43.02	14.77
13.	04:13	1.18	18.69	22.17	40.86	14.46
14.	05:13	1.24	19.51	22.62	42.13	13.13
15.	06:13	2.18	18.90	24.58	43.48	15.51
16.	07:13	2.19	17.66	25.99	43.65	14.57
17.	08:13	2.16	18.60	24.53	43.13	16.99
18.	09:13	2.25	19.41	23.00	42.41	17.26
19.	10:13	2.30	18.63	25.61	44.24	14.05
20.	11:13	1.24	20.15	25.06	45.21	14.75
21.	12:13	1.28	20.34	25.74	46.09	15.37
22.	13:13	1.22	19.79	27.27	47.06	13.81
23.	14:13	1.28	18.22	25.00	43.22	15.16
24.	15:13	1.38	18.31	26.25	44.56	16.28
Average Concentration		1.80	20.30	25.22	45.51	14.46

Monitoring Performed By:
Deputy Analyst
Muhammad Ilyas

Name of Chief Analyst with Seal:
Mr. Usman Raza Jaswal

Green Crescent Environmental Consultants Ltd. * PAKISTAN *

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Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 24A/ 19686

Ambient Air Quality Monitoring

Job Reference Number	GCEC-PK-PU-320/2024
Monitoring Point	Site Area
Date of Intervention	03-Dec-2024 to 04-Dec-2024
Monitoring Coordinates	30°15'46.9"N 71°55'07.8"E

Parameter	Unit	Monitoring Duration	LDL	Average Obtained Concentration	PEQS
Nitrogen Dioxide (NO_2)	µg/m³	24 Hours	1.00	25.22	80.0
Nitrogen Oxide (NO)	µg/m³	24 Hours	1.00	20.30	40.0
NO_x	µg/m³	24 Hours	1.00	45.51	120.0
Sulphur Dioxide (SO_2)	µg/m³	24 Hours	1.00	14.46	120.0
Carbon Monoxide (CO)	mg/m³	24 Hours	0.01	1.80	5.0*
Ozone (O_3)	µg/m³	24 Hours	-	14.07	130.0**
Particulate Matter ($PM_{2.5}$)	µg/m³	24 Hours	1.00	21.34	35.0
Particulate Matter (PM_{10})	µg/m³	24 Hours	1.00	117.62	150.0
Suspended Particulate Matter (SPM)	µg/m³	24 Hours	1.00	173.96	500.0
Lead Airborne Particles	µg/m³	24 Hours	-	0.15	1.5

Abbreviations:
µg/m³= Micrograms per Cubic Meter
mg/m³= Milligrams per Cubic Meter
LDL= Lowest Detection Limit
PEQS= Punjab Environmental Quality Standards
*08 hour standard for CO
**01 hour standard for O_3

Monitoring Performed By:
Deputy Analyst
Muhammad Ilyas

Name of Chief Analyst with Seal:
Mr. Usman Raza Jaswal

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Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 24A/ 19687

Meteorological Data

Job Reference Number	GCEC-PK-PU-320/2024
Monitoring Point	Site Area
Date of Intervention	03-Dec-2024 to 04-Dec-2024
Monitoring Coordinates	30°15'46.9"N 71°55'07.8"E

Time	Ambient Temperature °C	Wind Direction	Wind Velocity m/s	Humidity %	Pressure (mm of Hg)
16:13	23	NW	8.6	60	757.8
17:13	23	NW	6.7	63	758.5
18:13	21	N	6.5	70	757.2
19:13	19	N	6.7	77	757.3
20:13	18	N	8.5	82	759.0
21:13	17	N	8.9	82	757.4
22:13	16	N	8.8	84	758.2
23:13	16	NE	8.7	86	759.4
00:13	15	NE	8.2	86	757.7
01:13	14	NE	8.6	84	758.0
02:13	14	NE	6.5	86	757.8
03:13	13	NE	6.9	86	756.7
04:13	13	N	6.2	86	755.6
05:13	13	N	6.8	85	757.6
06:13	12	N	6.7	85	757.6
07:13	12	N	6.5	85	757.3
08:13	12	N	6.7	87	756.6
09:13	14	N	7.0	77	756.4
10:13	17	N	6.6	63	758.6
11:13	19	NW	6.5	53	757.6
12:13	22	NW	7.0	43	759.0
13:13	23	NW	6.6	38	757.6
14:13	23	NW	6.3	37	757.6
15:13	23	NW	5.4	37	759.0

Monitoring Performed By:
Deputy Analyst
Muhammad Ilyas

Name of Chief Analyst with Seal:
Mr. Usman Raza Jaswal

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Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 24A/ 19688

Noise Level Monitoring Report

Job Reference Number	GCEC-PK-PU-320/2024
Monitoring Point	Site Area
Date of Intervention	03-Dec-2024 to 04-Dec-2024
Monitoring Coordinates	30°15'46.9"N 71°55'07.8"E

Sr. #	Time	Method/Technique	Unit	Results LAavg	PEQS (Commercial)
		Night Time			
1.	23:13	Noise Meter	dB	51.3	
2.	00:13	Noise Meter	dB	52.1	
3.	01:13	Noise Meter	dB	48.3	
4.	02:13	Noise Meter	dB	53.4	
5.	03:13	Noise Meter	dB	49.8	55.0
6.	04:13	Noise Meter	dB	48.1	
7.	05:13	Noise Meter	dB	52.0	
8.	06:13	Noise Meter	dB	50.3	
	Night Time Average		dB	50.66	55.0
		Day Time			
9.	07:13	Noise Meter	dB	54.3	
10.	08:13	Noise Meter	dB	56.0	
11.	09:13	Noise Meter	dB	56.1	
12.	10:13	Noise Meter	dB	56.4	
13.	11:13	Noise Meter	dB	54.7	
14.	12:13	Noise Meter	dB	53.6	
15.	13:13	Noise Meter	dB	53.5	
16.	14:13	Noise Meter	dB	53.0	
17.	15:13	Noise Meter	dB	51.8	65.0
18.	16:13	Noise Meter	dB	56.5	
19.	17:13	Noise Meter	dB	57.9	
20.	18:13	Noise Meter	dB	57.5	
21.	19:13	Noise Meter	dB	56.6	
22.	20:13	Noise Meter	dB	55.9	
23.	21:13	Noise Meter	dB	56.8	
24.	22:13	Noise Meter	dB	54.9	
	Day Time Average		dB	55.34	65.0

Monitoring Performed By:
Deputy Analyst
Muhammad Ilyas

Name of Chief Analyst with Seal:
Mr. Usman Raza Jaswal

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Pictorial Evidence for Drinking Water Sampling & Ambient Air Monitoring

Figure 1: Drinking Water Sampling from Masha Allah TV Shop Near Site Location

Figure 2: Ambient Air Monitoring of Site Area

End of Report

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Validation for Stack & Ambient Monitoring / Sampling

Emission Monitoring under CTM-34 or OTM-39		
Facility Name & Address Phone: Electricity Distribution Efficiency Improvement Project for the construction of 132 KV grid station and 27Km Transmis... Chak No. 167/10-R Near District Jail Khanewal	No of Stacks /Sampling Point AA=01	
Industry Category		
Analyzer Model & Make: Horiba-370 (AQMS)		
Average stack emission Values of CO, NOx (in mg/nM3)		
Excess Air / Excess Oxygen (%age):-		
Analyzer exposed for Ramp-Up phase to the sample gas for 5 minutes	Yes	NO
Analyzer flow rate and EC temperature monitored during calibration and testing	Yes	No
Test Data Phase of sample gas recorded with 15 second interval	Yes	No
All key requirements to ensure QA/QC complied for said EPA approved Method	Yes	No
Particulate Matter (PM) Monitoring / Sampling under USEPA Method 5 / 17		
Model & Make of Iso-kinetic PM Assembly		
The PM sampling train is complete as per Method 5 & 17	Yes	No
Leak Test performed prior to sampling	Yes	No
Field data Sheet for PM Sampling filled during PM sampling	Yes	No
Data for determining of "K" factor & DGM "Y" Factor filled during sampling	Yes	No
All method key requirements during sampling were compiled to ensure QA/QC	Yes	No
Filter of Particulate matter is suitable for metal Testing	Yes	No
SOx sampling as per Method 8 (Thorin Indicator Method)		
The right absorbent solution are available for SOx Sampling	Yes	No
The equipment is capable to maintain flow rate @ 2.0LPM or as per method 8 requirement	Yes	No
Sampling for SOx is performed as per method	Yes	No
Ambient Air Quality Monitoring by Automatic Monitors for CO, O3, SO2, NOx, PM2.5 & PM1...		
In case of continuous monitoring at a site, One Point QC Check Single analyzer & Zero/span check is performed every 14 days.	Yes	No
The CE of NOx analyzer is ensured to be maintained within 96% - 104.1%	Yes ✓	No
Zero/span check is performed prior to starting ambient monitoring	Yes ✓	No
All key requirements for Critical & Operational Criteria for ambient air monitoring by automatic monitors were compiled during monitoring	Yes ✓	No
The measuring techniques of monitors comply PEQS	Yes ✓	No
Ambient Air Sampling of SPM, PM10, Pb by High Volume Sampler		
In case of Sampling for SPM through samplers, the flow rate of sampler comply PEQS (1.1m3/min).	Yes ✓	No
Calibration of Sampler performed prior to sampling	Yes ✓	No
Vehicular Emissions & Noise Measurement		
Sampling of Vehicle emissions and noise measurement have been performed as per method and SOPs	Yes ✓	No

Remarks (if Any):-

Visit verified

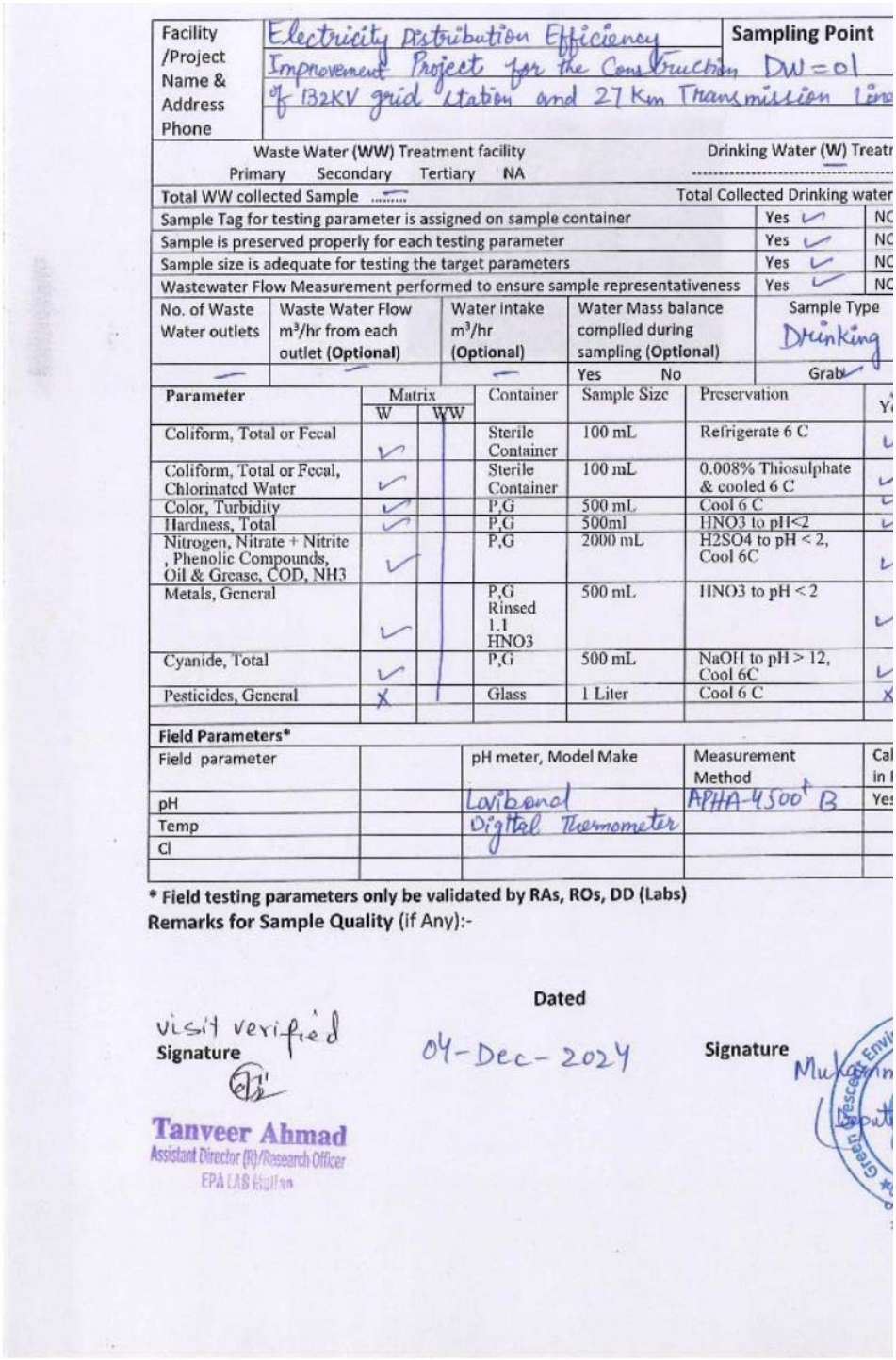
Signature

Dated 03-04 Dec, 2024

Signature Muhammad ... (Deputy ...)

Tanveer Ahmad
Assistant Director (R)/Research Officer
EPA LAB Multan

Green Crescent Environm...



Facility /Project Name & Address Phone	Electricity Distribution Efficiency Improvement Project for the Construction of 132KV grid station and 27 Km Transmission Line	Sampling Point DW=01

Waste Water (WW) Treatment facility — Primary Secondary Tertiary NA

Drinking Water (W) Treatr

Total WW collected Sample .....

Total Collected Drinking water

Sample Tag for testing parameter is assigned on sample container	Yes ✓	NO
Sample is preserved properly for each testing parameter	Yes ✓	NO
Sample size is adequate for testing the target parameters	Yes ✓	NO
Wastewater Flow Measurement performed to ensure sample representativeness	Yes ✓	NO

No. of Waste Water outlets	Waste Water Flow m^3/hr from each outlet (Optional)	Water intake m^3/hr (Optional)	Water Mass balance complied during sampling (Optional)	Sample Type
—	—	—	Yes No	Drinking / Grab ✓

Parameter	Matrix W	Matrix WW	Container	Sample Size	Preservation	Y
Coliform, Total or Fecal	✓		Sterile Container	100 mL	Refrigerate 6 C	✓
Coliform, Total or Fecal, Chlorinated Water	✓		Sterile Container	100 mL	0.008% Thiosulphate & cooled 6 C	✓
Color, Turbidity	✓		P,G	500 mL	Cool 6 C	✓
Hardness, Total	✓		P,G	500ml	HNO3 to pH<2	✓
Nitrogen, Nitrate + Nitrite , Phenolic Compounds, Oil & Grease, COD, NH3	✓		P,G	2000 mL	H2SO4 to pH < 2, Cool 6C	✓
Metals, General	✓		P,G Rinsed 1.1 HNO3	500 mL	HNO3 to pH < 2	✓
Cyanide, Total	✓		P,G	500 mL	NaOH to pH > 12, Cool 6C	✓
Pesticides, General	X		Glass	1 Liter	Cool 6 C	X

Field Parameters*

Field parameter		pH meter, Model Make	Measurement Method	Cal in I
pH		Lovibond	APHA-4500+ B	Yes
Temp		Digital Thermometer		
Cl				

*** Field testing parameters only be validated by RAs, ROs, DD (Labs)**

Remarks for Sample Quality (if Any):-

visit verified

Dated 04-Dec-2024

Signature

Tanveer Ahmad
Assistant Director (R)/Research Officer
EPA LAB Multan

Signature

ENVIRONMENTAL MONITORING, SAMPLING AND TESTING REPORT

FOR

Electricity Distribution Efficiency Improvement Project (EDEIP) for the Construction of 132 kV Grid Station and 27 Km Transmission Line

(District Layyah)

MULTITECH CONSULTING ENGINEERS

Prepared by: Green Crescent Environmental Consultants Pvt. Ltd

Reference Number: GCEC-PK-PU-320/2024

Contact Details of Client	
Client Name	Multan Electric Power Company (MEPCO)
Consultant Name	GOPA Intec-Multitech Consulting Engineers
Project Name	Electricity Distribution Efficiency Improvement Project (EDEIP) for the Construction of 132 kV Grid Station and 27 Km Transmission Line
Contact Person	Mr. Hassan Raza
Designation	Managing Director
Contact Number	0321-4553805
Email ID	Hassan@mcepak.com
Address	121J, Johar Town, Lahore, Pakistan
Contact Details of GCEC-Pakistan	
Director:	Mr. Mian Khurram Usman
Telephone:	+92 42 35962885
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Address	House No. 368-B Block B, Canal View, Lahore

Approved By:

Zara Yousaf
Coordination Department

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LIST OF ABBREVIATIONS

AA	Ambient Air
DW	Drinking Water
SPL	Sound Pressure Level
dB	Decibels
mg/m3	Milligram per Cubic meter
mg/l	Milligram per Liter
µg/m³	Micrograms per Cubic Meter
CO	Carbon Monoxide
SO_2	Sulfur Dioxide
NOx	Oxides of nitrogen
O_2	Oxygen
SPM	Suspended Particulate Matter
LDL	Lowest Detection Limit
PEQS	Punjab Environmental Quality Standards
LOR	Limit of Reporting
PM	Particulate Matter
SOPs	Standard Operating Procedures
TSS	Total Suspended Solids
APHA	American Public Health Association

SECTION 1: OBJECTIVES & SCOPE

1.1 STUDY OBJECTIVES

Followings were the main objectives of the study:

- To assess the current conditions of the environment in the surroundings of project area.
- To help the consultant and contractor to develop the strategies for the protection and betterment of environment.

1.2 SCOPE OF SERVICES

Scope of services covered following main components:

- Ambient Air Quality Monitoring
- Noise Level Monitoring
- Drinking Water Sampling & Analysis

MONITORING TEAM

Monitoring team of Green Crescent Environmental Consultants involved in the monitoring and sampling is given in below table:

Table 1-1 Monitoring Team

Sr. No.	Name of The Employee	Designation
1.	Muhammad Ilyas Durrani	Executive Field Officer

SECTION 2: ENVIRONMENTAL MONITORING, SAMPLING & TESTING SCHEDULE

Detailed Environmental monitoring was conducted at the mutually agreed sites of project area. The monitoring and sampling was conducted from 4th Dec to 5th Dec. 2024.

Table 2-1 Environmental Monitoring, Sampling & Testing Schedule

Sr. #	Intervention Date	Activity	Monitoring Location
1.	04-12-2024 to 05-12-2024	• Ambient Air Quality Monitoring • Meteorological Monitoring	Site Area
2.	05-12-2024	Drinking Water	Water Pump Near Site Location

SECTION 3: ENVIRONMENTAL MONITORING, SAMPLING & TESTING LOCATIONS

Environmental monitoring, sampling & testing locations are as per shown in the following figure.

Figure 3-1: Map Showing Ambient Air Monitoring Locations (4th Dec. to 5th Dec.2024)

Figure 3-2: Map Showing Drinking Water Sampling Location (5th Dec. 2024)

SECTION 4: ENVIRONMENTAL MONITORING, SAMPLING & TESTING METHODOLOGY

Following is a brief description of the methodology adopted for this Environmental Monitoring, Sampling & Testing including Ambient Air, Metrological Data, Noise and Water Analysis:

4.1 Onsite Monitoring

Among the environmental parameters selected by the client;

- Ambient Air
- Temperature and pH of water samples

Were monitored onsite. Ambient air monitoring including metrological monitoring and noise level monitoring was conducted using portable digital instruments while temperature and pH of the water samples were monitored manually using thermometer and pH strips. A brief description of each digital instrument used for onsite monitoring is given below;

4.1.1 Vantage Pro2, Davis

The Davis 6152 Wireless Vantage Pro2 Weather Station which was made in 2018 in America which consists of a console unit and an innovative integrated sensor suite that includes a rain collector with self-emptying bucket, temperature and humidity sensors and an anemometer. The sensor suite is housed inside a radiation shield, protecting the sensors against solar radiation and additional sources of reflected and/or radiated heat. It provides accurate weather data in a sophisticated yet easy-to-read format. With Wireless Vantage Pro2 Weather Station we can continuously measure metrological parameters including;

- Temperature
- Wind Direction
- Wind Velocity
- Humidity

- Atmospheric Pressure

Davis wireless weather station Vintage Pro2 was used for the assessment of these parameters according to standard operating procedures and obtained results are presented in **Annex-1** of this report.

Figure 4-1: View of Davis Vintage Pro at Site

4.1.2 Dust Trak II Aerosol Monitor 8530, TSI

The Dust Trak II Aerosol Monitor 8530 is a desktop battery-operated, data-logging, light-scattering laser photometer which was manufactured in 2014, that gives you realtime aerosol mass readings.

It uses a sheath air system that isolates the aerosol in the optics chamber to keep the optics clean for improved reliability and low maintenance. Using this instrument, particulate matter was monitored including;

- PM_{10}
- $PM_{2.5}$
- TSP

Figure 4-2: DustTrak II aerosol monitor 8530

4.1.3 Model 407730 Digital Sound Level Meter, Extech

It is a noise measuring instrument used to assess sound levels by measuring sound pressure. Often referred to as a sound pressure level (SPL) meter, decibel (dB) meter, noise meter or noise dosimeter, a sound level meter uses a microphone to capture sound. The sound is then evaluated within the device and acoustic measurement values are displayed. The most common unit of acoustic measurement for sound is the decibel (dBA). Hourly noise level monitoring was done for 24 hours at each point of selected location. Digital Sound meter was manufactured in 2014.

Noise level using portable digital sound meter was monitored at client's mutually agreed monitoring points. Noise level measurement was performed according to standard operating procedures and obtained results are presented in **Annex-1** of this report.

Figure 4-3: View of Digital Sound Level Meter

4.1.4 HORIBA

HORIBA, was manufactured in 2017, a Japanese brand which consists of ambient air analyzers and sampling systems for the measurement of regulatory pollutants and air quality control. It offers complete tailored or individual air quality monitoring solutions, in order to meet the requirements and regulatory needs of environmental monitoring.

4.1.4.1 AC32M. NITROGEN OXIDES ANALYZER (NO, NOX, NO2)

Chemiluminescence technology based, TÜV & US EPA approved. It is single chambered chemiluminescence technology with ultra-compact and lightweight – rackable 19"/3U. On board web server compatible with any internet browser and user interface with online help for the display, configuration, maintenance, diagnostics or software updating of the analyzer, remotely. It is capable to detect low levels of nitrogen oxides (NO-NO_2-NO_X) with standard ranges: 0-0.1/0.2/0.5/1.0 ppm

4.1.4.2 AF22E. NEW E-SERIES SO2 ANALYZER

UV Fluorescent sulfur dioxide analyzer AF22e, TUV certified and US-EPA approved for compliance with ISO 10498, 2008/50/EC, en 14212, EN 15267, 40 CFR part 53 SUB B and SUB C.

It is a light weight eco-friendly & eco-innovative conception unit which detects early signs of trouble, allows predictive maintenance, identifies the service needed and guides the service operations step by step.

It provides real-time calibration graph, animated synoptic, auto-diagnostic, control and maintenance data screens can be displayed while the instrument is operating. It provides superior metrological presentations for SO_2 measurements in the range as low as 0.05 ppm F.S.

4.1.4.3 CO12E. NEW E-SERIES CO ANALYZER

Non dispersive Infra-Red carbon monoxide analyzer CO12e, TUV certified and US-EPA approved for compliance with ISO 4224, EN 14626, EN 15267, 40 CFR part 53 SUB B and SUB C.

It is a light weight eco-friendly & eco-innovative conception unit with breakthrough mechanical design for weight and power saving as well as thermal insulation & reliability. It has automatic or programmable response time adjustment, ensuring efficient monitoring of low concentration levels of carbon monoxide. It provides superior metrological presentations for CO measurements in the range 0-100 ppm.

4.2 Water Sample Collection and Preservation

Water samples were collected from mutually agreed sampling points according to the SOPs based on American Public Health Association (APHA) for water sampling and analysis. Decontaminated Plastic bottles were used to collect the samples. To prevent air bubbles from being trapped in the bottles, they were filled to the brim. The lids of the sampling bottles were then replaced tightly. The bottles were then labeled and chain of custody forms were filled out and signed to keep track of the collected samples. Collected samples were then preserved in appropriate containers as per APHA Preservation Guidelines. A shipping container containing ice packs with maintained temperature was used for transporting the samples from sampling location to GCEC Lahore Branch for testing.

4.2.1 Drinking Water Sampling & Analysis

Sampling for drinking water was carried out at mutually agreed sampling points. Physical and chemical parameters were analyzed afterwards in GCEC labs for drinking water sample. Analytical methods used during the laboratory testing were in line with the American Public Health Association's Standard Methods for the Examination of Water.

Analysis Results are presented in **Annex 1** of this report.

4.3 Sample Tagging and Chain of Custody

In GCEC Lahore Branch, samples and chain of custody form were handed over by Field Monitoring Staff to the Coordination Staff for in-house tagging and logging according to the company's policy and handed over to the Laboratory Staff for further physical, chemical and microbiological testing. A brief description of each sampling type and further proceedings are also discussed in following section.

SECTION 5: RESULTS & DISCUSSIONS

This section of the report presents the Environmental testing results of noise-level monitoring, ambient air quality & drinking water analysis

5.1 Background Noise Level Monitoring

The Noise monitoring activity was carried at different locations. Monitoring schedule is presented in Table 2-1. While a brief description of monitoring session is as below.

Hourly noise monitoring was conducted at four selected locations. The results of monitoring locations were compared with commercial noise standards for Punjab Environmental Quality Standards i.e., 65.0 dB (A) for Day Time and 55.0 dB (A) for Night Time.

Discussion on Noise Results

Noise level Monitoring was conducted for 24 hours at four monitoring locations. The monitoring results obtained are not complying with the commercial noise standards of PEQS. Day and Night Time averages for monitoring points are presented in figures below.

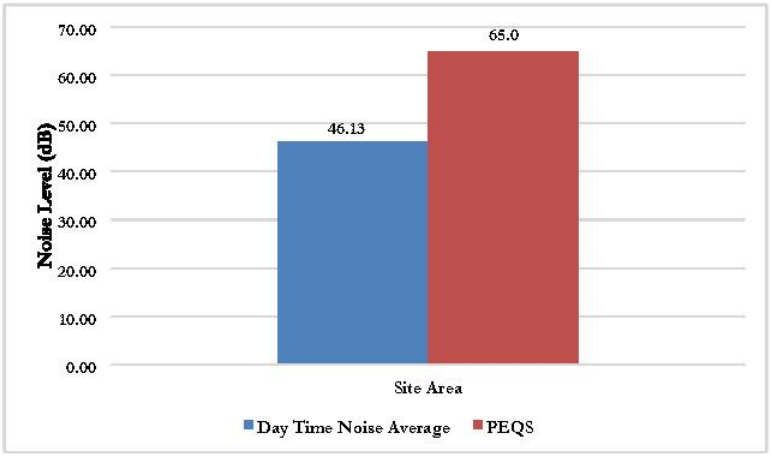

Figure 5-1: Day Time Average Noise Level Value Compared with Respective PEQS Standards

(4th Dec. to 5th Dec.2024)

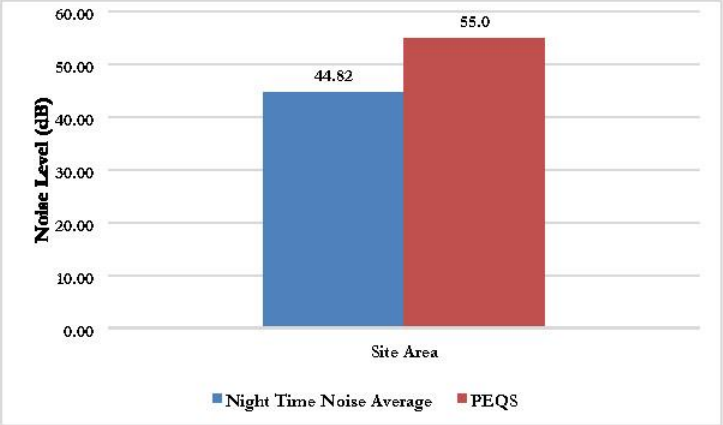

Figure 5-2: Night Time Average Noise Level Value Compared with Respective PEQS Standards (4th Dec. to 5th Dec.2024)

5.2 Ambient Air Quality Monitoring

The activity for monitoring the ambient air conditions was carried out at the agreed sites and its vicinity, for 24 hours at two monitoring locations starting from **(4th Dec. to 5th Dec.2024).** To assess the current quality of ambient air, Carbon Monoxide, Oxides of Nitrogen, Sulphur Dioxide, Ozone, Lead and Particulate Matter were monitored. Summary of monitoring results is presented in Table 5-1. Detailed result reports are also attached as **Annex 1**.

Discussion of NOx Measurements

The readings of NO, NO_2 and NOx for the project site and its surroundings comply with the Punjab Environmental Quality Standards i.e, 40 µg/m³, 80 µg/m³ and 120 µg/m³ respectively. Sum of NO and NO_2 is termed as NOx. NOx results found at the monitoring

location were within the PEQS limits. Monitoring results, compared with PEQS Standards, are graphically presented in figure below and in Summary Table below.

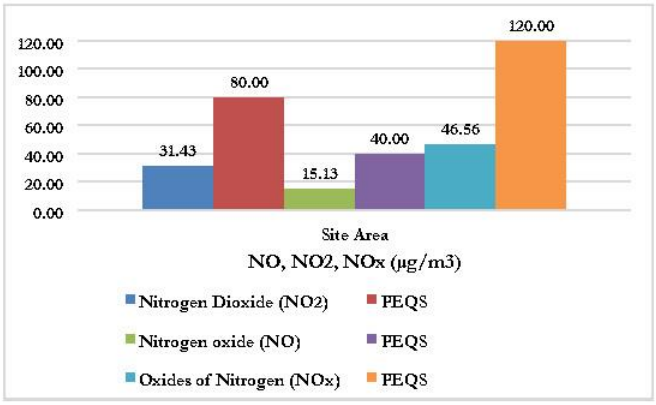

Figure 5-3: Daily Average NOx Measurements Compared with Respective PEQS Standards (4th Dec. to 5th Dec.2024)

Discussion of SO_2 Measurements

The SO_2 reading for both monitoring locations is presented in the summary table which depicts that the monitoring results are within the prescribed limits of PEQS i.e. 120 µg/m³. SO_2 results found at all two monitoring locations are within the PEQS limits.

Monitoring results, compared with PEQS Standards, are also graphically presented in figure below and in Summary Table 5-1 and 5-2.

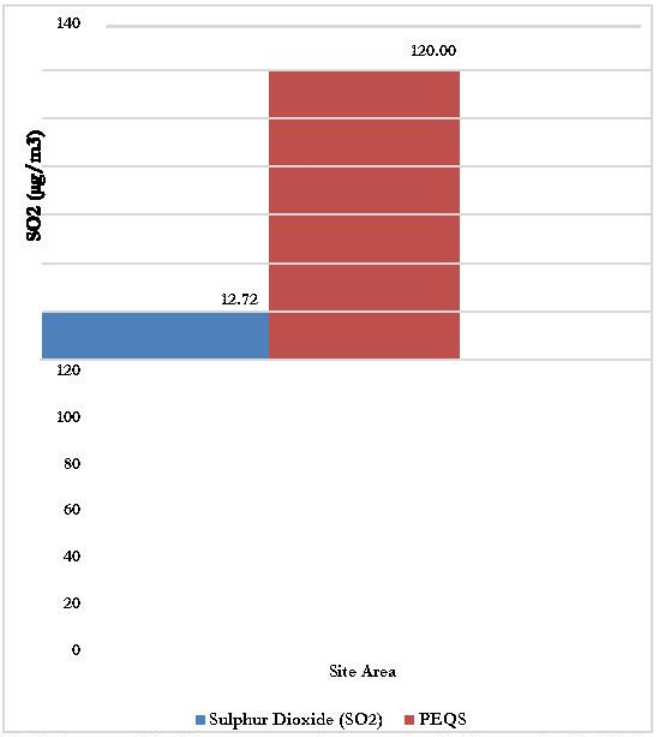

Figure 5-4: Daily Average SO_2 Measurement Compared with Respective PEQS Standards (4th Dec. to 5th Dec.2024)

Discussion of CO Measurements

Carbon Monoxide (CO) was monitored for 24 hours at two monitoring locations. The CO values detected at monitoring locations are within the permissible limit of PEQS i.e., 5.0 mg/m³. Monitoring results, compared with PEQS Standards, are graphically presented in figure below and in Summary Table below.

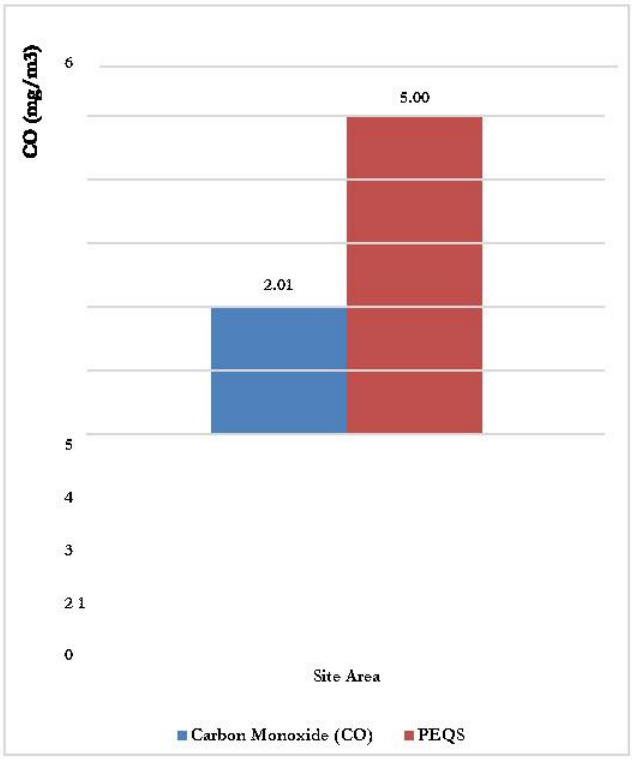

Figure 5-5: Daily Average CO Measurement Compared with Respective PEQS Standards (4th Dec. to 5th Dec.2024)

Discussion of Lead Measurements

Lead was monitored for 24 hours at two monitoring locations. The values detected at monitoring locations are within the permissible limit of PEQS i.e., 1.50 ug/m³. Monitoring results, compared with PEQS, are graphically presented in figure below and in Summary Table 5-1.

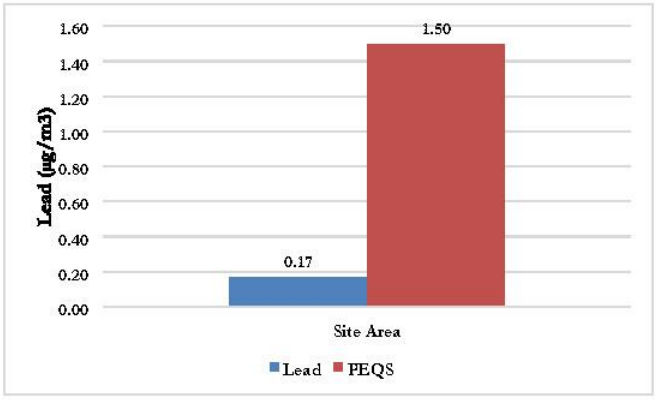

Figure 5-6: Daily Average Lead Measurement Compared with Respective PEQS Standards (4th Dec. to 5th Dec.2024)

Discussion of Ozone (O_3) Measurements

Ozone was monitored for 24 hours at two monitoring locations. The values detected at all two monitoring locations are within the permissible limit of PEQS i.e., 130 ug/m³. Monitoring results, compared with PEQS Standards, are graphically presented in figure below and in Summary Table below.

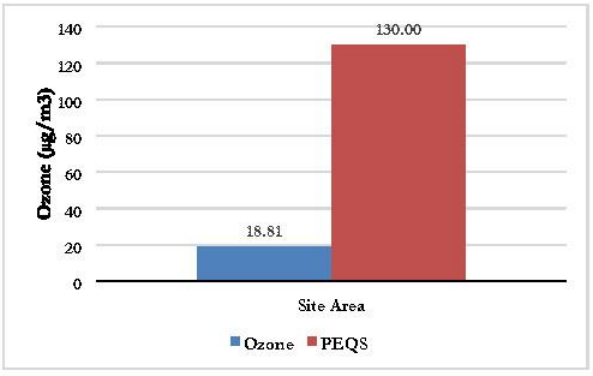

Figure 5-7: Daily Average Ozone Measurement Compared with Respective PEQS Standards (4th Dec. to 5th Dec.2024)

Discussion on Particulate Matter (PM_{10}, $PM_{2.5}$, TSP)

The monitoring results of *PM_{10}, $PM_{2.5}$* and *TSP* for all sites are compared with Punjab Environmental Quality Standard i.e., 150 µg/m³. The values of *PM_{10}, $PM_{2.5}$* and *TSP* were found falling within the prescribed limits of PEQS Limits, except for *$PM_{2.5}$* and *PM_{10}* in CB-I Construction Site. Monitoring result, compared with PEQS Standards, is graphically presented in figure below and in Summary Table below.

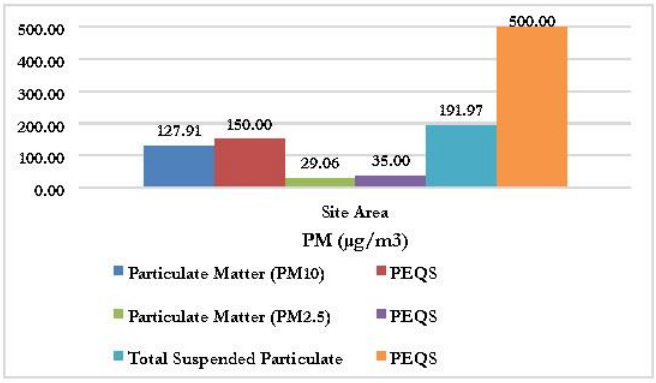

Figure 5-8: Daily Average TSP Measurements Compared with Respective PEQS Standards (4th Dec. to 5th Dec.2024)

Table 5-1 Summary of Ambient Air Quality Monitoring Results

Location Identification	
Monitoring Site:	01
Monitoring Location:	Site Area
Date:	04-Dec-2024 to 05-Dec-2024
Coordinates:	30°57'27.1"N 70°58'56.6"E

Parameter	Unit	Monitoring Duration	LDL	Average Obtained Concentration	PEQS
				01	
Nitrogen Dioxide (NO_2)	µg/m³	24 Hours	1.00	31.43	80.0
Nitrogen oxide (NO)	µg/m³	24 Hours	1.00	15.13	40.0
NO_X	µg/m³	24 Hours	1.00	46.56	120.0
Sulphur Dioxide (SO_2)	µg/m³	24 Hours	1.00	12.72	120.0
Carbon Monoxide (CO)	mg/m³	24 Hours	0.01	2.01	5.0
Ozone (O_3)	µg/m³	24 Hours	-	18.81	130.0**
Lead	µg/m³	24 Hours	0.05	0.17	1.50
Particulate Matter (PM_{10})	µg/m³	24 Hours	1.00	127.91	150.0
Particulate Matter ($PM_{2.5}$)	µg/m³	24 Hours	1.00	29.06	35.0

Total Suspended Particulate (TSP)	µg/m³	24 Hours	1.00	191.97	500.0

Abbreviations:
LDL= Lowest Detection Limit
PEQS= Punjab Environmental Quality Standards
*(24 Hours Standard for all the parameters Except O_3 and CO)
**(1 Hour Standard for O_3)
*(24 Hours Standard for all the parameters Except O_3) **µg/m³**= Micrograms per Cubic Meter **mg/m³**= Milligrams per Cubic Meter

5.3 Drinking Water Analysis

Drinking water sample were collected from one location on 05-12-2024 which were preserved and submitted in GCEC-Laboratory according to the standard methods. Summary of Analysis Results are given below in **Table 5-3**.

Discussion on Results

The laboratory test results of drinking water samples are summarized in the table below. It is obvious from the analysis results that the drinking water meets the permissible limits of Punjab Environmental Quality Standards for all tested parameters

Reference Number: GCEC-PK-PU-320/2024

Table 5-2 Summary of Drinking Water Analysis Results

Sample Marking & Identification			
01	Water Pump Near Site Location	Sampling Coordinates:	30°57'27.1"N 70°58'56.6"E

Parameters	Analysis Method	Unit	LOR	Result	PEQS
				01	
PHYSICAL & CHEMICAL ANALYSIS					
pH**	APHA-4500H+ B	-	0.01	7.10	6.5-8.5
Odor	In-house	-	-	Odorless	Non-Objectionable
Taste	In-house	-	-	Sweet	Non-Objectionable
Color	APHA-2120 B/C	Pt/Co	1.0	<1.0	≤15 TCU
Turbidity**	APHA-2130 B	NTU	-	<0.1	<5 NTU
Total Hardness**	APHA-2340 B & C	mg/l	0.1	388.0	< 500 mg/l
Total Dissolved Solid (TDS)**	APHA-2540 C	mg/l	1.0	977.0	< 1000
Ammonia	APHA-4500-NH_3-B	mg/l	0.002	<0.002	-
Chloride (Cl)**	APHA-4500Cl- B	mg/l	0.24	78.27	< 250
Cyanide (CN)	APHA-4500CN E	mg/l	0.01	<0.01	≤ 0.05
Fluoride (F)**	APHA-4500F- D	mg/l	0.01	<0.01	≤ 1.5
Nitrite	APHA-4500NO2 B	mg/l	0.01	<0.01	≤ 3 (P)
Nitrate**	APHA-4500NO3 C	mg/l	0.1	0.83	≤ 50
Phenolic Compound	APHA-5530 D	mg/l	0.01	<0.01	-
Residual Chlorine	APHA-4500Cl G	mg/l	0.1	<0.1	0.2-0.5
Aluminum (Al)	APHA-3111Al B	mg/l	0.028	<0.028	≤ 0.2
Cadmium**	APHA-3111Cd B	mg/l	0.0028	<0.0028	0.01
Copper**	APHA-3111Cu B	mg/l	0.0045	<0.0045	2
Chromium**	APHA-3111Cr B	mg/l	0.0054	<0.0054	≤ 0.05 (P)
Mercury	APHA-3112Hg B	mg/l	0.0008	<0.0008	≤ 0.001
Antimony (Sb)**	APHA-3111Sb B	mg/l	-	ND	≤ 0.005 (P)
Nickel**	APHA-3111Ni C	mg/l	0.008	<0.008	≤ 0.02
Zinc**	APHA-3111Zn B	mg/l	0.0033	<0.0033	5.0
Arsenic	APHA-3111As B	mg/l	0.01	<0.01	≤ 0.05 (P)
Barium	APHA-3111Ba B	mg/l	0.031	<0.031	0.7
Manganese**	APHA-3111Mn B	mg/l	0.0016	<0.0016	≤ 0.5
Iron**	APHA-3111Fe B	mg/l	0.1	<0.1	-
Boron	APHA-4500-B (C)	mg/l	0.1	<0.1	0.3
Lead**	APHA-3111Pb B	mg/l	0.013	<0.013	≤ 0.05
Selenium	APHA-3111Se B	mg/l	-	ND	0.01 (P)
MICROBIOLOGICAL ANALYSIS					
Total Coliforms	APHA:9222 B	CFU/100ml		Absent	0/100ml
Faecal Coliforms (Ecoli)	APHA:9222 D	CFU/100ml		Absent	0/100ml

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Abbreviations:
ND: Not Detected **LOR:** Limit of Reporting **PEQS:** Punjab Environmental Quality Standards
Note:
** Uncertainty of all the parameters and laboratory conditions at the time of analysis will be provided as per client's requirement. The lab environmental conditions are maintained at 25±5C° and humidity at 50±20%.*
Disclaimer: *The results are solely of the sample provided. **All the starred parameters are PNAC accredited.*

SECTION 6: CONCLUSION

Environmental monitoring was performed at mutually agreed sites to assess the environmental conditions of its surroundings.

The results of ambient air monitoring depict that all the tested parameters for air quality were within the permissible limits of Punjab Environmental Quality Standards.

Noise monitoring results of both sites were in compliance with the prescribed limits for commercial noise of Punjab Environmental Quality Standards.

Results of drinking water sample showed compliance with permissible limits of Punjab Environmental Quality Standards.

Reference Number: GCEC-PK-PU-320/2024

Environmental Monitoring, Sampling & Testing Analysis Reports

Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 24A/ 19690

Monitoring & Test Report

- Drinking Water
- Ambient Air
- Meteorological Data
- Noise Monitoring

GOPA Intec-Multitech Consulting Engineers (District Layyah)

13th Dec. 2024

Job Reference No.: GCEC-PK-PU-320/2024

1 of 9

Pakistan Office: House No. 368-B , Block Canal View Housing Society, Lahore. Pakistan.
0320 4143519, 0320 4143318
042 35962884-85 0320 4143318
manager.operations@gcee.ae www.gcee.pk

Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 24A/ 19691

Client Detail:	
Client Name:	Multan Electric Power Company (MEPCO)
Consultant Name:	GOPA Intec-Multitech Consulting Engineers
Project Name:	Electricity Distribution Efficiency Improvement Project (EDEIP) for the Construction of 132 kV Grid Station and 27 Km Transmission Line
Name of Contact Person:	Mr. Hassan Raza
Designation:	Managing Director
Contact Number:	0321-4553805
Email:	Hassan@mcepak.com
Address:	121J, Johar Town, Lahore, Pakistan

GCEC Details:	
Director:	Mr. Mian Khurram Usman
Telephone:	+92 42 35962885
Fax:	+92 42 35962884
Email:	manager.operations@gcee.ae
Address	House No. 368-B Block B, Canal View, Lahore

Signatories:

Green Crescent Environmental Consultants Pvt Ltd. PAKISTAN

2 of 9

Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 24A/ 19692

CHEMICAL ANALYSIS TEST REPORT (DRINKING WATER)

Sample Details			
Job Ref. No:	GCEC-PK-PU-320/2024	Client Name:	Multan Electric Power Company (MEPCO)
Telephone No.	0337-9820818	Consultant Name:	GOPA Intec- Multitech Consulting Engineers
Sample Date:	05-12-2024	Sample Matrix:	Drinking Water Sample
Sample Receipt Date:	06-12-2024	Sampled By:	GCEC
Grab/Composite:	Grab Sampling	Date of Completion of Analysis:	13-12-2024
Address:	121J, Johar Town, Lahore, Pakistan		
Project Name:	Electricity Distribution Efficiency Improvement Project (EDEIP) for the Construction of 132 kV Grid Station and 27 Km Transmission Line		
Sample Identification			
01	Water Pump Near Site Location		

Parameters	Analysis Method	Unit	LOR	Result 01	PEQS
PHYSICAL & CHEMICAL ANALYSIS					
pH**	APHA-4500H+ B	-	0.01	7.10	6.5-8.5
Odor	In-house	-	-	Odorless	Non-Objectionable
Taste	In-house	-	-	Sweet	Non-Objectionable
Color	APHA-2120 B/C	Pt/Co	1.0	<1.0	≤15 TCU
Turbidity**	APHA-2130 B	NTU	0.1	<0.1	<5 NTU
Total Hardness**	APHA-2340 B & C	mg/l	0.1	388.0	< 500 mg/l
Total Dissolved Solid (TDS)**	APHA-2540 C	mg/l	1.0	977.0	< 1000
Ammonia	APHA-4500-NH_3-B	mg/l	0.002	<0.002	-
Chloride**	APHA-4500Cl- B	mg/l	0.24	78.27	< 250
Cyanide (CN)	APHA-4500CN- E	mg/l	0.01	<0.01	≤ 0.05
Fluoride (F)**	APHA-4500F- D	mg/l	0.01	<0.01	≤ 1.5
Nitrite	APHA-4500NO2 B	mg/l	0.01	<0.01	≤ 3 (P)
Nitrate**	APHA-4500NO3 C	mg/l	0.1	0.83	≤ 50
Phenolic Compound	APHA-5530 D	mg/l	0.01	<0.01	-
Residual Chlorine	APHA-4500Cl G	mg/l	0.1	<0.1	0.2-0.5
Aluminum (Al)	APHA-3111Al B	mg/l	0.028	<0.028	≤ 0.2
Cadmium**	APHA-3111Cd B	mg/l	0.0028	<0.0028	0.01
Copper**	APHA-3111Cu B	mg/l	0.0045	<0.0045	2
Chromium**	APHA-3111Cr B	mg/l	0.0054	<0.0054	≤ 0.05 (P)
Mercury	APHA-3112Hg B	mg/l	0.0008	<0.0008	≤ 0.001
Antimony (Sb)**	APHA-3111Sb B	mg/l	-	ND	≤ 0.005 (P)
Nickel**	APHA-3111Ni C	mg/l	0.008	<0.008	≤ 0.02
Zinc**	APHA-3111Zn B	mg/l	0.0033	<0.0033	5.0
Arsenic	APHA-3111As B	mg/l	0.01	<0.01	≤ 0.05 (P)
Barium	APHA-3111Ba B	mg/l	0.031	<0.031	0.7
Manganese**	APHA-3111Mn B	mg/l	0.0016	<0.0016	≤ 0.5
Iron**	APHA-3111Fe B	mg/l	0.1	<0.1	-
Boron	APHA-4500-B (C)	mg/l	0.1	<0.1	0.3
Lead**	APHA-3111Pb B	mg/l	0.013	<0.013	≤ 0.05
Selenium	APHA-3111Se B	mg/l	-	ND	0.01 (P)
MICROBIOLOGICAL ANALYSIS					
Total Coliforms	APHA:9222 B	CFU/100ml		Absent	0/100ml
Faecal Coliforms (Ecoli)	APHA:9222 D	CFU/100ml		Absent	0/100ml

Abbreviations:
ND: Not Detected **LOR:** Limit of Reporting **PEQS:** Punjab Environmental Quality Standards

Note:
*Uncertainty of all the parameters and laboratory conditions at the time of analysis will be provided as per client's requirement. The lab environmental conditions are maintained at 25±5C° and humidity at 50±20%. **Disclaimer:** The results are solely of the sample provided. **All the starred parameters are PNAC accredited.

Sample Analyzed By:
Analyst
Mr. Idrees Zaman

Name of Chemist/Nazim with Seal:
Mr. Usman Raza Jaswal

Green Crescent Environmental Consultants Pvt. Ltd. ★ PAKISTAN ★

3 of 9

Pakistan Office: House No. 368-B , Block Canal View Housing Society, Lahore. Pakistan.
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manager.operations@gcee.ae www.gcee.pk

Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 24A/ 19693

Ambient Air Monitoring Location

SITE AREA

(Layyah)

Pakistan Office: House No. 368-B , Block Canal View Housing Society, Lahore. Pakistan.
0320 4143519, 0320 4143318
042 35962884-85 0320 4143318
manager.operations@gcee.ae www.gcee.pk

Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 24A/ 19694

Ambient Air Quality Monitoring

Job Reference Number	GCEC-PK-PU-320/2024
Monitoring Point	Site Area
Date of Intervention	04-Dec-2024 to 05-Dec-2024
Monitoring Coordinates	30°57'27.1"N 70°58'56.6"E

Sr. #	Time	CO (mg/m³)	NO (µg/m³)	NO_2 (µg/m³)	NO_x (µg/m³)	SO_2 (µg/m³)
1.	18:15	2.15	17.96	30.58	48.54	11.52
2.	19:15	2.77	19.11	27.48	46.59	13.76
3.	20:15	2.65	11.69	28.12	39.81	14.03
4.	21:15	1.81	12.81	27.16	39.96	12.31
5.	22:15	1.77	15.59	30.69	46.28	13.70
6.	23:15	1.83	18.11	31.97	50.08	14.03
7.	00:15	1.87	17.60	35.28	52.88	12.31
8.	01:15	2.44	12.59	32.29	44.88	15.52
9.	02:15	2.54	16.74	34.21	50.95	13.70
10.	03:15	2.57	15.21	30.58	45.79	14.77
11.	04:15	2.67	20.01	27.48	47.49	14.77
12.	05:15	2.66	15.09	28.12	43.21	14.03
13.	06:15	1.75	20.03	27.16	47.19	15.89
14.	07:15	1.13	17.00	30.69	47.69	12.96
15.	08:15	1.55	18.15	31.97	50.12	13.17
16.	09:15	1.44	10.72	35.28	46.01	13.28
17.	10:15	1.54	11.84	30.58	42.42	12.96
18.	11:15	1.78	14.63	27.48	42.11	12.64
19.	12:15	2.30	17.15	28.12	45.27	13.49
20.	13:15	2.42	16.64	27.16	43.79	13.70
21.	14:15	2.79	11.63	30.69	42.32	14.03
22.	15:15	1.34	15.78	31.97	47.75	13.92
23.	16:15	2.12	14.25	35.28	49.54	14.35
24.	17:15	1.87	12.30	32.29	44.59	13.92
Average Concentration		2.01	15.13	31.43	46.56	12.72

Monitoring Performed By:
Deputy Analyst
Muhammad Ilyas

Name of Chief Chemist with Seal:
Mr. Usman Raza Jaswal

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Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 24A/ 19695

Ambient Air Quality Monitoring

Job Reference Number	GCEC-PK-PU-320/2024
Monitoring Point	Site Area
Date of Intervention	04-Dec-2024 to 05-Dec-2024
Monitoring Coordinates	30°57'27.1"N 70°58'56.6"E

Parameter	Unit	Monitoring Duration	LDL	Average Obtained Concentration	PEQS
Nitrogen Dioxide (NO_2)	µg/m³	24 Hours	1.00	31.43	80.0
Nitrogen Oxide (NO)	µg/m³	24 Hours	1.00	15.13	40.0
NO_X	µg/m³	24 Hours	1.00	46.56	120.0
Sulphur Dioxide (SO_2)	µg/m³	24 Hours	1.00	12.72	120.0
Carbon Monoxide (CO)	mg/m³	24 Hours	0.01	2.01	5.0*
Ozone (O_3)	µg/m³	24 Hours	-	18.81	130.0**
Particulate Matter ($PM_{2.5}$)	µg/m³	24 Hours	1.00	29.06	35.0
Particulate Matter (PM_{10})	µg/m³	24 Hours	1.00	127.91	150.0
Suspended Particulate Matter (SPM)	µg/m³	24 Hours	1.00	191.97	500.0
Lead Airborne Particles	µg/m³	24 Hours	-	0.17	1.5

Abbreviations:
µg/m³= Micrograms per Cubic Meter
mg/m³= Milligrams per Cubic Meter
LDL= Lowest Detection Limit
PEQS= Punjab Environmental Quality Standards
*08 hour standard for CO
**01 hour standard for O_3

Monitoring Performed By:
Deputy Analyst
Muhammad Ilyas

Name of Chief Analyst with Seal:
Mr. Usman Raza Jaswal

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Sr. No# 24A/ 19696

Meteorological Data

Job Reference Number	GCEC-PK-PU-320/2024
Monitoring Point	Site Area
Date of Intervention	04-Dec-2024 to 05-Dec-2024
Monitoring Coordinates	30°57'27.1"N 70°58'56.6"E

Time	Ambient Temperature °C	Wind Direction	Wind Velocity m/s	Humidity %	Pressure (mm of Hg)
18:15	17	NW	2.2	69	754.4
19:15	16	NW	2.3	69	755.1
20:15	16	NW	3.1	68	753.8
21:15	16	NW	3.3	69	753.9
22:15	14	NW	3.1	70	755.5
23:15	14	NW	3.5	72	754.0
00:15	13	NW	3.4	73	754.8
01:15	13	NW	3.3	73	755.9
02:15	13	NW	3.0	72	755.2
03:15	12	N	5.2	76	756.4
04:15	12	N	5.1	79	754.4
05:15	11	N	5.5	83	753.3
06:15	11	N	5.8	83	755.2
07:15	11	N	6.4	86	754.2
08:15	11	N	6.3	87	754.2
09:15	12	N	6.1	86	753.9
10:15	15	N	6.3	88	753.2
11:15	17	NW	5.6	78	753.0
12:15	19	NW	5.2	68	755.2
13:15	21	NW	5.1	58	754.2
14:15	21	NW	6.6	52	754.6
15:15	22	NW	6.2	48	754.2
16:15	21	NW	6.9	50	754.2
17:15	21	NW	6.0	47	753.7

Monitoring Performed By:
Deputy Analyst
Muhammad Ilyas

Name of Chief Analyst with Seal:
Mr. Usman Raza Jaswal

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Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 24A/ 19697

Noise Level Monitoring Report

Job Reference Number	GCEC-PK-PU-320/2024
Monitoring Point	Site Area
Date of Intervention	04-Dec-2024 to 05-Dec-2024
Monitoring Coordinates	30°57'27.1"N 70°58'56.6"E

Sr. #	Time	Method/Technique	Unit	Results LAavg	PEQS (Commercial)
		Night Time			
1.	23:15	Noise Meter	dB	43.1	
2.	00:15	Noise Meter	dB	45.2	
3.	01:15	Noise Meter	dB	42.1	
4.	02:15	Noise Meter	dB	45.8	
5.	03:15	Noise Meter	dB	45.2	55.0
6.	04:15	Noise Meter	dB	44.1	
7.	05:15	Noise Meter	dB	45.9	
8.	06:15	Noise Meter	dB	47.3	
	Night Time Average		dB	44.82	55.0
		Day Time			
9.	07:15	Noise Meter	dB	46.8	
10.	08:15	Noise Meter	dB	47.1	
11.	09:15	Noise Meter	dB	48.9	
12.	10:15	Noise Meter	dB	46.5	
13.	11:15	Noise Meter	dB	47.6	
14.	12:15	Noise Meter	dB	47.0	
15.	13:15	Noise Meter	dB	45.2	
16.	14:15	Noise Meter	dB	46.4	
17.	15:15	Noise Meter	dB	45.3	65.0
18.	16:15	Noise Meter	dB	44.6	
19.	17:15	Noise Meter	dB	48.5	
20.	18:15	Noise Meter	dB	45.0	
21.	19:15	Noise Meter	dB	45.3	
22.	20:15	Noise Meter	dB	43.8	
23.	21:15	Noise Meter	dB	44.0	
24.	22:15	Noise Meter	dB	46.3	
	Day Time Average		dB	46.13	65.0

Monitoring Performed By:
Deputy Analyst
Muhammad Ilyas

Name of Chief Analyst with Seal:
Mr. Usman Raza Jaswal

Green Crescent Environmental Consultants Pvt Ltd. * PAKISTAN *

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Sr. No# 24A/ 19698

Pictorial Evidence for Drinking Water Sampling & Ambient Air Monitoring

Figure 1: Drinking Water Sampling from Water Pump Near Site Location

Figure 2: Ambient Air Monitoring of Site Area

End of Report

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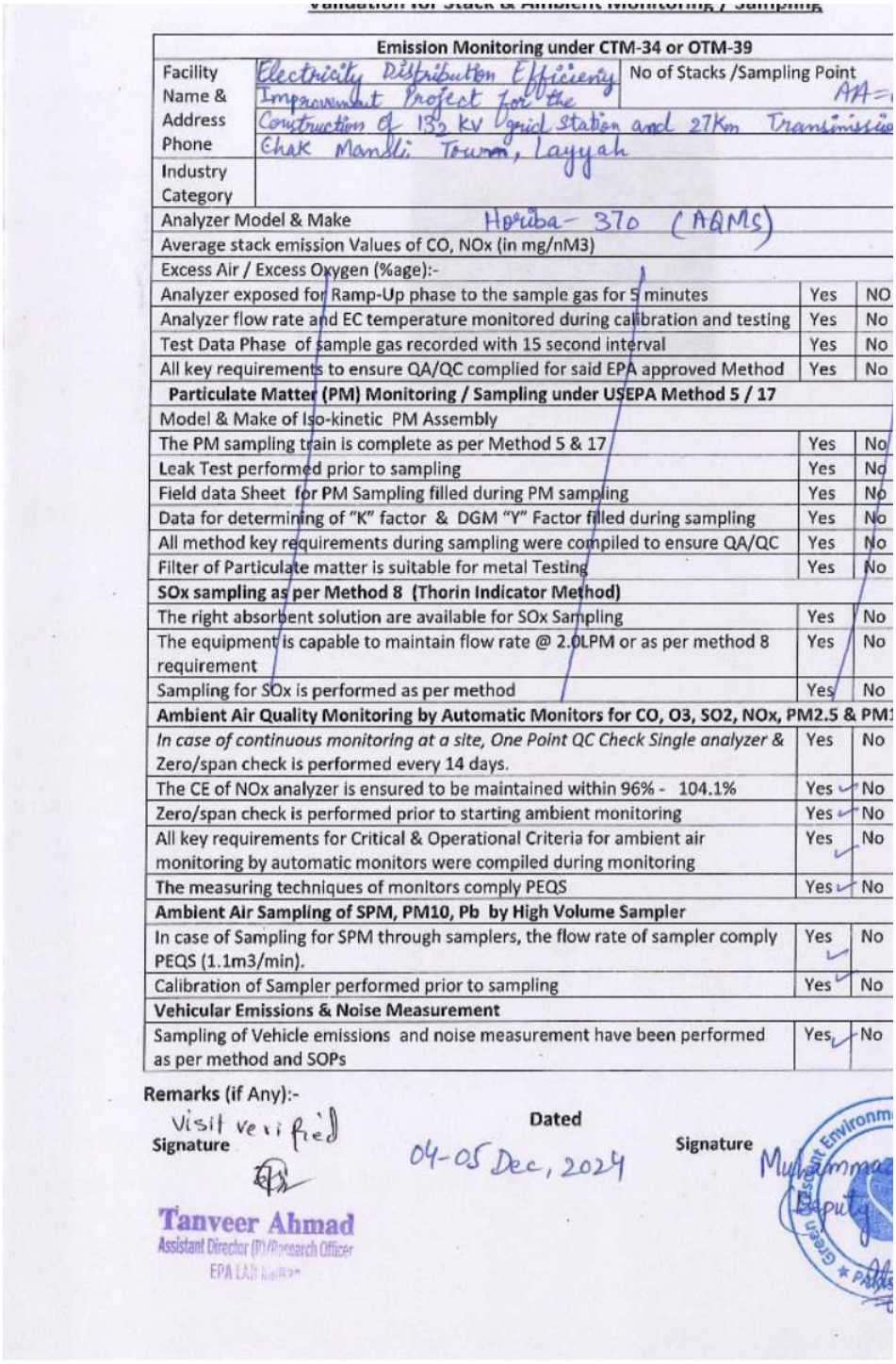

Validation for Stack & Ambient Monitoring / Sampling

Emission Monitoring under CTM-34 or OTM-39			
Facility Name & Address Phone	Electricity Distribution Efficiency Improvement Project for the Construction of 132 kV grid station and 27Km Transmission Chak Mandli Tower, Layyah	No of Stacks /Sampling Point	AA=
Industry Category			
Analyzer Model & Make	Horiba- 370 (AQMS)		
Average stack emission Values of CO, NOx (in mg/nM3)			
Excess Air / Excess Oxygen (%age):-			
Analyzer exposed for Ramp-Up phase to the sample gas for 5 minutes		Yes	NO
Analyzer flow rate and EC temperature monitored during calibration and testing		Yes	No
Test Data Phase of sample gas recorded with 15 second interval		Yes	No
All key requirements to ensure QA/QC complied for said EPA approved Method		Yes	No
Particulate Matter (PM) Monitoring / Sampling under USEPA Method 5 / 17			
Model & Make of Iso-kinetic PM Assembly			
The PM sampling train is complete as per Method 5 & 17		Yes	No
Leak Test performed prior to sampling		Yes	No
Field data Sheet for PM Sampling filled during PM sampling		Yes	No
Data for determining of "K" factor & DGM "Y" Factor filled during sampling		Yes	No
All method key requirements during sampling were compiled to ensure QA/QC		Yes	No
Filter of Particulate matter is suitable for metal Testing		Yes	No
SOx sampling as per Method 8 (Thorin Indicator Method)			
The right absorbent solution are available for SOx Sampling		Yes	No
The equipment is capable to maintain flow rate @ 2.0LPM or as per method 8 requirement		Yes	No
Sampling for SOx is performed as per method		Yes	No
Ambient Air Quality Monitoring by Automatic Monitors for CO, O3, SO2, NOx, PM2.5 & PM			
In case of continuous monitoring at a site, One Point QC Check Single analyzer & Zero/span check is performed every 14 days.		Yes	No
The CE of NOx analyzer is ensured to be maintained within 96% - 104.1%		Yes	No
Zero/span check is performed prior to starting ambient monitoring		Yes	No
All key requirements for Critical & Operational Criteria for ambient air monitoring by automatic monitors were compiled during monitoring		Yes	No
The measuring techniques of monitors comply PEQS		Yes	No
Ambient Air Sampling of SPM, PM10, Pb by High Volume Sampler			
In case of Sampling for SPM through samplers, the flow rate of sampler comply PEQS (1.1m3/min).		Yes	No
Calibration of Sampler performed prior to sampling		Yes	No
Vehicular Emissions & Noise Measurement			
Sampling of Vehicle emissions and noise measurement have been performed as per method and SOPs		Yes	No

Remarks (if Any):- Visit verified

Signature Tanveer Ahmad, Assistant Director (P)/Research Officer, EPA Lab

Dated 04-05 Dec, 2024

Signature Muhammad, Deputy

Facility /Project Name & Address Phone	Electricity Distribution Efficiency Improvement Project of the Construction of 132 KV grid station and 27 Km Transmission Chak Mandi Town, Layyah.	Sampling Point DW=01

Waste Water (WW) Treatment facility	Drinking Water (W) Treatr
Primary Secondary Tertiary NA	
Total WW collected Sample	Total Collected Drinking water

Sample Tag for testing parameter is assigned on sample container	Yes ✓	NO
Sample is preserved properly for each testing parameter	Yes ✓	NO
Sample size is adequate for testing the target parameters	Yes ✓	NO
Wastewater Flow Measurement performed to ensure sample representativeness	Yes ✓	NO

No. of Waste Water outlets	Waste Water Flow m^3/hr from each outlet (Optional)	Water intake m^3/hr (Optional)	Water Mass balance complied during sampling (Optional)	Sample Type
—	—	—	Yes No	Drinking Grab ✓

Parameter	Matrix W	Matrix WW	Container	Sample Size	Preservation	Y
Coliform, Total or Fecal	✓		Sterile Container	100 mL	Refrigerate 6 C	✓
Coliform, Total or Fecal, Chlorinated Water	✓		Sterile Container	100 mL	0.008% Thiosulphate & cooled 6 C	✓
Color, Turbidity	✓		P,G	500 mL	Cool 6 C	✓
Hardness, Total	✓		P,G	500ml	HNO3 to pH<2	✓
Nitrogen, Nitrate + Nitrite , Phenolic Compounds, Oil & Grease, COD, NH3	✓		P,G	2000 mL	H2SO4 to pH < 2, Cool 6C	✓
Metals, General	✓		P,G Rinsed 1.1 HNO3	500 mL	HNO3 to pH < 2	✓
Cyanide, Total	✓		P,G	500 mL	NaOH to pH > 12, Cool 6C	✓
Pesticides, General	X		Glass	1 Liter	Cool 6 C	X

Field Parameters*

Field parameter		pH meter, Model Make	Measurement Method	Cali in F
pH		Lovibond	APHA-4.500 B	Yes
Temp		Digital Thermometer		
Cl				

*** Field testing parameters only be validated by RAs, ROs, DD (Labs)**

Remarks for Sample Quality (if Any):-

visit verified

Signature

Tanveer Ahmad
Assistant Director (R)/Research Officer
EPA LAB Multan

Dated 05-Dec-2024

Signature

ENVIRONMENTAL MONITORING, SAMPLING AND TESTING REPORT

FOR

Electricity Distribution Efficiency Improvement Project (EDEIP) for the Construction of 132 kV Grid Station and 27 Km Transmission Line

(District Rahim Yar Khan)

MULTITECH CONSULTING ENGINEERS

Prepared by: Green Crescent Environmental Consultants Pvt. Ltd

Reference Number: GCEC-PK-PU-320/2024

Contact Details of Client	
Client Name	Multan Electric Power Company (MEPCO)
Consultant Name	GOPA Intec-Multitech Consulting Engineers
Project Name	Electricity Distribution Efficiency Improvement Project (EDEIP) for the Construction of 132 kV Grid Station and 27 Km Transmission Line
Contact Person	Mr. Hassan Raza
Designation	Managing Director
Contact Number	0321-4553805
Email ID	Hassan@mcepak.com
Address	121J, Johar Town, Lahore, Pakistan
Contact Details of GCEC-Pakistan	
Director:	Mr. Mian Khurram Usman
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Approved By:

Zara Yousaf
Coordination Department

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LIST OF ABBREVIATIONS

AA	Ambient Air
DW	Drinking Water
SPL	Sound Pressure Level
dB	Decibels
mg/m3	Milligram per Cubic meter
mg/l	Milligram per Liter
µg/m³	Micrograms per Cubic Meter
CO	Carbon Monoxide
SO_2	Sulfur Dioxide
NOx	Oxides of nitrogen
O_2	Oxygen
SPM	Suspended Particulate Matter
LDL	Lowest Detection Limit
PEQS	Punjab Environmental Quality Standards
LOR	Limit of Reporting
PM	Particulate Matter
SOPs	Standard Operating Procedures
TSS	Total Suspended Solids
APHA	American Public Health Association

SECTION 1: OBJECTIVES & SCOPE

1.1 STUDY OBJECTIVES

Followings were the main objectives of the study:

- To assess the current conditions of the environment in the surroundings of project area.
- To help the consultant and contractor to develop the strategies for the protection and betterment of environment.

1.2 SCOPE OF SERVICES

Scope of services covered following main components:

- Ambient Air Quality Monitoring
- Noise Level Monitoring
- Drinking Water Sampling & Analysis

MONITORING TEAM

Monitoring team of Green Crescent Environmental Consultants involved in the monitoring and sampling is given in below table:

Table 1-1 Monitoring Team

Sr. No.	Name of The Employee	Designation
1.	Muhammad Ilyas Durrani	Executive Field Officer

SECTION 2: ENVIRONMENTAL MONITORING, SAMPLING & TESTING SCHEDULE

Detailed Environmental monitoring was conducted at the mutually agreed sites of project area. The monitoring and sampling was conducted from 6th Dec to 7th Dec. 2024.

Table 2-1 Environmental Monitoring, Sampling & Testing Schedule

Sr. #	Intervention Date	Activity	Monitoring Location
1.	06-12-2024 to 07-12-2024	• Ambient Air Quality Monitoring • Meteorological Monitoring	Site Area
2.	06-12-2024	Drinking Water	Tube Well Point Near Site Location

SECTION 3: ENVIRONMENTAL MONITORING, SAMPLING & TESTING LOCATIONS

Environmental monitoring, sampling & testing locations are as per shown in the following figure.

Figure 3-1: Map Showing Ambient Air Monitoring Locations (6th Dec. to 7th Dec.2024)

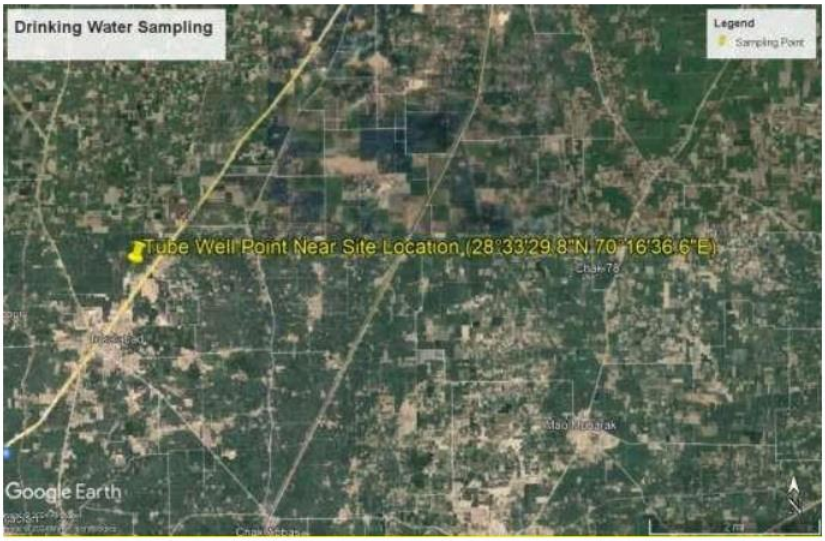

Figure 3-2: Map Showing Drinking Water Sampling Location (6th Dec. 2024)

SECTION 4: ENVIRONMENTAL MONITORING, SAMPLING & TESTING METHODOLOGY

Following is a brief description of the methodology adopted for this Environmental Monitoring, Sampling & Testing including Ambient Air, Metrological Data, Noise and Water Analysis:

4.1 Onsite Monitoring

Among the environmental parameters selected by the client;

- Ambient Air
- Temperature and pH of water samples

Were monitored onsite. Ambient air monitoring including metrological monitoring and noise level monitoring was conducted using portable digital instruments while temperature and pH of the water samples were monitored manually using thermometer and pH strips. A brief description of each digital instrument used for onsite monitoring is given below;

4.1.1 Vantage Pro2, Davis

The Davis 6152 Wireless Vantage Pro2 Weather Station which was made in 2018 in America which consists of a console unit and an innovative integrated sensor suite that includes a rain collector with self-emptying bucket, temperature and humidity sensors and an anemometer. The sensor suite is housed inside a radiation shield, protecting the sensors against solar radiation and additional sources of reflected and/or radiated heat. It provides accurate weather data in a sophisticated yet easy-to-read format. With Wireless Vantage Pro2 Weather Station we can continuously measure metrological parameters including;

- Temperature
- Wind Direction
- Wind Velocity
- Humidity

- Atmospheric Pressure

Davis wireless weather station Vintage Pro2 was used for the assessment of these parameters according to standard operating procedures and obtained results are presented in **Annex-1** of this report.

Figure 4-1: View of Davis Vintage Pro at Site

4.1.2 Dust Trak II Aerosol Monitor 8530, TSI

The Dust Trak II Aerosol Monitor 8530 is a desktop battery-operated, data-logging, light-scattering laser photometer which was manufactured in 2014, that gives you realtime aerosol mass readings.

It uses a sheath air system that isolates the aerosol in the optics chamber to keep the optics clean for improved reliability and low maintenance. Using this instrument, particulate matter was monitored including;

- PM_{10}
- $PM_{2.5}$
- TSP

Figure 4-2: DustTrak II aerosol monitor 8530

4.1.3 Model 407730 Digital Sound Level Meter, Extech

It is a noise measuring instrument used to assess sound levels by measuring sound pressure. Often referred to as a sound pressure level (SPL) meter, decibel (dB) meter, noise meter or noise dosimeter, a sound level meter uses a microphone to capture sound. The sound is then evaluated within the device and acoustic measurement values are displayed. The most common unit of acoustic measurement for sound is the decibel (dBA). Hourly noise level monitoring was done for 24 hours at each point of selected location. Digital Sound meter was manufactured in 2014.

Noise level using portable digital sound meter was monitored at client's mutually agreed monitoring points. Noise level measurement was performed according to standard operating procedures and obtained results are presented in **Annex-1** of this report.

Figure 4-3: View of Digital Sound Level Meter

4.1.4 HORIBA

HORIBA, was manufactured in 2017, a Japanese brand which consists of ambient air analyzers and sampling systems for the measurement of regulatory pollutants and air quality control. It offers complete tailored or individual air quality monitoring solutions, in order to meet the requirements and regulatory needs of environmental monitoring.

4.1.4.1 AC32M. NITROGEN OXIDES ANALYZER (NO, NOX, NO2)

Chemiluminescence technology based, TÜV & US EPA approved. It is single chambered chemiluminescence technology with ultra-compact and lightweight – rackable 19"/3U. On board web server compatible with any internet browser and user interface with online help for the display, configuration, maintenance, diagnostics or software updating of the analyzer, remotely. It is capable to detect low levels of nitrogen oxides (NO-NO_2-NO_X) with standard ranges: 0-0.1/0.2/0.5/1.0 ppm

4.1.4.2 AF22E. NEW E-SERIES SO2 ANALYZER

UV Fluorescent sulfur dioxide analyzer AF22e, TUV certified and US-EPA approved for compliance with ISO 10498, 2008/50/EC, en 14212, EN 15267, 40 CFR part 53 SUB B and SUB C.

It is a light weight eco-friendly & eco-innovative conception unit which detects early signs of trouble, allows predictive maintenance, identifies the service needed and guides the service operations step by step.

It provides real-time calibration graph, animated synoptic, auto-diagnostic, control and maintenance data screens can be displayed while the instrument is operating. It provides superior metrological presentations for SO_2 measurements in the range as low as 0.05 ppm F.S.

4.1.4.3 CO12E. NEW E-SERIES CO ANALYZER

Non dispersive Infra-Red carbon monoxide analyzer CO12e, TUV certified and US-EPA approved for compliance with ISO 4224, EN 14626, EN 15267, 40 CFR part 53 SUB B and SUB C.

It is a light weight eco-friendly & eco-innovative conception unit with breakthrough mechanical design for weight and power saving as well as thermal insulation & reliability. It has automatic or programmable response time adjustment, ensuring efficient monitoring of low concentration levels of carbon monoxide. It provides superior metrological presentations for CO measurements in the range 0-100 ppm.

4.2 Water Sample Collection and Preservation

Water samples were collected from mutually agreed sampling points according to the SOPs based on American Public Health Association (APHA) for water sampling and analysis. Decontaminated Plastic bottles were used to collect the samples. To prevent air bubbles from being trapped in the bottles, they were filled to the brim. The lids of the sampling bottles were then replaced tightly. The bottles were then labeled and chain of custody forms were filled out and signed to keep track of the collected samples. Collected samples were then preserved in appropriate containers as per APHA Preservation Guidelines. A shipping container containing ice packs with maintained temperature was used for transporting the samples from sampling location to GCEC Lahore Branch for testing.

4.2.1 Drinking Water Sampling & Analysis

Sampling for drinking water was carried out at mutually agreed sampling points. Physical and chemical parameters were analyzed afterwards in GCEC labs for drinking water sample. Analytical methods used during the laboratory testing were in line with the American Public Health Association's Standard Methods for the Examination of Water.

Analysis Results are presented in **Annex 1** of this report.

4.3 Sample Tagging and Chain of Custody

In GCEC Lahore Branch, samples and chain of custody form were handed over by Field Monitoring Staff to the Coordination Staff for in-house tagging and logging according to the company's policy and handed over to the Laboratory Staff for further physical, chemical and microbiological testing. A brief description of each sampling type and further proceedings are also discussed in following section.

SECTION 5: RESULTS & DISCUSSIONS

This section of the report presents the Environmental testing results of noise-level monitoring, ambient air quality & drinking water analysis

5.1 Background Noise Level Monitoring

The Noise monitoring activity was carried at different locations. Monitoring schedule is presented in Table 2-1. While a brief description of monitoring session is as below.

Hourly noise monitoring was conducted at four selected locations. The results of monitoring locations were compared with commercial noise standards for Punjab Environmental Quality Standards i.e., 65.0 dB (A) for Day Time and 55.0 dB (A) for Night Time.

Discussion on Noise Results

Noise level Monitoring was conducted for 24 hours at four monitoring locations. The monitoring results obtained are not complying with the commercial noise standards of PEQS. Day and Night Time averages for monitoring points are presented in figures below.

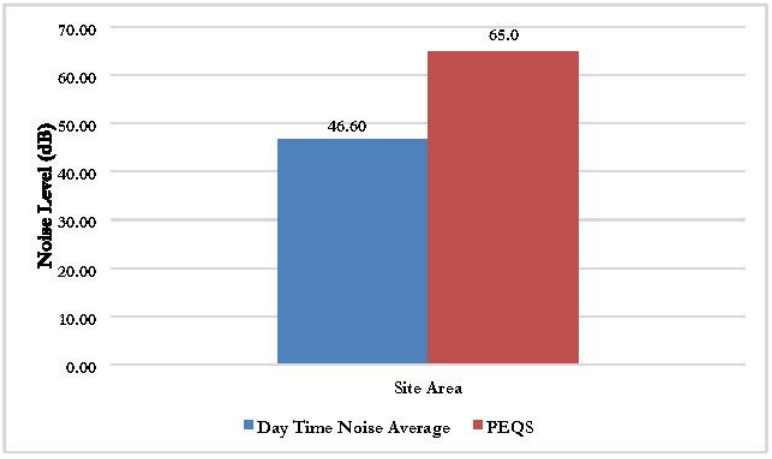

Figure 5-1: Day Time Average Noise Level Value Compared with Respective PEQS Standards

(6th Dec. to 7th Dec.2024)

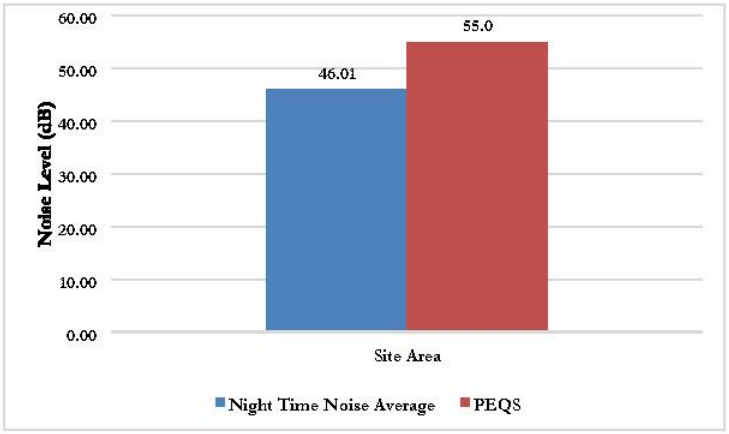

Figure 5-2: Night Time Average Noise Level Value Compared with Respective PEQS Standards (6th Dec. to 7th Dec.2024)

5.2 Ambient Air Quality Monitoring

The activity for monitoring the ambient air conditions was carried out at the agreed sites and its vicinity, for 24 hours at two monitoring locations starting from **(6th Dec. to 7th Dec.2024).** To assess the current quality of ambient air, Carbon Monoxide, Oxides of Nitrogen, Sulphur Dioxide, Ozone, Lead and Particulate Matter were monitored. Summary of monitoring results is presented in Table 5-1. Detailed result reports are also attached as **Annex 1**.

Discussion of NOx Measurements

The readings of NO, NO_2 and NOx for the project site and its surroundings comply with the Punjab Environmental Quality Standards i.e, 40 µg/m³, 80 µg/m³ and 120 µg/m³ respectively. Sum of NO and NO_2 is termed as NOx. NOx results found at the monitoring

location were within the PEQS limits. Monitoring results, compared with PEQS Standards, are graphically presented in figure below and in Summary Table below.

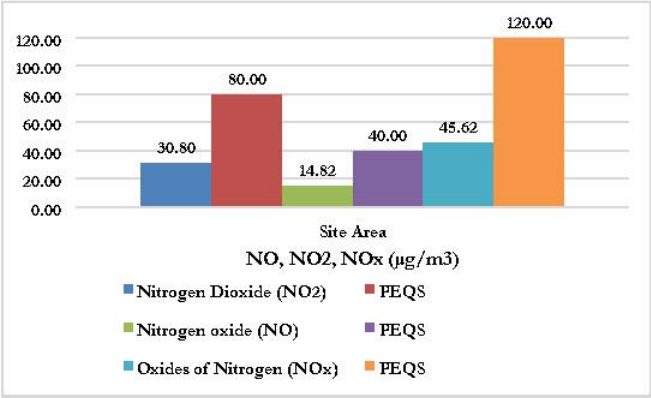

Figure 5-3: Daily Average NOx Measurements Compared with Respective PEQS Standards (6th Dec. to 7th Dec.2024)

Discussion of SO_2 Measurements

The SO_2 reading for both monitoring locations is presented in the summary table which depicts that the monitoring results are within the prescribed limits of PEQS i.e. 120 µg/m³. SO_2 results found at all two monitoring locations are within the PEQS limits.

Monitoring results, compared with PEQS Standards, are also graphically presented in figure below and in Summary Table 5-1 and 5-2.

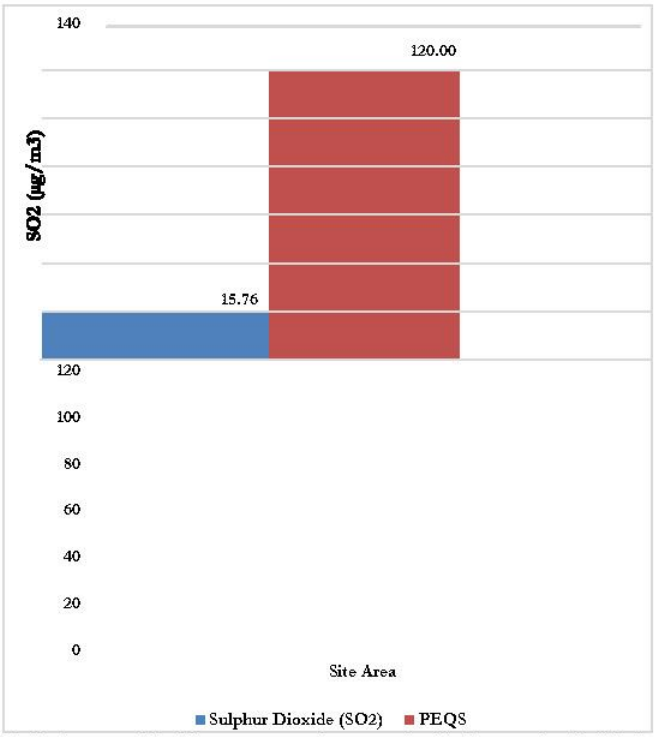

Figure 5-4: Daily Average SO_2 Measurement Compared with Respective PEQS Standards (6th Dec. to 7th Dec.2024)

Discussion of CO Measurements

Carbon Monoxide (CO) was monitored for 24 hours at two monitoring locations. The CO values detected at monitoring locations are within the permissible limit of PEQS i.e., 5.0 mg/m³. Monitoring results, compared with PEQS Standards, are graphically presented in figure below and in Summary Table below.

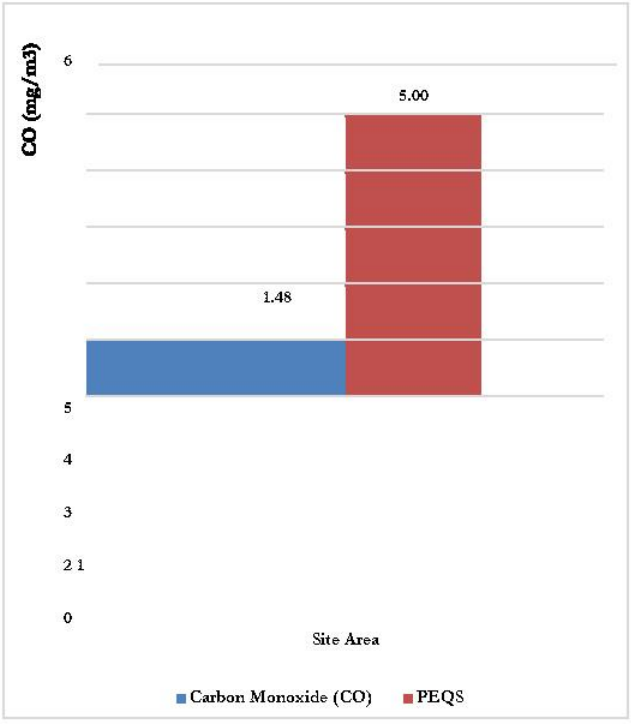

Figure 5-5: Daily Average CO Measurement Compared with Respective PEQS Standards (6th Dec. to 7th Dec.2024)

Discussion of Lead Measurements

Lead was monitored for 24 hours at two monitoring locations. The values detected at monitoring locations are within the permissible limit of PEQS i.e., 1.50 ug/m^3. Monitoring results, compared with PEQS, are graphically presented in figure below and in Summary Table 5-1.

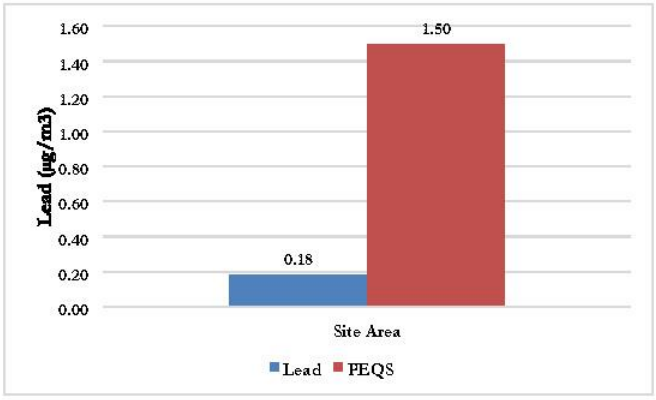

Figure 5-6: Daily Average Lead Measurement Compared with Respective PEQS Standards (6th Dec. to 7th Dec.2024)

Discussion of Ozone (O_3) Measurements

Ozone was monitored for 24 hours at two monitoring locations. The values detected at all two monitoring locations are within the permissible limit of PEQS i.e., 130 ug/m³. Monitoring results, compared with PEQS Standards, are graphically presented in figure below and in Summary Table below.

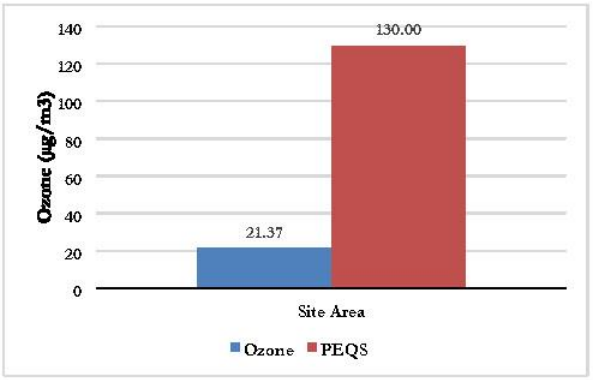

Figure 5-7: Daily Average Ozone Measurement Compared with Respective PEQS Standards (6th Dec. to 7th Dec.2024)

Discussion on Particulate Matter (PM_{10}, $PM_{2.5}$, TSP)

The monitoring results of *PM_{10}, $PM_{2.5}$* and *TSP* for all sites are compared with Punjab Environmental Quality Standard i.e., 150 µg/m³. The values of *PM_{10}, $PM_{2.5}$* and *TSP* were found falling within the prescribed limits of PEQS Limits, except for *$PM_{2.5}$* and *PM_{10}* in CB-I Construction Site. Monitoring result, compared with PEQS Standards, is graphically presented in figure below and in Summary Table below.

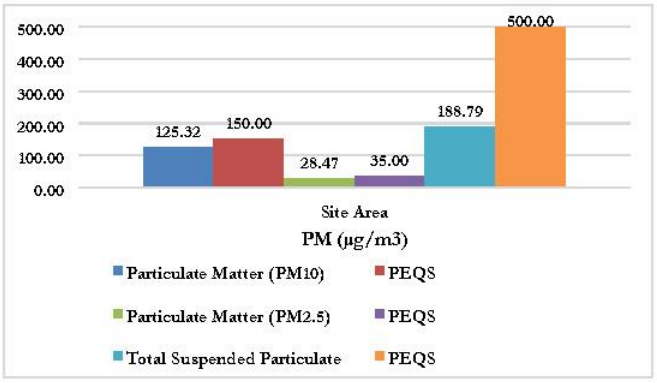

Figure 5-8: Daily Average TSP Measurements Compared with Respective PEQS Standards (6th Dec. to 7th Dec.2024)

Table 5-1 Summary of Ambient Air Quality Monitoring Results

Location Identification	
Monitoring Site:	**01**
Monitoring Location:	Site Area
Date:	06-Dec-2024 to 07-Dec-2024
Coordinates:	28°33'20.4"N 70°16'39.5"E

Parameter	Unit	Monitoring Duration	LDL	Average Obtained Concentration	PEQS
				01	
Nitrogen Dioxide (NO_2)	µg/m³	24 Hours	1.00	30.80	80.0
Nitrogen oxide (NO)	µg/m³	24 Hours	1.00	14.82	40.0
NO_X	µg/m³	24 Hours	1.00	45.62	120.0
Sulphur Dioxide (SO_2)	µg/m³	24 Hours	1.00	15.76	120.0
Carbon Monoxide (CO)	mg/m³	24 Hours	0.01	1.48	5.0
Ozone (O_3)	µg/m³	24 Hours	-	21.37	130.0**
Lead	µg/m³	24 Hours	0.05	0.18	1.50
Particulate Matter (PM_{10})	µg/m³	24 Hours	1.00	125.32	150.0
Particulate Matter ($PM_{2.5}$)	µg/m³	24 Hours	1.00	28.47	35.0

Total Suspended Particulate (TSP)	µg/m³	24 Hours	1.00	188.79	500.0

Abbreviations:
LDL= Lowest Detection Limit
PEQS= Punjab Environmental Quality Standards
*(24 Hours Standard for all the parameters Except O_3 and CO)
**(1 Hour Standard for O_3)
*(24 Hours Standard for all the parameters Except O_3) **µg/m³**= Micrograms per Cubic Meter **mg/m³**= Milligrams per Cubic Meter

5.3 Drinking Water Analysis

Drinking water sample were collected from one location on 06-12-2024 which were preserved and submitted in GCEC-Laboratory according to the standard methods. Summary of Analysis Results are given below in **Table 5-3**.

Discussion on Results

The laboratory test results of drinking water samples are summarized in the table below. It is obvious from the analysis results that the drinking water meets the permissible limits of Punjab Environmental Quality Standards for all tested parameters

GCEC-PK-PU-320/2024

Reference Number:

Table 5-2 Summary of Drinking Water Analysis Results

Sample Marking & Identification			
01	Tube well Point Near Site Location	Sampling Coordinates:	28°33'29.8"N 70°16'36.6"E

Parameters	Analysis Method	Unit	LOR	Result 01	PEQS
PHYSICAL & CHEMICAL ANALYSIS					
pH**	APHA-4500H+ B	-	0.01	7.06	6.5-8.5
Odor	In-house	-	-	Odorless	Non-Objectionable
Taste	In-house	-	-	Sweet	Non-Objectionable
Color	APHA-2120 B/C	Pt/Co	1.0	<1.0	≤15 TCU
Turbidity**	APHA-2130 B	NTU	-	<0.1	<5 NTU
Total Hardness**	APHA-2340 B & C	mg/l	0.1	328.0	< 500 mg/l
Total Dissolved Solid (TDS)**	APHA-2540 C	mg/l	1.0	686.0	< 1000
Ammonia	APHA-4500-NH_3-B	mg/l	0.002	<0.002	-
Chloride (Cl)**	APHA-4500Cl- B	mg/l	0.24	48.92	< 250
Cyanide (CN)	APHA-4500CN E	mg/l	0.01	<0.01	≤ 0.05
Fluoride (F)**	APHA-4500F- D	mg/l	0.01	<0.01	≤ 1.5
Nitrite	APHA-4500NO2 B	mg/l	0.01	<0.01	≤ 3 (P)
Nitrate**	APHA-4500NO3 C	mg/l	0.1	0.16	≤ 50
Phenolic Compound	APHA-5530 D	mg/l	0.01	<0.01	-
Residual Chlorine	APHA-4500Cl G	mg/l	0.1	<0.1	0.2-0.5
Aluminum (Al)	APHA-3111Al B	mg/l	0.028	<0.028	≤ 0.2
Cadmium**	APHA-3111Cd B	mg/l	0.0028	<0.0028	0.01
Copper**	APHA-3111Cu B	mg/l	0.0045	<0.0045	2
Chromium**	APHA-3111Cr B	mg/l	0.0054	<0.0054	≤ 0.05 (P)
Mercury	APHA-3112Hg B	mg/l	0.0008	<0.0008	≤ 0.001
Antimony (Sb)**	APHA-3111Sb B	mg/l	-	ND	≤ 0.005 (P)
Nickel**	APHA-3111Ni C	mg/l	0.008	<0.008	≤ 0.02
Zinc**	APHA-3111Zn B	mg/l	0.0033	<0.0033	5.0
Arsenic	APHA-3111As B	mg/l	0.01	<0.01	≤ 0.05 (P)
Barium	APHA-3111Ba B	mg/l	0.031	<0.031	0.7
Manganese**	APHA-3111Mn B	mg/l	0.0016	<0.0016	≤ 0.5
Iron**	APHA-3111Fe B	mg/l	0.1	<0.1	-
Boron	APHA-4500-B (C)	mg/l	0.1	<0.1	0.3
Lead**	APHA-3111Pb B	mg/l	0.013	<0.013	≤ 0.05
Selenium	APHA-3111Se B	mg/l	-	ND	0.01 (P)
MICROBIOLOGICAL ANALYSIS					
Total Coliforms	APHA:9222 B	CFU/100ml		Absent	0/100ml

Page 21 of 21

Faecal Coliforms (Ecoli)	APHA:9222 D	CFU/100ml	Absent	0/100ml

Abbreviations:
ND: Not Detected **LOR:** Limit of Reporting **PEQS:** Punjab Environmental Quality Standards
Note:
** Uncertainty of all the parameters and laboratory conditions at the time of analysis will be provided as per client's requirement. The lab environmental conditions are maintained at 25±5C° and humidity at 50±20%.*
Disclaimer: *The results are solely of the sample provided. **All the starred parameters are PNAC accredited.*

Reference Number:

SECTION 6: CONCLUSION

Environmental monitoring was performed at mutually agreed sites to assess the environmental conditions of its surroundings.

The results of ambient air monitoring depict that all the tested parameters for air quality were within the permissible limits of Punjab Environmental Quality Standards.

Noise monitoring results of both sites were in compliance with the prescribed limits for commercial noise of Punjab Environmental Quality Standards.

Results of drinking water sample showed compliance with permissible limits of Punjab Environmental Quality Standards.

GCEC-PK-PU-320/2024

Environmental Monitoring, Sampling & Testing Analysis Reports

Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 24A/ 19699

Monitoring & Test Report

- Drinking Water
- Ambient Air
- Meteorological Data
- Noise Monitoring

GOPA Intec-Multitech Consulting Engineers (District Rahim Yar Khan)

14th Dec. 2024

Job Reference No.: GCEC-PK-PU-320/2024

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Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 24A/ 19700

Client Detail:	
Client Name:	Multan Electric Power Company (MEPCO)
Consultant Name:	GOPA Intec-Multitech Consulting Engineers
Project Name:	Electricity Distribution Efficiency Improvement Project (EDEIP) for the Construction of 132 kV Grid Station and 27 Km Transmission Line
Name of Contact Person:	Mr. Hassan Raza
Designation:	Managing Director
Contact Number:	0321-4553805
Email:	Hassan@mcepak.com
Address:	121J, Johar Town, Lahore, Pakistan

GCEC Details:	
Director:	Mr. Mian Khurram Usman
Telephone:	+92 42 35962885
Fax:	+92 42 35962884
Email:	manager.operations@gcee.ae
Address	House No. 368-B Block B, Canal View, Lahore

Signatories:

Green Crescent Environmental Consultants Pvt. Ltd. ★ PAKISTAN ★

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Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 24A/ 19701

CHEMICAL ANALYSIS TEST REPORT (DRINKING WATER)

Sample Details			
Job Ref. No:	GCEC-PK-PU-320/2024	Client Name:	Multan Electric Power Company (MEPCO)
Telephone No.	0337-9820818	Consultant Name:	GOPA Intec- Multitech Consulting Engineers
Sample Date:	06-12-2024	Sample Matrix:	Drinking Water Sample
Sample Receipt Date:	07-12-2024	Sampled By:	GCEC
Grab/Composite:	Grab Sampling	Date of Completion of Analysis:	13-12-2024
Address:	121J, Johar Town, Lahore, Pakistan		
Project Name:	Electricity Distribution Efficiency Improvement Project (EDEIP) for the Construction of 132 kV Grid Station and 27 Km Transmission Line		

Sample Identification	
01	Tube well Point Near Site Location

Parameters	Analysis Method	Unit	LOR	Result 01	PEQS
PHYSICAL & CHEMICAL ANALYSIS					
pH**	APHA-4500H+ B	-	0.01	7.06	6.5-8.5
Odor	In-house	-	-	Odorless	Non-Objectionable
Taste	In-house	-	-	Sweet	Non-Objectionable
Color	APHA-2120 B/C	Pt/Co	1.0	<1.0	≤15 TCU
Turbidity**	APHA-2130 B	NTU	0.1	<0.1	<5 NTU
Total Hardness**	APHA-2340 B & C	mg/l	0.1	328.0	< 500 mg/l
Total Dissolved Solid (TDS)**	APHA-2540 C	mg/l	1.0	686.0	< 1000
Ammonia	APHA-4500-NH3 B	mg/l	0.002	<0.002	-
Chloride**	APHA-4500Cl- B	mg/l	0.24	48.92	< 250
Cyanide (CN)	APHA-4500CN- E	mg/l	0.01	<0.01	≤ 0.05
Fluoride (F)**	APHA-4500F- D	mg/l	0.01	<0.01	≤ 1.5
Nitrite	APHA-4500NO2 B	mg/l	0.01	<0.01	≤ 3 (P)
Nitrate**	APHA-4500NO3 C	mg/l	0.1	0.16	≤ 50
Phenolic Compound	APHA-5530 D	mg/l	0.01	<0.01	-
Residual Chlorine	APHA-4500Cl G	mg/l	0.1	<0.1	0.2-0.5
Aluminum (Al)	APHA-3111Al B	mg/l	0.028	<0.028	≤ 0.2
Cadmium**	APHA-3111Cd B	mg/l	0.0028	<0.0028	0.01
Copper**	APHA-3111Cu B	mg/l	0.0045	<0.0045	2
Chromium**	APHA-3111Cr B	mg/l	0.0054	<0.0054	≤ 0.05 (P)
Mercury	APHA-3112Hg B	mg/l	0.0008	<0.0008	≤ 0.001
Antimony (Sb)**	APHA-3111Sb B	mg/l	-	ND	≤ 0.005 (P)
Nickel**	APHA-3111Ni C	mg/l	0.008	<0.008	≤ 0.02
Zinc**	APHA-3111Zn B	mg/l	0.0033	<0.0033	5.0
Arsenic	APHA-3111As B	mg/l	0.01	<0.01	≤ 0.05 (P)
Barium	APHA-3111Ba B	mg/l	0.031	<0.031	0.7
Manganese**	APHA-3111Mn B	mg/l	0.0016	<0.0016	≤ 0.5
Iron**	APHA-3111Fe B	mg/l	0.1	<0.1	-
Boron	APHA-4500-B (C)	mg/l	0.1	<0.1	0.3
Lead**	APHA-3111Pb B	mg/l	0.013	<0.013	≤ 0.05
Selenium	APHA-3111Se B	mg/l	-	ND	0.01 (P)
MICROBIOLOGICAL ANALYSIS					
Total Coliforms	APHA:9222 B	CFU/100ml		Absent	0/100ml
Faecal Coliforms (Ecoli)	APHA:9222 D	CFU/100ml		Absent	0/100ml

Abbreviations:
ND: Not Detected **LOR:** Limit of Reporting **PEQS:** Punjab Environmental Quality Standards

Note:
*Uncertainty of all the parameters and laboratory conditions at the time of analysis will be provided as per client's requirement. The lab environmental conditions are maintained at 25±5C° and humidity at 50±20%. **Disclaimer:** The results are solely of the sample provided. **All the starred parameters are PNAC accredited.

Sample Analyzed By:

Analyst
Mr. Idrees Zaman

Name of Chief Analyst with Seal:

Mr. Usman Raza Jaswal

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Sr. No# 24A/ 19702

Ambient Air Monitoring Location

SITE AREA

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Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 24A/ 19703

Ambient Air Quality Monitoring

Job Reference Number	GCEC-PK-PU-320/2024
Monitoring Point	Site Area
Date of Intervention	06-Dec-2024 to 07-Dec-2024
Monitoring Coordinates	28°33'20.4"N 70°16'39.5"E

Sr. #	Time	CO (mg/m³)	NO (µg/m³)	NO_2 (µg/m³)	NO_x (µg/m³)	SO_2 (µg/m³)
1.	08:15	1.13	17.60	29.96	47.56	15.05
2.	09:15	1.74	18.72	26.92	45.65	16.11
3.	10:15	1.61	11.45	27.55	39.00	17.58
4.	11:15	1.77	12.55	26.61	39.16	15.90
5.	12:15	1.74	15.28	30.07	45.34	16.27
6.	13:15	1.79	17.75	31.32	49.07	17.58
7.	14:15	1.83	17.24	34.57	51.81	16.90
8.	15:15	1.41	12.34	31.64	43.98	17.05
9.	16:15	1.51	16.40	33.52	49.92	16.27
10.	17:15	1.54	14.91	29.96	44.87	16.31
11.	18:15	1.63	19.60	26.92	46.53	17.31
12.	19:15	1.62	14.78	27.55	42.34	18.58
13.	20:15	1.72	19.63	26.61	46.24	16.40
14.	21:15	1.10	16.66	30.07	46.73	15.53
15.	22:15	1.52	17.78	31.32	49.11	17.74
16.	23:15	1.41	10.51	34.57	45.08	17.85
17.	00:15	1.51	11.60	29.96	41.57	17.53
18.	01:15	1.74	14.33	26.92	41.26	16.22
19.	02:15	1.28	16.80	27.55	44.35	17.06
20.	03:15	1.39	16.30	26.61	42.91	18.27
21.	04:15	2.73	11.39	30.07	41.46	16.58
22.	05:15	1.31	15.46	31.32	46.78	17.48
23.	06:15	2.07	13.96	34.57	48.54	16.89
24.	07:15	1.83	12.05	31.64	43.68	16.48
Average Concentration		1.48	14.82	30.80	45.62	15.76

Monitoring Performed By:
Deputy Analyst
Muhammad Ilyas

Name of Chief Analyst with Seal:
Mr. Usman Raza Jaswal

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Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 24A/ 19704

Ambient Air Quality Monitoring

Job Reference Number	GCEC-PK-PU-320/2024
Monitoring Point	Site Area
Date of Intervention	06-Dec-2024 to 07-Dec-2024
Monitoring Coordinates	28°33'20.4"N 70°16'39.5"E

Parameter	Unit	Monitoring Duration	LDL	Average Obtained Concentration	PEQS
Nitrogen Dioxide (NO_2)	µg/m³	24 Hours	1.00	30.80	80.0
Nitrogen Oxide (NO)	µg/m³	24 Hours	1.00	14.82	40.0
NO_x	µg/m³	24 Hours	1.00	45.62	120.0
Sulphur Dioxide (SO_2)	µg/m³	24 Hours	1.00	15.76	120.0
Carbon Monoxide (CO)	mg/m³	24 Hours	0.01	1.48	5.0*
Ozone (O_3)	µg/m³	24 Hours	-	21.37	130.0**
Particulate Matter ($PM_{2.5}$)	µg/m³	24 Hours	1.00	28.47	35.0
Particulate Matter (PM_{10})	µg/m³	24 Hours	1.00	125.32	150.0
Suspended Particulate Matter (SPM)	µg/m³	24 Hours	1.00	188.79	500.0
Lead Airborne Particles	µg/m³	24 Hours	-	0.18	1.5

Abbreviations:
µg/m³= Micrograms per Cubic Meter
mg/m³= Milligrams per Cubic Meter
LDL= Lowest Detection Limit
PEQS= Punjab Environmental Quality Standards
*08 hour standard for CO
**01 hour standard for O_3

Monitoring Performed By:
Deputy Analyst
Muhammad Ilyas

Name of Chief Analyst with Seal:
ME Usman Raza Jaswal

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Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 24A/ 19705

Meteorological Data

Job Reference Number	GCEC-PK-PU-320/2024
Monitoring Point	Site Area
Date of Intervention	06-Dec-2024 to 07-Dec-2024
Monitoring Coordinates	28°33'20.4"N 70°16'39.5"E

Time	Ambient Temperature °C	Wind Direction	Wind Velocity m/s	Humidity %	Pressure (mm of Hg)
08:15	19	NE	6.8	48	756.3
09:15	19	NE	6.9	48	757.0
10:15	20	NE	6.7	48	755.7
11:15	20	NE	6.9	46	755.8
12:15	22	NE	6.7	39	757.4
13:15	24	NE	5.1	34	755.9
14:15	25	NW	6.0	31	756.7
15:15	26	NW	5.9	29	757.8
16:15	25	NW	5.4	29	757.1
17:15	21	NW	5.8	33	758.3
18:15	19	NW	5.7	38	756.3
19:15	17	NW	5.1	45	755.2
20:15	16	NW	3.4	50	757.1
21:15	15	N	4.0	52	756.1
22:15	15	N	3.9	54	756.1
23:15	13	N	3.7	52	755.8
00:15	13	N	3.9	54	755.1
01:15	12	N	5.2	54	754.9
02:15	11	N	6.8	57	757.1
03:15	11	NE	6.7	59	756.1
04:15	10	NE	6.2	61	756.5
05:15	9	NE	6.8	59	756.1
06:15	9	NE	6.5	60	756.1
07:15	11	NE	6.6	58	755.6

Monitoring Performed By:
Deputy Analyst
Muhammad Ilyas

Name of Chief Analyst with Seal:
Mr. Usman Raza Jaswal

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Environmental Consultants Pvt. Ltd.

Sr. No# 24A/ 19706

Noise Level Monitoring Report

Job Reference Number	GCEC-PK-PU-320/2024
Monitoring Point	Site Area
Date of Intervention	06-Dec-2024 to 07-Dec-2024
Monitoring Coordinates	28°33'20.4"N 70°16'39.5"E

Sr. #	Time	Method/Technique	Unit	Results LAavg	PEQS (Commercial)
		Night Time			
1.	23:15	Noise Meter	dB	47.4	
2.	00:15	Noise Meter	dB	47.1	
3.	01:15	Noise Meter	dB	45.4	
4.	02:15	Noise Meter	dB	46.3	
5.	03:15	Noise Meter	dB	45.5	55.0
6.	04:15	Noise Meter	dB	46.5	
7.	05:15	Noise Meter	dB	43.6	
8.	06:15	Noise Meter	dB	46.4	
	Night Time Average		dB	46.01	55.0
		Day Time			
9.	07:15	Noise Meter	dB	45.3	
10.	08:15	Noise Meter	dB	47.2	
11.	09:15	Noise Meter	dB	47.5	
12.	10:15	Noise Meter	dB	47.4	
13.	11:15	Noise Meter	dB	45.5	
14.	12:15	Noise Meter	dB	46.4	
15.	13:15	Noise Meter	dB	46.3	
16.	14:15	Noise Meter	dB	46.5	
17.	15:15	Noise Meter	dB	48.3	65.0
18.	16:15	Noise Meter	dB	45.5	
19.	17:15	Noise Meter	dB	45.3	
20.	18:15	Noise Meter	dB	46.3	
21.	19:15	Noise Meter	dB	47.4	
22.	20:15	Noise Meter	dB	47.1	
23.	21:15	Noise Meter	dB	47.5	
24.	22:15	Noise Meter	dB	46.4	
	Day Time Average		dB	46.60	65.0

Monitoring Performed By:
Deputy Analyst
Muhammad Ilyas

Name of Chief Analyst with Seal:
Mr. Usman Raza Jaswal

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Pictorial Evidence for Drinking Water Sampling & Ambient Air Monitoring

Figure 1: Drinking Water Sampling

Figure 2: Ambient Air Monitoring

End of Report

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042 35962884-85 0320 4143318
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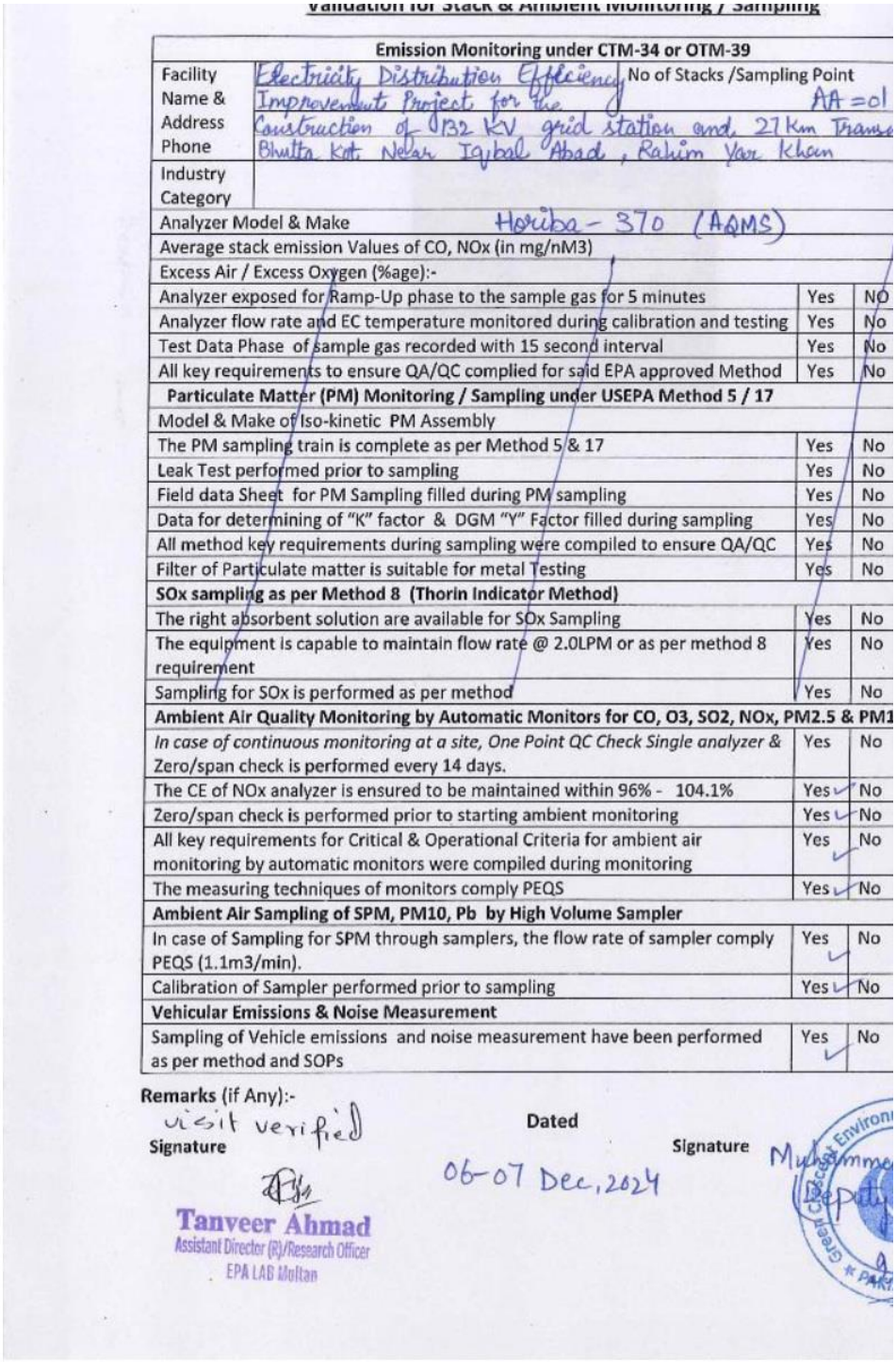

Validation for Stack & Ambient Monitoring / Sampling

Emission Monitoring under CTM-34 or OTM-39			
Facility Name & Address Phone	Electricity Distribution Efficiency Improvement Project for the Construction of 132 KV grid station and 27 Km Trans... Bhutta Kot Nolar Iqbal Abad, Rahim Yar Khan	No of Stacks /Sampling Point	AA =01
Industry Category			
Analyzer Model & Make	Horiba - 370 (AQMS)		
Average stack emission Values of CO, NOx (in mg/nM3)			
Excess Air / Excess Oxygen (%age):-			
Analyzer exposed for Ramp-Up phase to the sample gas for 5 minutes		Yes	NO
Analyzer flow rate and EC temperature monitored during calibration and testing		Yes	No
Test Data Phase of sample gas recorded with 15 second interval		Yes	No
All key requirements to ensure QA/QC complied for said EPA approved Method		Yes	No
Particulate Matter (PM) Monitoring / Sampling under USEPA Method 5 / 17			
Model & Make of Iso-kinetic PM Assembly			
The PM sampling train is complete as per Method 5 & 17		Yes	No
Leak Test performed prior to sampling		Yes	No
Field data Sheet for PM Sampling filled during PM sampling		Yes	No
Data for determining of "K" factor & DGM "Y" Factor filled during sampling		Yes	No
All method key requirements during sampling were compiled to ensure QA/QC		Yes	No
Filter of Particulate matter is suitable for metal Testing		Yes	No
SOx sampling as per Method 8 (Thorin Indicator Method)			
The right absorbent solution are available for SOx Sampling		Yes	No
The equipment is capable to maintain flow rate @ 2.0LPM or as per method 8 requirement		Yes	No
Sampling for SOx is performed as per method		Yes	No
Ambient Air Quality Monitoring by Automatic Monitors for CO, O3, SO2, NOx, PM2.5 & PM1			
In case of continuous monitoring at a site, One Point QC Check Single analyzer & Zero/span check is performed every 14 days.		Yes	No
The CE of NOx analyzer is ensured to be maintained within 96% - 104.1%		Yes ✓	No
Zero/span check is performed prior to starting ambient monitoring		Yes ✓	No
All key requirements for Critical & Operational Criteria for ambient air monitoring by automatic monitors were compiled during monitoring		Yes ✓	No
The measuring techniques of monitors comply PEQS		Yes ✓	No
Ambient Air Sampling of SPM, PM10, Pb by High Volume Sampler			
In case of Sampling for SPM through samplers, the flow rate of sampler comply PEQS (1.1m3/min).		Yes ✓	No
Calibration of Sampler performed prior to sampling		Yes ✓	No
Vehicular Emissions & Noise Measurement			
Sampling of Vehicle emissions and noise measurement have been performed as per method and SOPs		Yes ✓	No

Remarks (if Any):- visit verified

Dated 06-07 Dec, 2024

Signature

Tanveer Ahmad
Assistant Director (R)/Research Officer
EPA LAB Multan

Signature

Muhammad
Deputy

Facility /Project Name & Address Phone	Electricity Distribution Efficiency Improvement Project for the construction of 132 kV grid station and 27 Km Transmission Line Bhutta Kot Near Iqbal Abad, Rahim Yar Kha	Sampling Point DW=01

Waste Water (WW) Treatment facility: Primary Secondary Tertiary NA

Drinking Water (W) Treat

Total WW collected Sample .....

Total Collected Drinking wate

Sample Tag for testing parameter is assigned on sample container	Yes ✓	N
Sample is preserved properly for each testing parameter	Yes ✓	N
Sample size is adequate for testing the target parameters	Yes ✓	N
Wastewater Flow Measurement performed to ensure sample representativeness	Yes ✓	N

No. of Waste Water outlets	Waste Water Flow m^3/hr from each outlet (Optional)	Water intake m^3/hr (Optional)	Water Mass balance complied during sampling (Optional)	Sample Type
—	—	—	Yes No	Drinking Grab ✓

Parameter	Matrix W	Matrix WW	Container	Sample Size	Preservation	Y
Coliform, Total or Fecal	✓		Sterile Container	100 mL	Refrigerate 6 C	
Coliform, Total or Fecal, Chlorinated Water	✓		Sterile Container	100 mL	0.008% Thiosulphate & cooled 6 C	
Color, Turbidity	✓		P,G	500 mL	Cool 6 C	
Hardness, Total	✓		P,G	500ml	1INO3 to pH<2	
Nitrogen, Nitrate + Nitrite , Phenolic Compounds, Oil & Grease, COD, NH3	✓		P,G	2000 mL	H2SO4 to pH < 2, Cool 6C	
Metals, General	✓		P,G Rinsed 1.1 HNO3	500 mL	HNO3 to pH < 2	
Cyanide, Total	✓		P,G	500 mL	NaOH to pH > 12, Cool 6C	
Pesticides, General	X		Glass	1 Liter	Cool 6 C	

Field Parameters*

Field parameter		pH meter, Model Make	Measurement Method	Ca in
pH		Lovibond	APHA-4500 B	Ye
Temp		Digital Thermometer		
Cl				

*** Field testing parameters only be validated by RAs, ROs, DD (Labs)**

Remarks for Sample Quality (if Any):-

Visit verified

Dated 07-Dec-2024

Signature

Tanveer Ahmad
Assistant Director (R)/Research Officer
EPA LAB Multan

Signature

ENVIRONMENTAL MONITORING, SAMPLING AND TESTING REPORT

FOR

Electricity Distribution Efficiency Improvement Project (EDEIP) for the Construction of 132 kV Grid Station and 27 Km Transmission Line

(District Shahjamal)

MULTITECH CONSULTING ENGINEERS

Prepared by: Green Crescent Environmental Consultants Pvt. Ltd

Reference Number: GCEC-PK-PU-320/2024

Contact Details of Client	
Client Name	Multan Electric Power Company (MEPCO)
Consultant Name	GOPA Intec-Multitech Consulting Engineers
Project Name	Electricity Distribution Efficiency Improvement Project (EDEIP) for the Construction of 132 kV Grid Station and 27 Km Transmission Line
Contact Person	Mr. Hassan Raza
Designation	Managing Director
Contact Number	0321-4553805
Email ID	Hassan@mcepak.com
Address	121J, Johar Town, Lahore, Pakistan
Contact Details of GCEC-Pakistan	
Director:	Mr. Mian Khurram Usman
Telephone:	+92 42 35962885
Fax:	+92 42 35962884
Email:	manager.operations@gcee.ae
Address	House No. 368-B Block B, Canal View, Lahore

Reference Number: GCEC-PK-PU-320/2024

Approved By:

Zara Yousaf
Coordination Department

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LIST OF ABBREVIATIONS

AA	Ambient Air
DW	Drinking Water
SPL	Sound Pressure Level
dB	Decibels
mg/m3	Milligram per Cubic meter
mg/l	Milligram per Liter
µg/m³	Micrograms per Cubic Meter
CO	Carbon Monoxide
SO_2	Sulfur Dioxide
NOx	Oxides of nitrogen
O_2	Oxygen
SPM	Suspended Particulate Matter
LDL	Lowest Detection Limit
PEQS	Punjab Environmental Quality Standards
LOR	Limit of Reporting
PM	Particulate Matter
SOPs	Standard Operating Procedures
TSS	Total Suspended Solids
APHA	American Public Health Association

SECTION 1: OBJECTIVES & SCOPE

1.1 STUDY OBJECTIVES

Followings were the main objectives of the study:

- To assess the current conditions of the environment in the surroundings of project area.
- To help the consultant and contractor to develop the strategies for the protection and betterment of environment.

1.2 SCOPE OF SERVICES

Scope of services covered following main components:

- Ambient Air Quality Monitoring
- Noise Level Monitoring
- Drinking Water Sampling & Analysis

MONITORING TEAM

Monitoring team of Green Crescent Environmental Consultants involved in the monitoring and sampling is given in below table:

Table 1-1 Monitoring Team

Sr. No.	Name of The Employee	Designation
1.	Muhammad Ilyas Durrani	Executive Field Officer

SECTION 2: ENVIRONMENTAL MONITORING, SAMPLING & TESTING SCHEDULE

Detailed Environmental monitoring was conducted at the mutually agreed sites of project area. The monitoring and sampling was conducted from 7th Dec to 8th Dec. 2024.

Table 2-1 Environmental Monitoring, Sampling & Testing Schedule

Sr. #	Intervention Date	Activity	Monitoring Location
1.	07-12-2024 to 08-12-2024	• Ambient Air Quality Monitoring • Meteorological Monitoring	Site Area
2.	08-12-2024	Drinking Water	Water Pump Near Site Location

SECTION 3: ENVIRONMENTAL MONITORING, SAMPLING & TESTING LOCATIONS

Environmental monitoring, sampling & testing locations are as per shown in the following figure.

Figure 3-1: Map Showing Ambient Air Monitoring Locations (7th Dec. to 8th Dec.2024)

Figure 3-2: Map Showing Drinking Water Sampling Location (8th Dec. 2024)

SECTION 4: ENVIRONMENTAL MONITORING, SAMPLING & TESTING METHODOLOGY

Following is a brief description of the methodology adopted for this Environmental Monitoring, Sampling & Testing including Ambient Air, Metrological Data, Noise and Water Analysis:

4.1 Onsite Monitoring

Among the environmental parameters selected by the client;

- Ambient Air
- Temperature and pH of water samples

Were monitored onsite. Ambient air monitoring including metrological monitoring and noise level monitoring was conducted using portable digital instruments while temperature and pH of the water samples were monitored manually using thermometer and pH strips. A brief description of each digital instrument used for onsite monitoring is given below;

4.1.1 Vantage Pro2, Davis

The Davis 6152 Wireless Vantage Pro2 Weather Station which was made in 2018 in America which consists of a console unit and an innovative integrated sensor suite that includes a rain collector with self-emptying bucket, temperature and humidity sensors and an anemometer. The sensor suite is housed inside a radiation shield, protecting the sensors against solar radiation and additional sources of reflected and/or radiated heat. It provides accurate weather data in a sophisticated yet easy-to-read format. With Wireless Vantage Pro2 Weather Station we can continuously measure metrological parameters including;

- Temperature
- Wind Direction
- Wind Velocity
- Humidity

- Atmospheric Pressure

Davis wireless weather station Vintage Pro2 was used for the assessment of these parameters according to standard operating procedures and obtained results are presented in **Annex-1** of this report.

Figure 4-1: View of Davis Vintage Pro at Site

4.1.2 Dust Trak II Aerosol Monitor 8530, TSI

The Dust Trak II Aerosol Monitor 8530 is a desktop battery-operated, data-logging, light-scattering laser photometer which was manufactured in 2014, that gives you realtime aerosol mass readings.

It uses a sheath air system that isolates the aerosol in the optics chamber to keep the optics clean for improved reliability and low maintenance. Using this instrument, particulate matter was monitored including;

- PM_{10}
- $PM_{2.5}$
- TSP

Figure 4-2: DustTrak II aerosol monitor 8530

4.1.3 Model 407730 Digital Sound Level Meter, Extech

It is a noise measuring instrument used to assess sound levels by measuring sound pressure. Often referred to as a sound pressure level (SPL) meter, decibel (dB) meter, noise meter or noise dosimeter, a sound level meter uses a microphone to capture sound. The sound is then evaluated within the device and acoustic measurement values are displayed. The most common unit of acoustic measurement for sound is the decibel (dBA). Hourly noise level monitoring was done for 24 hours at each point of selected location. Digital Sound meter was manufactured in 2014.

Noise level using portable digital sound meter was monitored at client's mutually agreed monitoring points. Noise level measurement was performed according to standard operating procedures and obtained results are presented in **Annex-1** of this report.

Figure 4-3: View of Digital Sound Level Meter

4.1.4 HORIBA

HORIBA, was manufactured in 2017, a Japanese brand which consists of ambient air analyzers and sampling systems for the measurement of regulatory pollutants and air quality control. It offers complete tailored or individual air quality monitoring solutions, in order to meet the requirements and regulatory needs of environmental monitoring.

4.1.4.1 AC32M. NITROGEN OXIDES ANALYZER (NO, NOX, NO2)

Chemiluminescence technology based, TÜV & US EPA approved. It is single chambered chemiluminescence technology with ultra-compact and lightweight – rackable 19"/3U. On board web server compatible with any internet browser and user interface with online help for the display, configuration, maintenance, diagnostics or software updating of the analyzer, remotely. It is capable to detect low levels of nitrogen oxides (NO-NO_2-NO_X) with standard ranges: 0-0.1/0.2/0.5/1.0 ppm

4.1.4.2 AF22E. NEW E-SERIES SO2 ANALYZER

UV Fluorescent sulfur dioxide analyzer AF22e, TUV certified and US-EPA approved for compliance with ISO 10498, 2008/50/EC, en 14212, EN 15267, 40 CFR part 53 SUB B and SUB C.

It is a light weight eco-friendly & eco-innovative conception unit which detects early signs of trouble, allows predictive maintenance, identifies the service needed and guides the service operations step by step.

It provides real-time calibration graph, animated synoptic, auto-diagnostic, control and maintenance data screens can be displayed while the instrument is operating. It provides superior metrological presentations for SO_2 measurements in the range as low as 0.05 ppm F.S.

4.1.4.3 CO12E. NEW E-SERIES CO ANALYZER

Non dispersive Infra-Red carbon monoxide analyzer CO12e, TUV certified and US-EPA approved for compliance with ISO 4224, EN 14626, EN 15267, 40 CFR part 53 SUB B and SUB C.

It is a light weight eco-friendly & eco-innovative conception unit with breakthrough mechanical design for weight and power saving as well as thermal insulation & reliability. It has automatic or programmable response time adjustment, ensuring efficient monitoring of low concentration levels of carbon monoxide. It provides superior metrological presentations for CO measurements in the range 0-100 ppm.

4.2 Water Sample Collection and Preservation

Water samples were collected from mutually agreed sampling points according to the SOPs based on American Public Health Association (APHA) for water sampling and analysis. Decontaminated Plastic bottles were used to collect the samples. To prevent air bubbles from being trapped in the bottles, they were filled to the brim. The lids of the sampling bottles were then replaced tightly. The bottles were then labeled and chain of custody forms were filled out and signed to keep track of the collected samples. Collected samples were then preserved in appropriate containers as per APHA Preservation Guidelines. A shipping container containing ice packs with maintained temperature was used for transporting the samples from sampling location to GCEC Lahore Branch for testing.

4.2.1 Drinking Water Sampling & Analysis

Sampling for drinking water was carried out at mutually agreed sampling points. Physical and chemical parameters were analyzed afterwards in GCEC labs for drinking water sample. Analytical methods used during the laboratory testing were in line with the American Public Health Association's Standard Methods for the Examination of Water.

Analysis Results are presented in **Annex 1** of this report.

4.3 Sample Tagging and Chain of Custody

In GCEC Lahore Branch, samples and chain of custody form were handed over by Field Monitoring Staff to the Coordination Staff for in-house tagging and logging according to the company's policy and handed over to the Laboratory Staff for further physical, chemical and microbiological testing. A brief description of each sampling type and further proceedings are also discussed in following section.

SECTION 5: RESULTS & DISCUSSIONS

This section of the report presents the Environmental testing results of noise-level monitoring, ambient air quality & drinking water analysis

5.1 Background Noise Level Monitoring

The Noise monitoring activity was carried at different locations. Monitoring schedule is presented in Table 2-1. While a brief description of monitoring session is as below.

Hourly noise monitoring was conducted at four selected locations. The results of monitoring locations were compared with commercial noise standards for Punjab Environmental Quality Standards i.e., 65.0 dB (A) for Day Time and 55.0 dB (A) for Night Time.

Discussion on Noise Results

Noise level Monitoring was conducted for 24 hours at four monitoring locations. The monitoring results obtained are not complying with the commercial noise standards of PEQS. Day and Night Time averages for monitoring points are presented in figures below.

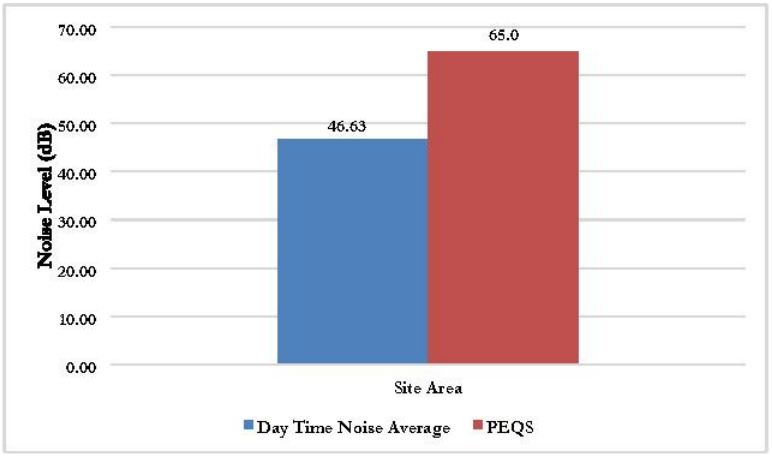

Figure 5-1: Day Time Average Noise Level Value Compared with Respective PEQS Standards

(7th Dec. to 8th Dec.2024)

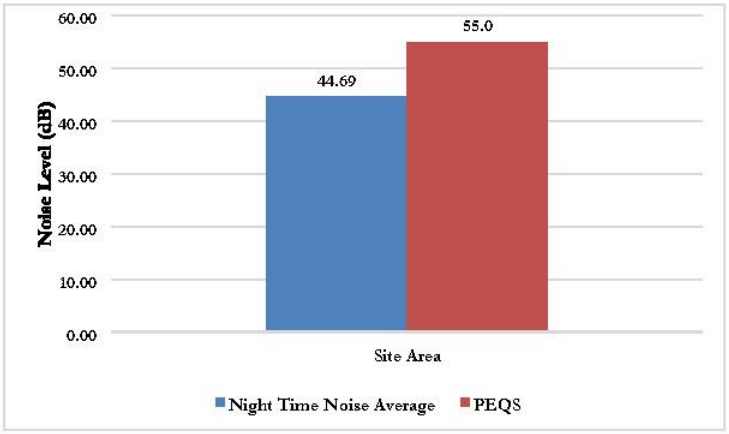

Figure 5-2: Night Time Average Noise Level Value Compared with Respective PEQS Standards (7th Dec. to 8th Dec.2024)

5.2 Ambient Air Quality Monitoring

The activity for monitoring the ambient air conditions was carried out at the agreed sites and its vicinity, for 24 hours at two monitoring locations starting from **(7th Dec. to 8th Dec.2024).** To assess the current quality of ambient air, Carbon Monoxide, Oxides of Nitrogen, Sulphur Dioxide, Ozone, Lead and Particulate Matter were monitored. Summary of monitoring results is presented in Table 5-1. Detailed result reports are also attached as **Annex 1**.

Discussion of NOx Measurements

The readings of NO, NO_2 and NOx for the project site and its surroundings comply with the Punjab Environmental Quality Standards i.e, 40 µg/m³, 80 µg/m³ and 120 µg/m³ respectively. Sum of NO and NO_2 is termed as NOx. NOx results found at the monitoring

location were within the PEQS limits. Monitoring results, compared with PEQS Standards, are graphically presented in figure below and in Summary Table below.

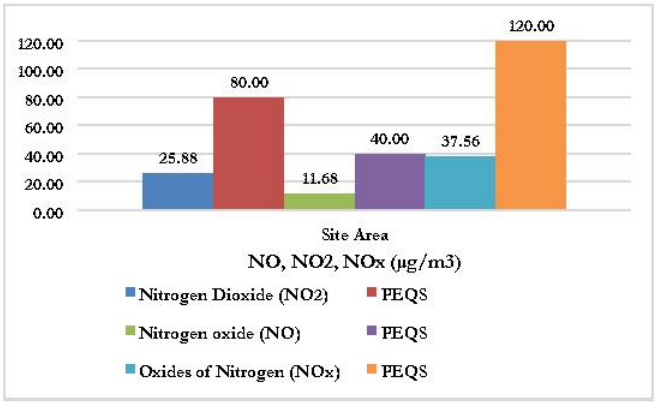

Figure 5-3: Daily Average NOx Measurements Compared with Respective PEQS Standards (7th Dec. to 8th Dec.2024)

Discussion of SO_2 Measurements

The SO_2 reading for both monitoring locations is presented in the summary table which depicts that the monitoring results are within the prescribed limits of PEQS i.e. 120 µg/m³. SO_2 results found at all two monitoring locations are within the PEQS limits.

Monitoring results, compared with PEQS Standards, are also graphically presented in figure below and in Summary Table 5-1 and 5-2.

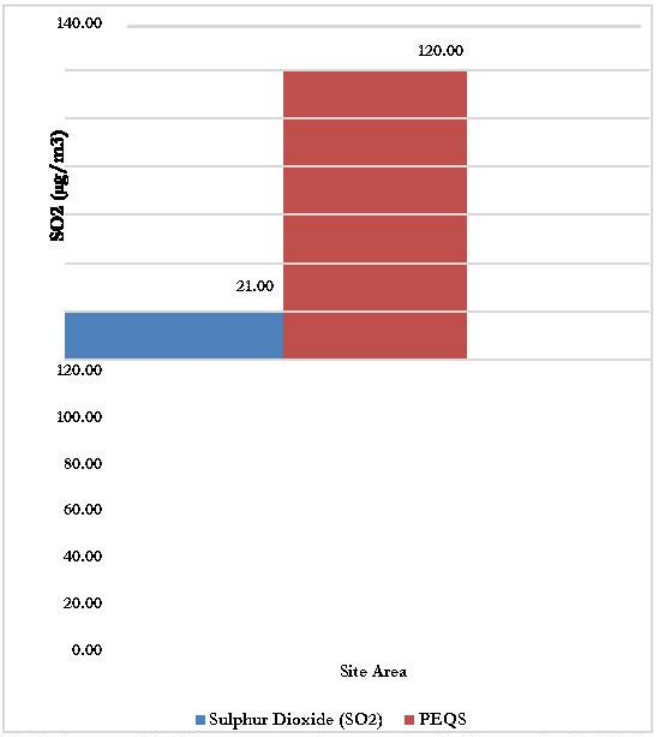

Figure 5-4: Daily Average SO_2 Measurement Compared with Respective PEQS Standards (7th Dec. to 8th Dec.2024)

Discussion of CO Measurements

Carbon Monoxide (CO) was monitored for 24 hours at two monitoring locations. The CO values detected at monitoring locations are within the permissible limit of PEQS i.e., 5.0 mg/m³. Monitoring results, compared with PEQS Standards, are graphically presented in figure below and in Summary Table below.

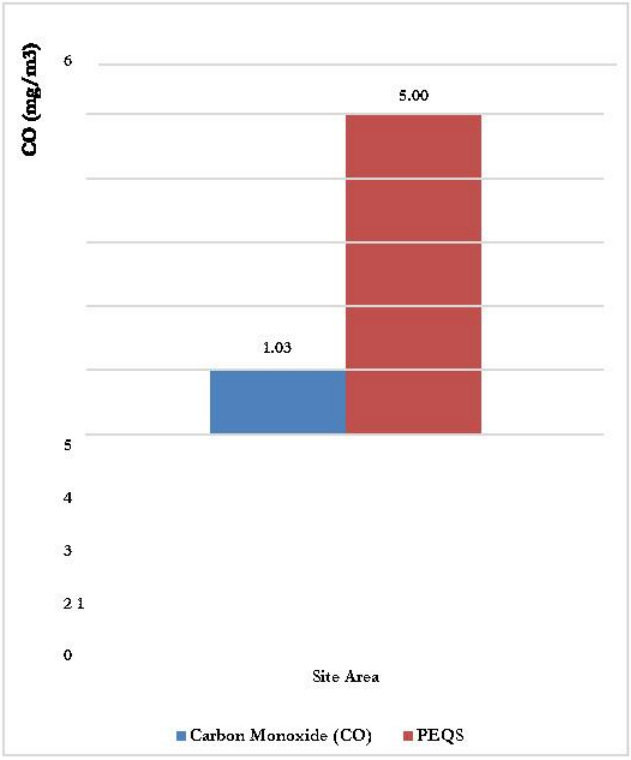

Figure 5-5: Daily Average CO Measurement Compared with Respective PEQS Standards (7th Dec. to 8th Dec.2024)

Discussion of Lead Measurements

Lead was monitored for 24 hours at two monitoring locations. The values detected at monitoring locations are within the permissible limit of PEQS i.e., 1.50 ug/m³. Monitoring results, compared with PEQS, are graphically presented in figure below and in Summary Table 5-1.

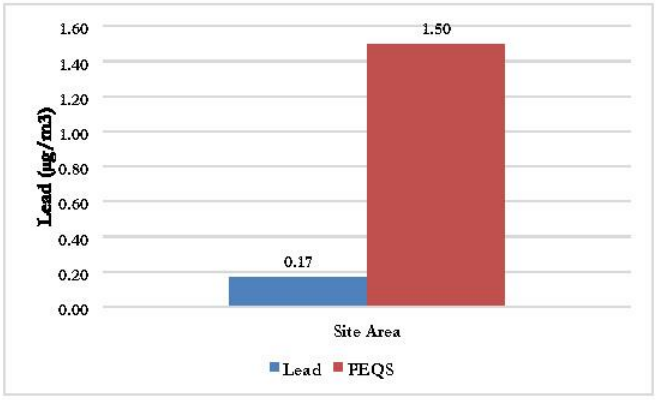

Figure 5-6: Daily Average Lead Measurement Compared with Respective PEQS Standards (7th Dec. to 8th Dec.2024)

Discussion of Ozone (O_3) Measurements

Ozone was monitored for 24 hours at two monitoring locations. The values detected at all two monitoring locations are within the permissible limit of PEQS i.e., 130 ug/m³. Monitoring results, compared with PEQS Standards, are graphically presented in figure below and in Summary Table below.

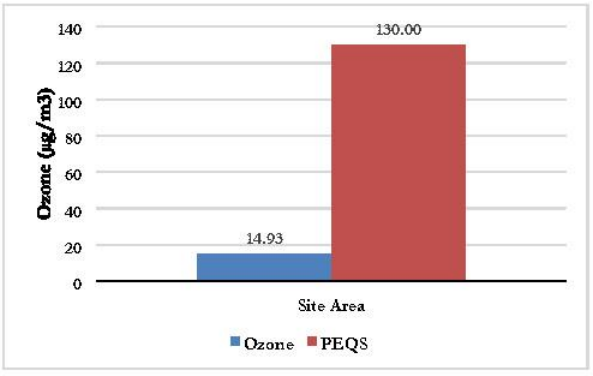

Figure 5-7: Daily Average Ozone Measurement Compared with Respective PEQS Standards (7th Dec. to 8th Dec.2024)

Discussion on Particulate Matter (PM_{10}, $PM_{2.5}$, TSP)

The monitoring results of *PM_{10}, $PM_{2.5}$* and *TSP* for all sites are compared with Punjab Environmental Quality Standard i.e., 150 µg/m³. The values of *PM_{10}, $PM_{2.5}$* and *TSP* were found falling within the prescribed limits of PEQS Limits, except for *$PM_{2.5}$* and *PM_{10}* in CB-I Construction Site. Monitoring result, compared with PEQS Standards, is graphically presented in figure below and in Summary Table below.

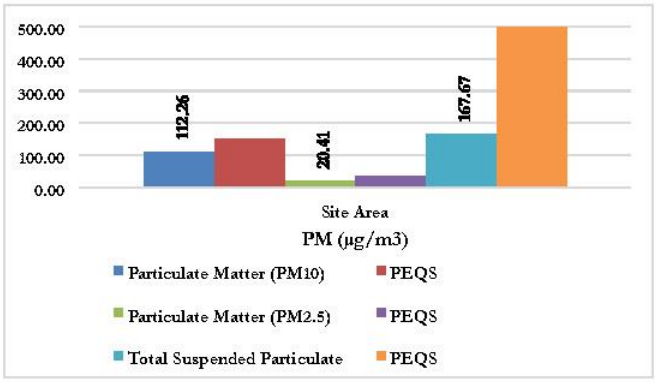

Figure 5-8: Daily Average TSP Measurements Compared with Respective PEQS Standards (7th Dec. to 8th Dec.2024)

Table 5-1 Summary of Ambient Air Quality Monitoring Results

Location Identification	
Monitoring Site:	01
Monitoring Location:	Site Area
Date:	07-Dec-2024 to 08-Dec-2024
Coordinates:	29°56'11.5"N 70°58'05.7"E

Parameter	Unit	Monitoring Duration	LDL	Average Obtained Concentration	PEQS
				01	
Nitrogen Dioxide (NO_2)	µg/m³	24 Hours	1.00	25.88	80.0
Nitrogen oxide (NO)	µg/m³	24 Hours	1.00	11.68	40.0
NO_X	µg/m³	24 Hours	1.00	37.56	120.0
Sulphur Dioxide (SO_2)	µg/m³	24 Hours	1.00	21.00	120.0
Carbon Monoxide (CO)	mg/m³	24 Hours	0.01	1.03	5.0
Ozone (O_3)	µg/m³	24 Hours	-	14.93	130.0**
Lead	µg/m³	24 Hours	0.05	0.17	1.50
Particulate Matter (PM_{10})	µg/m³	24 Hours	1.00	112.26	150.0
Particulate Matter ($PM_{2.5}$)	µg/m³	24 Hours	1.00	20.41	35.0

Total Suspended Particulate (TSP)	µg/m³	24 Hours	1.00	167.67	500.0

Abbreviations:
LDL= Lowest Detection Limit
PEQS= Punjab Environmental Quality Standards
*(24 Hours Standard for all the parameters Except O_3 and CO)
**(1 Hour Standard for O_3)
*(24 Hours Standard for all the parameters Except O_3) **µg/m³**= Micrograms per Cubic Meter **mg/m³**= Milligrams per Cubic Meter

5.3 Drinking Water Analysis

Drinking water sample were collected from one location on 08-12-2024 which were preserved and submitted in GCEC-Laboratory according to the standard methods. Summary of Analysis Results are given below in **Table 5-3**.

Discussion on Results

The laboratory test results of drinking water samples are summarized in the table below. It is obvious from the analysis results that the drinking water meets the permissible limits of Punjab Environmental Quality Standards for all tested parameters

Reference Number: GCEC-PK-PU-320/2024

Table 5-2 Summary of Drinking Water Analysis Results

Sample Marking & Identification			
01	Water Pump Near Site Location	Sampling Coordinates:	29°56'11.5"N 70°58'05.7"E

Parameters	Analysis Method	Unit	LOR	Result	PEQS
				01	
PHYSICAL & CHEMICAL ANALYSIS					
pH**	APHA-4500H+ B	-	0.01	7.09	6.5-8.5
Odor	In-house	-	-	Odorless	Non-Objectionable
Taste	In-house	-	-	Sweet	Non-Objectionable
Color	APHA-2120 B/C	Pt/Co	1.0	<1.0	≤15 TCU
Turbidity**	APHA-2130 B	NTU	-	<0.1	<5 NTU
Total Hardness**	APHA-2340 B & C	mg/l	0.1	344.0	< 500 mg/l
Total Dissolved Solid (TDS)**	APHA-2540 C	mg/l	1.0	732.0	< 1000
Ammonia	APHA-4500-NH_3-B	mg/l	0.002	<0.002	-
Chloride (Cl)**	APHA-4500Cl- B	mg/l	0.24	66.53	< 250
Cyanide (CN)	APHA-4500CN E	mg/l	0.01	<0.01	≤ 0.05
Fluoride (F)**	APHA-4500F- D	mg/l	0.01	<0.01	≤ 1.5
Nitrite	APHA-4500NO2 B	mg/l	0.01	<0.01	≤ 3 (P)
Nitrate**	APHA-4500NO3 C	mg/l	0.1	<0.1	≤ 50
Phenolic Compound	APHA-5530 D	mg/l	0.01	<0.01	-
Residual Chlorine	APHA-4500Cl G	mg/l	0.1	<0.1	0.2-0.5
Aluminum (Al)	APHA-3111Al B	mg/l	0.028	<0.028	≤ 0.2
Cadmium**	APHA-3111Cd B	mg/l	0.0028	<0.0028	0.01
Copper**	APHA-3111Cu B	mg/l	0.0045	<0.0045	2
Chromium**	APHA-3111Cr B	mg/l	0.0054	<0.0054	≤ 0.05 (P)
Mercury	APHA-3112Hg B	mg/l	0.0008	<0.0008	≤ 0.001
Antimony (Sb)**	APHA-3111Sb B	mg/l	-	ND	≤ 0.005 (P)
Nickel**	APHA-3111Ni C	mg/l	0.008	<0.008	≤ 0.02
Zinc**	APHA-3111Zn B	mg/l	0.0033	<0.0033	5.0
Arsenic	APHA-3111As B	mg/l	0.01	<0.01	≤ 0.05 (P)
Barium	APHA-3111Ba B	mg/l	0.031	<0.031	0.7
Manganese**	APHA-3111Mn B	mg/l	0.0016	<0.0016	≤ 0.5
Iron**	APHA-3111Fe B	mg/l	0.1	<0.1	-
Boron	APHA-4500-B (C)	mg/l	0.1	<0.1	0.3
Lead**	APHA-3111Pb B	mg/l	0.013	<0.013	≤ 0.05
Selenium	APHA-3111Se B	mg/l	-	ND	0.01 (P)
MICROBIOLOGICAL ANALYSIS					
Total Coliforms	APHA:9222 B	CFU/100ml		Absent	0/100ml
Faecal Coliforms (Ecoli)	APHA:9222 D	CFU/100ml		Absent	0/100ml

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Abbreviations:
ND: Not Detected **LOR:** Limit of Reporting **PEQS:** Punjab Environmental Quality Standards
Note:
** Uncertainty of all the parameters and laboratory conditions at the time of analysis will be provided as per client's requirement. The lab environmental conditions are maintained at 25±5C° and humidity at 50±20%.*
Disclaimer: *The results are solely of the sample provided. **All the starred parameters are PNAC accredited.*

SECTION 6: CONCLUSION

Environmental monitoring was performed at mutually agreed sites to assess the environmental conditions of its surroundings.

The results of ambient air monitoring depict that all the tested parameters for air quality were within the permissible limits of Punjab Environmental Quality Standards.

Noise monitoring results of both sites were in compliance with the prescribed limits for commercial noise of Punjab Environmental Quality Standards.

Results of drinking water sample showed compliance with permissible limits of Punjab Environmental Quality Standards.

Reference Number: GCEC-PK-PU-320/2024

Environmental Monitoring, Sampling & Testing Analysis Reports

Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 24A/ 19708

Monitoring & Test Report

- Drinking Water
- Ambient Air
- Meteorological Data
- Noise Monitoring

GOPA Intec-Multitech Consulting Engineers (District Shahjamal)

14th Dec. 2024

Job Reference No.: GCEC-PK-PU-320/2024

1 of 9

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Sr. No# 24A/ 19709

Client Detail:	
Client Name:	Multan Electric Power Company (MEPCO)
Consultant Name:	GOPA Intec-Multitech Consulting Engineers
Project Name:	Electricity Distribution Efficiency Improvement Project (EDEIP) for the Construction of 132 kV Grid Station and 27 Km Transmission Line
Name of Contact Person:	Mr. Hassan Raza
Designation:	Managing Director
Contact Number:	0321-4553805
Email:	Hassan@mccpak.com
Address:	121J, Johar Town, Lahore, Pakistan

GCEC Details:	
Director:	Mr. Mian Khurram Usman
Telephone:	+92 42 35962885
Fax:	+92 42 35962884
Email:	manager.operations@gcee.ae
Address	House No. 368-B Block B, Canal View, Lahore

Signatories:

Green Crescent Environmental Consultants Pvt Ltd. ★PAKISTAN★

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Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 24A/ 19710

CHEMICAL ANALYSIS TEST REPORT (DRINKING WATER)

Sample Details			
Job Ref. No:	GCEC-PK-PU-320/2024	Client Name:	Multan Electric Power Company (MEPCO)
Telephone No.	0337-9820818	Consultant Name:	GOPA Intec- Multitech Consulting Engineers
Sample Date:	08-12-2024	Sample Matrix:	Drinking Water Sample
Sample Receipt Date:	09-12-2024	Sampled By:	GCEC
Grab/Composite:	Grab Sampling	Date of Completion of Analysis:	13-12-2024
Address:	121J, Johar Town, Lahore, Pakistan		
Project Name:	Electricity Distribution Efficiency Improvement Project (EDEIP) for the Construction of 132 kV Grid Station and 27 Km Transmission Line		
Sample Identification			
01	Water Pump Near Site Location		

Parameters	Analysis Method	Unit	LOR	Result 01	PEQS
PHYSICAL & CHEMICAL ANALYSIS					
pH**	APHA-4500H+ B	-	0.01	7.09	6.5-8.5
Odor	In-house	-	-	Odorless	Non-Objectionable
Taste	In-house	-	-	Sweet	Non-Objectionable
Color	APHA-2120 B/C	Pt/Co	1.0	<1.0	≤15 TCU
Turbidity**	APHA-2130 B	NTU	0.1	<0.1	<5 NTU
Total Hardness**	APHA-2340 B & C	mg/l	0.1	344.0	< 500 mg/l
Total Dissolved Solid (TDS)**	APHA-2540 C	mg/l	1.0	732.0	< 1000
Ammonia	APHA-4500-NH3-B	mg/l	0.002	<0.002	-
Chloride**	APHA-4500Cl- B	mg/l	0.24	66.53	< 250
Cyanide (CN)	APHA-4500CN E	mg/l	0.01	<0.01	≤ 0.05
Fluoride (F)**	APHA-4500F D	mg/l	0.01	<0.01	≤ 1.5
Nitrite	APHA-4500NO2 B	mg/l	0.01	<0.01	≤ 3 (P)
Nitrate**	APHA-4500NO3 C	mg/l	0.1	<0.1	≤ 50
Phenolic Compound	APHA-5530 D	mg/l	0.01	<0.01	-
Residual Chlorine	APHA-4500Cl G	mg/l	0.1	<0.1	0.2-0.5
Aluminum (Al)	APHA-3111Al B	mg/l	0.028	<0.028	≤ 0.2
Cadmium**	APHA-3111Cd B	mg/l	0.0028	<0.0028	0.01
Copper**	APHA-3111Cu B	mg/l	0.0045	<0.0045	2
Chromium**	APHA-3111Cr B	mg/l	0.0054	<0.0054	≤ 0.05 (P)
Mercury	APHA-3112Hg B	mg/l	0.0008	<0.0008	≤ 0.001
Antimony (Sb)**	APHA-3111Sb B	mg/l	-	ND	≤ 0.005 (P)
Nickel**	APHA-3111Ni C	mg/l	0.008	<0.008	≤ 0.02
Zinc**	APHA-3111Zn B	mg/l	0.0033	<0.0033	5.0
Arsenic	APHA-3111As B	mg/l	0.01	<0.01	≤ 0.05 (P)
Barium	APHA-3111Ba B	mg/l	0.031	<0.031	0.7
Manganese**	APHA-3111Mn B	mg/l	0.0016	<0.0016	≤ 0.5
Iron**	APHA-3111Fe B	mg/l	0.1	<0.1	-
Boron	APHA-4500-B (C)	mg/l	0.1	<0.1	0.3
Lead**	APHA-3111Pb B	mg/l	0.013	<0.013	≤ 0.05
Selenium	APHA-3111Se B	mg/l	-	ND	0.01 (P)
MICROBIOLOGICAL ANALYSIS					
Total Coliforms	APHA-9222 B	CFU/100ml		Absent	0/100ml
Faecal Coliforms (Ecoli)	APHA-9222 D	CFU/100ml		Absent	0/100ml

Abbreviations:
ND: Not Detected LOR: Limit of Reporting PEQS: Punjab Environmental Quality Standards

Note:
*Uncertainty of all the parameters and laboratory conditions at the time of analysis will be provided as per client's requirement. The lab environmental conditions are maintained at 25±5C° and humidity at 50±20%. Disclaimer: The results are solely of the sample provided. **All the starred parameters are PNAC accredited.

Sample Analyzed By:

Analyst
Mr. Idrees Zaman

Name of Chief Analyst with Seal:

Mr. Usman Raza Jaswal

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Sr. No# 24A/ 19711

Ambient Air Monitoring Location

SITE AREA

(Shah Jamal)

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Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 24A/ 19712

Ambient Air Quality Monitoring

Job Reference Number	GCEC-PK-PU-320/2024
Monitoring Point	Site Area
Date of Intervention	07-Dec-2024 to 08-Dec-2024
Monitoring Coordinates	29°56'11.5"N 70°58'05.7"E

Sr. #	Time	CO (mg/m³)	NO (µg/m³)	NO_2 (µg/m³)	NO_x (µg/m³)	SO_2 (µg/m³)
1.	12:46	1.05	11.21	24.72	35.93	21.83
2.	13:46	1.22	10.37	28.60	38.97	19.72
3.	14:46	0.24	11.00	27.03	38.03	15.92
4.	15:46	1.15	12.15	27.87	40.02	18.02
5.	16:46	1.23	11.42	24.62	36.04	19.07
6.	17:46	0.15	11.31	24.09	35.41	20.22
7.	18:46	1.09	11.94	25.25	37.19	20.85
8.	19:46	1.08	13.10	28.08	41.17	22.52
9.	20:46	1.24	12.15	24.62	36.77	24.41
10.	21:46	0.96	11.31	25.88	37.19	25.35
11.	22:46	0.92	10.37	24.72	35.09	22.52
12.	23:46	0.98	10.48	26.82	37.29	21.16
13.	00:46	1.00	8.90	28.08	36.98	25.46
14.	01:46	0.92	10.27	29.44	39.70	23.15
15.	02:46	0.98	9.74	27.87	37.61	21.89
16.	03:46	1.14	12.36	27.13	39.49	20.95
17.	04:46	1.13	12.05	29.12	41.17	21.37
18.	05:46	1.15	12.99	27.03	40.02	25.25
19.	06:46	1.12	11.31	27.76	39.08	24.41
20.	07:46	1.18	12.26	26.92	39.18	23.26
21.	08:46	1.20	11.52	24.62	36.14	22.10
22.	09:46	1.17	11.42	26.82	38.24	20.74
23.	10:46	1.06	11.31	27.87	39.18	21.48
24.	11:46	1.01	12.15	27.03	39.18	20.17
Average Concentration		**1.03**	**11.68**	**25.88**	**37.56**	**21.00**

Monitoring Performed By:
Deputy Analyst
Muhammad Ilyas

Name of Chief Analyst with Seal:
Mr. Kamran Raza Jaswal

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Environmental Consultants Pvt. Ltd.

Sr. No# 24A/ 19713

Ambient Air Quality Monitoring

Job Reference Number	GCEC-PK-PU-320/2024
Monitoring Point	Site Area
Date of Intervention	07-Dec-2024 to 08-Dec-2024
Monitoring Coordinates	29°56'11.5"N 70°58'05.7"E

Parameter	Unit	Monitoring Duration	LDL	Average Obtained Concentration	PEQS
Nitrogen Dioxide (NO_2)	µg/m³	24 Hours	1.00	25.88	80.0
Nitrogen Oxide (NO)	µg/m³	24 Hours	1.00	11.68	40.0
NO_X	µg/m³	24 Hours	1.00	37.56	120.0
Sulphur Dioxide (SO_2)	µg/m³	24 Hours	1.00	21.00	120.0
Carbon Monoxide (CO)	mg/m³	24 Hours	0.01	1.03	5.0*
Ozone (O_3)	µg/m³	24 Hours	-	14.93	130.0**
Particulate Matter ($PM_{2.5}$)	µg/m³	24 Hours	1.00	20.41	35.0
Particulate Matter (PM_{10})	µg/m³	24 Hours	1.00	112.26	150.0
Suspended Particulate Matter (SPM)	µg/m³	24 Hours	1.00	167.67	500.0
Lead Airborne Particles	µg/m³	24 Hours	-	0.17	1.5

Abbreviations:
µg/m³= Micrograms per Cubic Meter
mg/m³= Milligrams per Cubic Meter
LDL= Lowest Detection Limit
PEQS= Punjab Environmental Quality Standards
*08 hour standard for CO
**01 hour standard for O_3

Monitoring Performed By:
Deputy Analyst
Muhammad Ilyas

Name of Chief Analyst with Seal:
Mr. Usman Raza Jaswal

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Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 24A/ 19714

Meteorological Data

Job Reference Number	GCEC-PK-PU-320/2024
Monitoring Point	Site Area
Date of Intervention	07-Dec-2024 to 08-Dec-2024
Monitoring Coordinates	29°56'11.5"N 70°58'05.7"E

Time	Ambient Temperature °C	Wind Direction	Wind Velocity m/s	Humidity %	Pressure (mm of Hg)
12:46	20	NW	7.3	60	753.0
13:46	19	NW	7.4	62	753.7
14:46	19	W	7.2	62	752.4
15:46	19	NW	7.4	57	752.5
16:46	17	NW	7.2	52	754.2
17:46	16	NW	7.6	54	752.6
18:46	14	NW	7.5	54	753.4
19:46	11	SW	7.4	54	754.6
20:46	11	NW	6.9	47	755.7
21:46	12	W	7.3	72	755.1
22:46	13	W	7.2	72	753.0
23:46	16	NW	6.6	74	752.0
00:46	17	SW	6.9	79	750.9
01:46	12	NW	7.5	77	752.8
02:46	12	NW	7.4	72	752.8
03:46	12	NE	7.2	66	752.5
04:46	11	SW	7.4	68	751.9
05:46	11	SW	7.7	67	751.7
06:46	10	NE	7.3	66	753.8
07:46	9	NE	7.2	62	752.8
08:46	13	SW	7.7	57	754.2
09:46	14	NE	7.3	57	752.8
10:46	14	NE	7.0	59	752.8
11:46	16	NE	7.1	61	755.1

Monitoring Performed By:
Deputy Analyst
Muhammad Ilyas

Name of Authorized Analyst with Seal:
Mr. Usman Raza Jaswal

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Sr. No# 24A/ 19715

Noise Level Monitoring Report

Job Reference Number	GCEC-PK-PU-320/2024
Monitoring Point	Site Area
Date of Intervention	07-Dec-2024 to 08-Dec-2024
Monitoring Coordinates	29°56'11.5"N 70°58'05.7"E

Sr. #	Time	Method/Technique	Unit	Results LAavg	PEQS (Commercial)
		Night Time			
1.	23:46	Noise Meter	dB	45.0	
2.	00:46	Noise Meter	dB	43.3	
3.	01:46	Noise Meter	dB	46.6	
4.	02:46	Noise Meter	dB	45.6	
5.	03:46	Noise Meter	dB	44.2	55.0
6.	04:46	Noise Meter	dB	43.3	
7.	05:46	Noise Meter	dB	43.7	
8.	06:46	Noise Meter	dB	45.8	
	Night Time Average		dB	44.69	55.0
		Day Time			
9.	07:46	Noise Meter	dB	47.2	
10.	08:46	Noise Meter	dB	46.1	
11.	09:46	Noise Meter	dB	46.4	
12.	10:46	Noise Meter	dB	49.2	
13.	11:46	Noise Meter	dB	44.0	
14.	12:46	Noise Meter	dB	49.1	
15.	13:46	Noise Meter	dB	44.5	
16.	14:46	Noise Meter	dB	46.8	
17.	15:46	Noise Meter	dB	45.8	65.0
18.	16:46	Noise Meter	dB	43.5	
19.	17:46	Noise Meter	dB	46.7	
20.	18:46	Noise Meter	dB	54.6	
21.	19:46	Noise Meter	dB	45.2	
22.	20:46	Noise Meter	dB	44.7	
23.	21:46	Noise Meter	dB	46.5	
24.	22:46	Noise Meter	dB	45.6	
	Day Time Average		dB	46.63	65.0

Monitoring Performed By:
Deputy Analyst
Muhammad Ilyas

Name of Chief Analyst with Seal:
Mr. Usama Raza Jaswal

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Sr. No# 24A/ 19716

Pictorial Evidence for Drinking Water Sampling & Ambient Air Monitoring

Figure 1: Drinking Water Sampling from Water Pump Near Site Location

Figure 2: Ambient Air Monitoring of Site Area

End of Report

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Emission Monitoring under CTM-34 or OTM-39			
Facility Name & Address Phone	Electricity Distribution Efficiency Improvement Project for the construction of 132 kV grid station and 27 Km Trans Basti Jark, Mirza Rukh Karamdad Qureshi Road Shah	No of Stacks /Sampling Point	AA=01
Industry Category			
Analyzer Model & Make	Horiba - 370 (AAMS)		
Average stack emission Values of CO, NOx (in mg/nM3)			
Excess Air / Excess Oxygen (%age):-			
Analyzer exposed for Ramp-Up phase to the sample gas for 5 minutes		Yes	NO
Analyzer flow rate and EC temperature monitored during calibration and testing		Yes	No
Test Data Phase of sample gas recorded with 15 second interval		Yes	No
All key requirements to ensure QA/QC complied for said EPA approved Method		Yes	No
Particulate Matter (PM) Monitoring / Sampling under USEPA Method 5 / 17			
Model & Make of Iso-kinetic PM Assembly			
The PM sampling train is complete as per Method 5 & 17		Yes	No
Leak Test performed prior to sampling		Yes	No
Field data Sheet for PM Sampling filled during PM sampling		Yes	No
Data for determining of "K" factor & DGM "Y" Factor filled during sampling		Yes	No
All method key requirements during sampling were compiled to ensure QA/QC		Yes	No
Filter of Particulate matter is suitable for metal Testing		Yes	No
SOx sampling as per Method 8 (Thorin Indicator Method)			
The right absorbent solution are available for SOx Sampling		Yes	No
The equipment is capable to maintain flow rate @ 2.0LPM or as per method 8 requirement		Yes	No
Sampling for SOx is performed as per method		Yes	No
Ambient Air Quality Monitoring by Automatic Monitors for CO, O3, SO2, NOx, PM2.5 & PM1			
In case of continuous monitoring at a site, One Point QC Check Single analyzer & Zero/span check is performed every 14 days.		Yes	No
The CE of NOx analyzer is ensured to be maintained within 96% - 104.1%		Yes ✓	No
Zero/span check is performed prior to starting ambient monitoring		Yes ✓	No
All key requirements for Critical & Operational Criteria for ambient air monitoring by automatic monitors were compiled during monitoring		Yes ✓	No
The measuring techniques of monitors comply PEQS		Yes ✓	No
Ambient Air Sampling of SPM, PM10, Pb by High Volume Sampler			
In case of Sampling for SPM through samplers, the flow rate of sampler comply PEQS (1.1m3/min).		Yes ✓	No
Calibration of Sampler performed prior to sampling		Yes ✓	No
Vehicular Emissions & Noise Measurement			
Sampling of Vehicle emissions and noise measurement have been performed as per method and SOPs		Yes ✓	No

Remarks (if Any):-

Visit verified

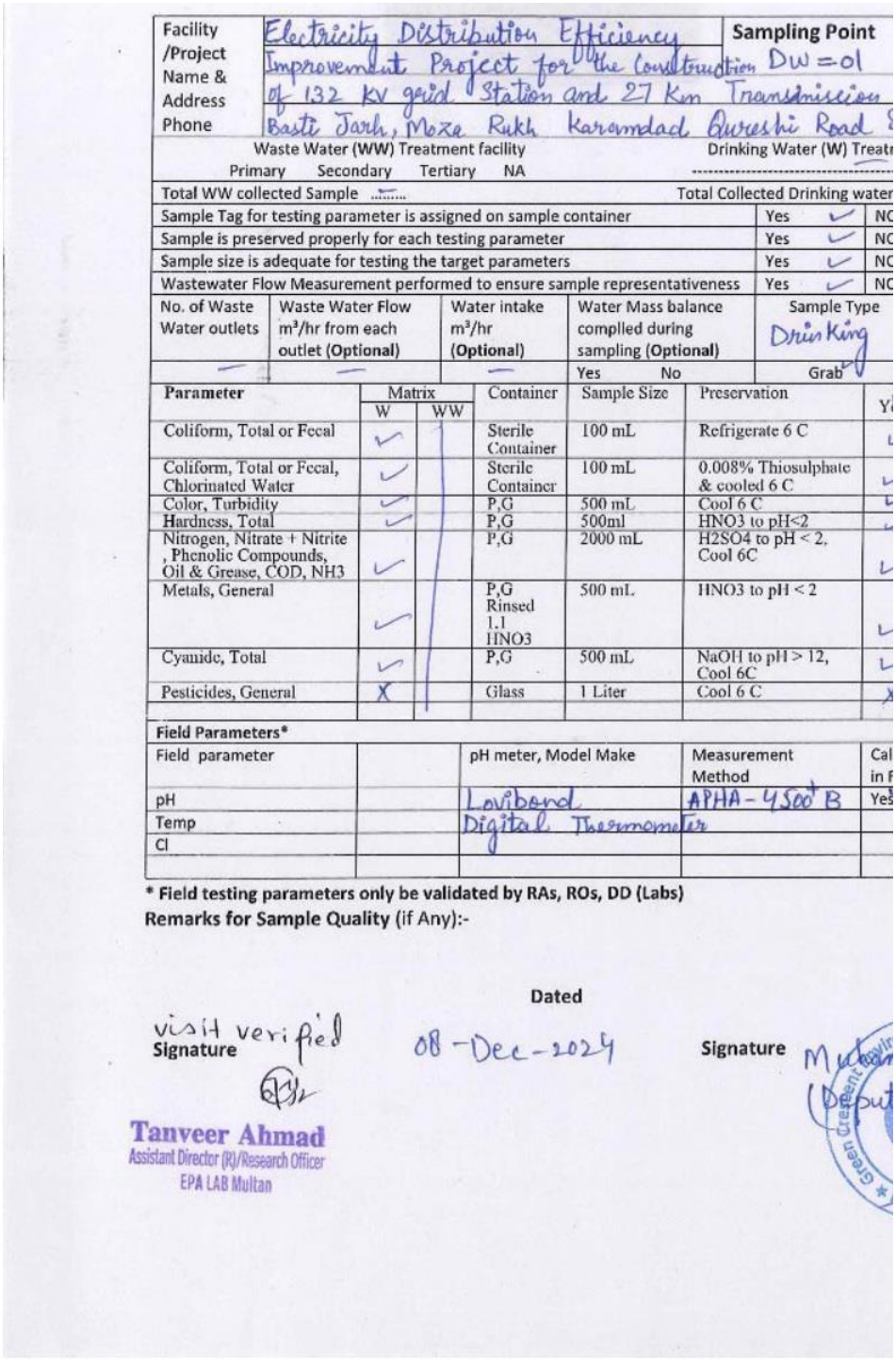
Signature

Dated 07-08 Dec, 2024

Signature

Tanveer Ahmad
Assistant Director (R)/Research Officer
EPA LAB Multan

Deputy



Facility /Project Name & Address Phone	Electricity Distribution Efficiency Improvement Project for the construction of 132 kV grid Station and 27 Km Transmission Basti Jarh, Moza Rukh Karamdad Qureshi Road	Sampling Point DW-01

Waste Water (WW) Treatment facility: Primary Secondary Tertiary NA

Drinking Water (W) Treatr

Total WW collected Sample .....

Total Collected Drinking water

Sample Tag for testing parameter is assigned on sample container	Yes ✓	NO
Sample is preserved properly for each testing parameter	Yes ✓	NO
Sample size is adequate for testing the target parameters	Yes ✓	NO
Wastewater Flow Measurement performed to ensure sample representativeness	Yes ✓	NO

No. of Waste Water outlets	Waste Water Flow m^3/hr from each outlet (Optional)	Water intake m^3/hr (Optional)	Water Mass balance complied during sampling (Optional)	Sample Type
—	—	—	Yes No	Drinking Grab

Parameter	Matrix W	Matrix WW	Container	Sample Size	Preservation	Y
Coliform, Total or Fecal	✓		Sterile Container	100 mL	Refrigerate 6 C	
Coliform, Total or Fecal, Chlorinated Water	✓		Sterile Container	100 mL	0.008% Thiosulphate & cooled 6 C	
Color, Turbidity	✓		P,G	500 mL	Cool 6 C	
Hardness, Total	✓		P,G	500ml	HNO3 to pH<2	
Nitrogen, Nitrate + Nitrite , Phenolic Compounds, Oil & Grease, COD, NH3	✓		P,G	2000 mL	H2SO4 to pH < 2, Cool 6C	
Metals, General	✓		P,G Rinsed 1:1 HNO3	500 mL	HNO3 to pH < 2	
Cyanide, Total	✓		P,G	500 mL	NaOH to pH > 12, Cool 6C	
Pesticides, General	X		Glass	1 Liter	Cool 6 C	X

Field Parameters*

Field parameter		pH meter, Model Make	Measurement Method	Cal in F
pH		Lovibond	APHA-4500 B	Yes
Temp		Digital Thermometer		
Cl				

*** Field testing parameters only be validated by RAs, ROs, DD (Labs)**

Remarks for Sample Quality (if Any):-

visit verified

Dated 08-Dec-2024

Signature

Tanveer Ahmad
Assistant Director (R)/Research Officer
EPA LAB Multan

Signature

Annex C – Environmental Code of Practice

Environmental Code of Practice

Based on the proposed activities of the project, it is expected that the environmental and social (E&S) impacts will be localized and minor, which will be addressed through adequate mitigation measures and related guidelines incorporated in this Environmental Code of Practice (ECoP). The ECoPs will provide guidelines for the best operating practices through environmental and social management to be followed by the contractors and relevant staff during construction.

ECoP 1: Waste Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
General Waste	Soil and water pollution from the improper management of wastes and excess materials from the construction sites.	The Contractor shall Develop waste management plan for various specific waste streams (e.g., reusable waste, flammable waste, construction debris, food waste etc.) prior to commencing of construction and submit to CSC for approval. Organize disposal of all wastes generated during construction in an environmentally acceptable manner. This will include consideration of the nature and location of disposal site, so as to cause less environmental impact. Minimize the production of waste materials by 3R (Reduce, Recycle and Reuse) approach. Segregate and reuse or recycle all the wastes, wherever practical. Prohibit burning of solid waste Collect and transport non-hazardous wastes to all the approved disposal sites. Vehicles transporting solid waste shall be covered with tarps or nets to prevent spilling waste along the route Train and instruct all personnel in waste management practices and procedures as a component of the environmental induction process. Provide refuse containers at each worksite. Request suppliers to minimize packaging where practicable. Place a high emphasis on good housekeeping practices. Maintain all construction sites in a cleaner, tidy and safe condition and provide and maintain appropriate facilities as temporary storage of all wastes before transportation and final disposal.
Hazardous Waste	Health hazards and environmental impacts due to improper waste management practices	The Contractor shall Collect chemical wastes in 200 liter drums (or similar sealed container), appropriately labeled for safe transport to an approved chemical waste depot. Store, transport and handle all chemicals avoiding potential environmental pollution. Store all hazardous wastes appropriately in bunded areas away from water courses. Make available Material Safety Data Sheets (MSDS) for hazardous materials on-site during construction. Collect hydrocarbon wastes, including lube oils, for safe transport off-site for reuse, recycling, treatment or disposal at approved locations. Construct concrete or other impermeable flooring to prevent seepage in case of spills

ECOP 2: Fuels and Hazardous Goods Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Fuels and hazardous goods.	Materials used in construction have a potential to be a source of contamination. Improper storage and handling of fuels, lubricants, chemicals and hazardous goods/materials on-site, and potential spills from these goods may harm the environment or health of construction workers.	The Contractor shall Prepare spill control procedures and submit the plan for CSC approval. Train the relevant construction personnel in handling of fuels and spill control procedures. Store dangerous goods in bunded areas on a top of a sealed plastic sheet away from watercourses; and also under a rainwater shed (to prevent contact with rainwater). Refueling shall occur only within bunded areas. Make available Material Safety Data Sheet (MSDS) for chemicals and dangerous goods on-site. Transport waste of dangerous goods, which cannot be recycled, to a designated disposal site approved by EPA or sold to EPA registered vendors. Provide absorbent and containment material (e.g., absorbent matting) where hazardous material are used and stored and personnel trained in the correct use. Provide protective clothing, safety boots, helmets, masks, gloves, goggles, to the construction personnel, appropriate to materials in use. Make sure all containers, drums, and tanks that are used for storage are in good condition and are labeled with expiry date. Any container, drum, or tank that is dented, cracked, or rusted might eventually leak. Check for leakage regularly to identify potential problems before they occur. Put containers and drums in temporary storages in clearly marked areas, where they will not be run over by vehicles or heavy machinery. The area shall preferably slope or drain to a safe collection area in the event of a spill. Put containers and drums in permanent storage areas on an impermeable floor that slopes to a safe collection area in the event of a spill or leak. Take all precautionary measures when handling and storing fuels and lubricants, avoiding environmental pollution. Avoid the use of material with greater potential for contamination by substituting them with more environmentally friendly materials. Return the gas cylinders to the supplier. However, if they are not empty prior to their return, they must be labeled with the name of the material they contained or contain, information on the supplier, cylinder serial number, pressure, their last hydrostatic test date, and any additional identification marking that may be considered necessary.

ECoP 3: Water Resources Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Hazardous Material and Waste	Water pollution from the storage, handling and disposal of hazardous materials and general construction waste, and accidental spillage	The Contractor shall Follow the management guidelines proposed in ESCOPs 1 and 2. Minimize the generation of sediment, oil and grease, excess nutrients, organic matter, litter, debris and any form of waste (particularly petroleum and chemical wastes). These substances must not enter waterways, storm water systems or underground water tables
Discharge from construction sites	Waste waters from construction sites and work camps. The construction works will modify groundcover and topography changing the surface water drainage patterns of the area including infiltration and storage of storm water.	The Contractor shall Minimise the amount of exposed soil at any one time (only clear vegetation immediately before construction is about to begin) Install temporary drainage works (channels and bunds) in areas required for sediment and erosion control and around storage areas for construction materials Install temporary sediment basins, where appropriate, to capture sediment-laden run-off from site Divert runoff from undisturbed areas around the construction site Stockpile materials away from drainage lines Prevent all solid entering waterways by collecting solid waste, oils, chemicals, bitumen spray waste and wastewaters from brick, concrete and asphalt cutting and transport to an approved waste disposal site or recycling depot Collect, transport and discharge the septic tank waste from the construction camps in the nearby municipal waste water treatment plants Ensure that tires of construction vehicles are cleaned in the washing bay (constructed at the entrance of the construction site) to remove the mud from the wheels. This shall be done in every exit of each construction vehicle to ensure the local roads are kept clean.
Soil Erosion and siltation	Soil erosion and dust from the material stockpiles will increase the sediment and contaminant loading of surface water bodies.	The Contractor shall Ensure that sealed roads used by construction vehicles are swept regularly to remove sediment. Water the material stockpiles, access roads and bare soils on an as required basis to minimize dust. Increase the watering frequency during periods of high risk (e.g. high winds)

ECoP 4: Drainage Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Excavation and earth works, and construction yards	Lack of proper drainage for rainwater/liquid waste or wastewater owing to the construction activities harms environment in terms of water and soil contamination, and mosquito growth.	The Contractor shall Prepare a program for prevent/avoid standing waters, which CSC will verify in advance and confirm during implementation Provide alternative drainage for rainwater if the construction works/earth-fillings cut the established drainage line Establish local drainage line with appropriate silt collector and silt screen for rainwater or wastewater connecting to the existing established drainage lines already there Rehabilitate road drainage structures immediately if damaged by contractors' road transports. Build new drainage lines as appropriate and required for wastewater from construction yards connecting to the available nearby recipient water bodies. Ensure wastewater quality conforms to the relevant standards provided by NEQS, before it being discharged into the recipient water bodies. Ensure the internal roads/hard surfaces in the construction yards/construction camps that generate has storm water drainage to accommodate high runoff during downpour and that there is no stagnant water in the area at the end of the downpour. Construct wide drains instead of deep drains to avoid sand deposition in the drains that require frequent cleaning. Provide appropriate silt collector and silt screen at the inlet and manholes and periodically clean the drainage system to avoid drainage congestion Protect natural slopes of drainage channels to ensure adequate storm water drains. Regularly inspect and maintain all drainage channels to assess and alleviate any drainage congestion problem. Reduce infiltration of contaminated drainage through storm water management design
Ponding of water	Health hazards due to mosquito breeding	Do not allow ponding of water especially near the waste storage areas and construction camps Discard all the storage containers that are capable of storing of water, after use or store them in inverted position

ECOP 5: Soil Quality Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Storage of hazardous and toxic chemicals	Spillage of hazardous and toxic chemicals will contaminate the soils	The Contractor shall Strictly manage the wastes management plans proposed in ESCOP 1 and storage of materials in ESCOP 2 Construct appropriate spill contaminant facilities for all fuel storage areas Establish and maintain a hazardous materials register detailing the location and quantities of hazardous substances including the storage, use of disposals Train personnel and implement safe work practices for minimizing the risk of spillage Identify the cause of contamination, if it is reported, and contain the area of contamination. The impact may be contained by isolating the source or implementing controls around the affected site Remediate the contaminated land using the most appropriate available method to achieve required commercial/industrial guideline validation results
Construction material stock piles	Erosion from construction material stockpiles may contaminate the soils	The Contractor shall Protect the toe of all stockpiles, where erosion is likely to occur, with silt fences, straw bales or bunds

ECOP 6: Erosion and Sediment Control

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction activities and material stockpiles	The impact of soil erosion are (i) Increased run off and sedimentation causing a greater flood hazard to the downstream, (ii) destruction of aquatic environment in nearby lakes, streams, and reservoirs caused by erosion and/or deposition of sediment damaging the spawning grounds of fish, and (iii) destruction of vegetation by burying or gullying.	The Contractor shall Locate stockpiles away from drainage lines Protect the toe of all stockpiles, where erosion is likely to occur, with silt fences, straw bales or bunds Remove debris from drainage paths and sediment control structures Cover the loose sediments and water them if required Divert natural runoff around construction areas prior to any site disturbance Install protective measures on site prior to construction, for example, sediment traps Observe the performance of drainage structures and erosion controls during rain and modify as required.

ECOP 7: Top Soil Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Land clearing and earth works	Earthworks will impact the fertile top soils that are enriched with nutrients required for plant growth or agricultural development.	The Contractor shall Strip the top soil to a depth of 15 cm and store in stock piles of height not exceeding 2m. Remove unwanted materials from top soil like grass, roots of trees and similar others. The stockpiles will be done in slopes of 2:1 to reduce surface runoff and enhance percolation through the mass of stored soil. Locate topsoil stockpiles in areas outside drainage lines and protect from erosion. Construct diversion channels and silt fences around the topsoil stockpiles to prevent erosion and loss of topsoil. Spread the topsoil to maintain the physico-chemical and biological activity of the soil. The stored top soil will be utilized for covering all disturbed area and along the proposed plantation sites Prior to the re-spreading of topsoil, the ground surface will be ripped to assist the bunding of the soil layers, water penetration and revegetation
Transport	Vehicular movement outside right of way of existing roads or temporary access roads will affect the soil fertility of the agricultural lands	Limit equipment and vehicular movements to within the approved construction zone Construct temporary access tracks to cross concentrated water flow lines at right angles Plan construction access to make use, if possible, of the final road alignment Use vehicle-cleaning devices, for example, ramps or wash down areas

ECoP 8: Topography and Landscaping

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Land clearing and earth works	Construction activities especially earthworks will change topography and disturb the natural rainwater/flood water drainage as well as will change the local landscape.	The Contractor shall Ensure the topography of the final surface of all raised lands (construction yards, approach roads, access roads, etc.) are conducive to enhance natural draining of rainwater/flood water; Keep the final or finished surface of all the raised lands free from any kind of depression that insists water logging Undertake mitigation measures for erosion control/prevention by grass-turfing and tree plantation, where there is a possibility of rain-cut that will change the shape of topography. Cover immediately the uncovered open surface that has no use of construction activities with grass-cover and tree plantation to prevent soil erosion and bring improved landscaping

ECoP 9: Quarry and Borrow Areas Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Development and operation of Quarry and borrow areas. The project will use approved quarry sites available near the project site. This ESCOP will be used only when a new quarry or borrow area to be developed.	Quarry areas will have impacts on local topography, landscaping and natural drainage.	The Contractor shall Use only approved quarry and borrow sites Identify new borrow and quarry areas in consultation with Project Director, if required. Reuse excavated or disposed material available in the project to the maximum extent possible. Store top soil for reinstatement and landscaping. Develop surface water collection and drainage systems, anti-erosion measures (berms, revegetation etc.) and retaining walls and gabions where required. Implement mitigation measures in ESCOP 3: Water Resources Management, ESCOP 6: Erosion and Sediment Control The use of explosive should be used in as much minimum quantity as possible to reduce noise, vibration and dust. Control dust and air quality deterioration by application of watering and implementing mitigation measures proposed in ESCOP 10: Air Quality Management Noise and vibration control by ESCOP 11: Noise and Vibration Management.

ECoP 10: Air Quality Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction vehicular traffic	Air quality can be adversely affected by vehicle exhaust emissions and combustion of fuels.	The Contractor shall Fit vehicles with appropriate exhaust systems and emission control devices. Maintain these devices in good working condition. Operate the vehicles in a fuel efficient manner Cover haul vehicles carrying dusty materials moving outside the construction site Impose speed limits on all vehicle movement at the worksite to reduce dust emissions Control the movement of construction traffic Water construction materials prior to loading and transport Service all vehicles regularly to minimize emissions Limit the idling time of vehicles not more than 2 minutes
Construction machinery	Air quality can be adversely affected by emissions from machinery and combustion of fuels.	The Contractor shall Fit machinery with appropriate exhaust systems and emission control devices. Maintain these devices in good working condition in accordance with the specifications defined by their manufacturers to maximize combustion efficiency and minimize the contaminant emissions. Proof or maintenance register shall be required by the equipment suppliers and contractors/subcontractors

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		Focus special attention on containing the emissions from generators Machinery causing excess pollution (e.g. visible smoke) will be banned from construction sites Service all equipment regularly to minimize emissions Provide filtering systems, duct collectors or humidification or other techniques (as applicable) to the concrete batching and mixing plant to control the particle emissions in all its stages, including unloading, collection, aggregate handling, cement dumping, circulation of trucks and machinery inside the installations
Construction activities	Dust generation from construction sites, material stockpiles and access roads is a nuisance in the environment and can be a health hazard.	Water the material stockpiles, access roads and bare soils on an as required basis to minimize the potential for environmental nuisance due to dust. Increase the watering frequency during periods of high risk (e.g. high winds). Stored materials such as gravel and sand shall be covered and confined to avoid their being wind-drifted Minimize the extent and period of exposure of the bare surfaces Reschedule earthwork activities or vegetation clearing activities, where practical, if necessary to avoid during periods of high wind and if visible dust is blowing off-site Store the cement in silos and minimize the emissions from silos by equipping them with filters. Establish adequate locations for storage, mixing and loading of construction materials, in a way that dust dispersion is prevented because of such operations Crushing of rocky and aggregate materials shall be wet-crushed, or performed with particle emission control systems

ECOP 11: Noise and Vibration Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction vehicular traffic	Noise quality will be deteriorated due to vehicular traffic	The Contractor shall Maintain all vehicles in order to keep it in good working order in accordance with manufactures maintenance procedures Make sure all drivers will comply with the traffic codes concerning maximum speed limit, driving hours, etc. Organize the loading and unloading of trucks, and handling operations for the purpose of minimizing construction noise on the work site

Project Activity/ Impact Source	**Environmental Impacts**	**Mitigation Measures/ Management Guidelines**
Construction machinery	Noise and vibration may have an impact on people, property, fauna, livestock and the natural environment.	The Contractor shall Appropriately site all noise generating activities to avoid noise pollution to local residents Use the quietest available plant and equipment Modify equipment to reduce noise (for example, noise control kits, lining of truck trays or pipelines) Maintain all equipment in order to keep it in good working order in accordance with manufactures maintenance procedures. Equipment suppliers and contractors shall present proof of maintenance register of their equipment. Install acoustic enclosures around generators to reduce noise levels. Fit high efficiency mufflers to appropriate construction equipment Avoid the unnecessary use of alarms, horns and sirens
Construction activity	Noise and vibration may have an impact on people, property, fauna, livestock and the natural environment.	The Contractor shall Notify adjacent landholders prior any typical noise events outside of daylight hours (6 pm to 7 am) if the construction works are being carried out near residential areas Educate the operators of construction equipment on potential noise problems and the techniques to minimize noise emissions Employ best available work practices on-site to minimize occupational noise levels Install temporary noise control barriers where appropriate Notify affected people if major noisy activities will be undertaken, e.g. pile driving Plan activities on site and deliveries to and from site to minimize impact Monitor and analyze noise and vibration results and adjust construction practices as required. Avoid undertaking the noisiest activities, where possible, when working at night (6pm to 7 am) near the residential areas

ECOP 12: Protection of Flora

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Vegetation clearance	Local flora are important to provide shelters for the birds, offer fruits and/or timber/fire wood, protect soil erosion and overall keep the environment very friendly to human-living. As such damage to flora has wide range of adverse environmental impacts.	The Contractor shall Reduce disturbance to surrounding vegetation Use appropriate type and minimum size of machine to avoid disturbance to adjacent vegetation. Get approval from supervision consultant for clearance of vegetation. Make selective and careful pruning of trees where possible to reduce need of tree removal. Control noxious weeds by disposing of at designated dump site or burn on site. Clear only the vegetation that needs to be cleared in accordance with the plans. These measures are applicable to both the construction areas as well as to any associated activities such as sites for stockpiles, disposal of fill and construction of diversion roads, etc. Before excavation, mark the trees that must remain on the site and cannot be removed. Do not burn off cleared vegetation – where feasible, chip or mulch and reuse it for the rehabilitation of affected areas, temporary access tracks or landscaping. Mulch provides a seed source, can limit embankment erosion, retains soil moisture and nutrients, and encourages re-growth and protection from weeds. Return topsoil and mulched vegetation (in areas of native vegetation) to approximately the same area of the roadside it came from. Avoid work within the drip-line of trees to prevent damage to the tree roots and compacting the soil. Minimize the length of time the ground is exposed or excavation left open by clearing and re-vegetate the area at the earliest practically possible. Ensure excavation works occur progressively and re-vegetation done at the earliest Provide adequate knowledge to the workers regarding nature protection and the need of avoid felling trees during construction Supply appropriate fuel in the work caps to prevent fuel wood collection

ECOP 13: Protection of Fauna

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Vegetation clearance	Clearance of vegetation may impact shelter, feeding and/or breeding of animals	The Contractor shall Restrict the tree removal to the minimum required. Retain tree hollows on site, or relocate hollows, where appropriate Leave dead trees where possible as habitat for fauna Identify the trees that require specific attention (e.g the hollow bearing trees) and fell them in a manner

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		which reduces the potential for fauna mortality. Felled trees will be inspected after felling for fauna and if identified and readily accessible will be removed and relocated or rendered assistance if injured. After felling, hollow bearing trees will remain unmoved overnight to allow animals to move of their own volition.
Construction camps	Illegal poaching	Provide adequate knowledge to the workers regarding protection of flora and fauna, and relevant government regulations and punishments for illegal poaching.

ECOP 14: Road Transport and Road Traffic Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction vehicular traffic	Increased traffic use of road by construction vehicles will affect the movement of normal road traffics and the safety of the road-users.	The Contractor shall Prepare and submit a traffic management plan to the CSC for their approval before commencement of construction. Include in the traffic management plan to ensure uninterrupted traffic movement during construction: detailed drawings of traffic arrangements showing all detours, temporary road, temporary bridges temporary diversions, necessary barricades, warning signs / lights, and road signs. Provide signs at strategic locations of the roads complying with the schedules of signs contained in the Pakistan Traffic Regulations. Install and maintain a display board at each important road intersection on the roads to be used during construction, which shall clearly show the following information in local language: o Location: chainage and village name o Duration of construction period o Period of proposed detour / alternative route o Suggested detour route map o Name and contact address/telephone number of the concerned personnel o Name and contact address / telephone number of the Contractor o Inconvenience is sincerely regretted.
	Accidents and spillage of fuels and chemicals	Restrict truck deliveries, where practicable, to day time working hours (7 am to 6 pm). Restrict the transport of oversize loads. Operate road traffics/transport vehicles, if possible, to non-peak periods to minimize traffic disruptions. Enforce on-site speed limit

ECOP 15: Construction Camp Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Siting and Location of construction camps	Campsites for construction workers are the important locations that have significant impacts such as health and safety hazards on local resources and infrastructure of nearby communities.	The Contractor shall Locate the construction camps within the proposed grid station site Consider the location of construction camps away from communities in order to avoid social conflict in using the natural resources such as water or to avoid the possible adverse impacts of the construction camps on the surrounding communities. Submit to the CSC for approval a detailed layout plan for the development of the construction camp showing the relative locations of all temporary buildings and facilities that are to be constructed together with the location of site roads, fuel storage areas (for use in power supply generators), solid waste management and dumping locations, and drainage facilities, prior to the development of the construction camps. Local authorities responsible for health, religious and security shall be duly informed on the set up of camp facilities so as to maintain effective surveillance over public health, social and security matters
Construction Camp Facilities	Lack of proper infrastructure facilities , such as housing, water supply and sanitation facilities will increase pressure on the local services and generate substandard living standards and health hazards.	Contractor shall provide the following facilities in the campsites Housing facilities for all the non-local workers hired by the contractor Safe and reliable water supply. Hygienic sanitary facilities and sewerage system. The toilets and domestic waste water will be collected through a common sewerage. Provide separate latrines and bathing places for males and females with total isolation by wall or by location. The minimum number of toilet facilities required is one toilet for every ten persons. Treatment facilities for sewerage of toilet and domestic wastes Storm water drainage facilities. Both sides of roads are to be provided with shallow v drains to drain off storm water to a silt retention pond which shall be sized to provide a minimum of 20 minutes retention of storm water flow from the whole site. Channel all discharge from the silt retention pond to natural drainage via a grassed swale at least 20 meters in length with suitable longitudinal gradient. Paved internal roads. Ensure with grass/vegetation coverage to be made of the use of top soil that there is no dust generation from the loose/exposed sandy surface. Pave the internal roads of at least haring-bond bricks to suppress dusts and to work against possible muddy surface during monsoon. Provide child crèches for women working construction site. The crèche shall have facilities for dormitory, kitchen, indoor and outdoor play area. Schools shall be attached to these crèches so that children are not

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		deprived of education whose mothers are construction workers Provide in-house community/common entertainment facilities. dependence of local entertainment outlets by the construction camps to be discouraged/prohibited to the extent possible.
Disposal of waste	Management of wastes is crucial to minimize impacts on the environment	The Contractor shall Ensure proper collection and disposal of solid wastes within the construction camps Insist waste separation by source; organic wastes in one pot and inorganic wastes in another pot at household level. Store inorganic wastes in a safe place within the household and clear organic wastes on daily basis to waste collector. Establish waste collection, transportation and disposal systems with the manpower and equipments/vehicles needed. Dispose organic wastes in a designated safe place on daily basis. At the end of the day cover the organic wastes with a thin layer of sand so that flies, mosquitoes, dogs, cats, rats, are not attracted. One may dig a large hole to put organic wastes in it; take care to protect groundwater from contamination by leachate formed due to decomposition of wastes. Cover the bed of the pit with impervious layer of materials (clayey or thin concrete) to protect groundwater from contamination. Locate the garbage pit/waste disposal site min 500 m away from the residence so that peoples are not disturbed with the odor likely to be produced from anaerobic decomposition of wastes at the waste dumping places. Encompass the waste dumping place by fencing and tree plantation to prevent children to enter and play with. Do not establish site specific landfill sites. All solid waste will be collected and removed from the work camps and disposed in approval waste disposal sites.
Fuel supplies for cooking purposes	Illegal sourcing of fuel wood by construction workers will impact the natural flora and fauna	The Contractor shall Provide fuel to the construction camps for their domestic purpose, in order to discourage them to use fuel wood or other biomass. Made available alternative fuels like natural gas or kerosene on ration to the workforce to prevent them using biomass for cooking. Conduct awareness campaigns to educate workers on preserving the protecting the biodiversity and wildlife of the project area, and relevant government regulations and punishments on wildlife protection.
Health and Hygiene	There will be a potential for diseases to be transmitted including malaria, exacerbated by inadequate health and safety practices.	The Contractor shall Provide adequate health care facilities within construction sites.

Project Activity/ Impact Source	**Environmental Impacts**	**Mitigation Measures/ Management Guidelines**
	There will be an increased risk of work crews spreading sexually transmitted infections and HIV/AIDS.	Provide first aid facility round the clock. Maintain stock of medicines in the facility and appoint fulltime designated first aider or nurse. Provide ambulance facility for the laborers during emergency to be transported to nearest hospitals. Initial health screening of the laborers coming from outside areas Train all construction workers in basic sanitation and health care issues and safety matters, and on the specific hazards of their work Provide HIV awareness programming, including STI (sexually transmitted infections) and HIV information, education and communication for all workers on regular basis Complement educational interventions with easy access to condoms at campsites as well as voluntary counseling and testing Provide adequate drainage facilities throughout the camps to ensure that disease vectors such as stagnant water bodies and puddles do not form. Regular mosquito repellant sprays during monsoon. Carryout short training sessions on best hygiene practices to be mandatorily participated by all workers. Place display boards at strategic locations within the camps containing messages on best hygienic practices
Safety	In adequate safety facilities to the construction camps may create security problems and fire hazards	The Contractor shall Provide appropriate security personnel (police / home guard or private security guards) and enclosures to prevent unauthorized entry in to the camp area. Maintain register to keep a track on a head count of persons present in the camp at any given time. Encourage use of flameproof material for the construction of labor housing / site office. Also, ensure that these houses/rooms are of sound construction and capable of withstanding wind storms/cyclones. Provide appropriate type of firefighting equipment suitable for the construction camps Display emergency contact numbers clearly and prominently at strategic places in camps. Communicate the roles and responsibilities of laborers in case of emergency in the monthly meetings with contractors.
Site Restoration	Restoration of the construction camps to original condition requires demolition of construction camps.	The Contractor shall Dismantle and remove from the site all facilities established within the construction camp including the perimeter fence and lockable gates at the completion of the construction work. Dismantle camps in phases and as the work gets decreased and not wait for the entire work to be completed Give prior notice to the laborers before demolishing their camps/units Reuse the demolition debris to a maximum extent. Dispose remaining debris at the designated waste disposal site.

Project Activity/ Impact Source	**Environmental Impacts**	**Mitigation Measures/ Management Guidelines**
		Handover the construction camps with all built facilities as it is if agreement between both parties (contactor and land-owner) has been made so. Restore the site to its condition prior to commencement of the works or to an agreed condition with the landowner. Not make false promises to the laborers for future employment in O&M of the project.

ECOP 16: Socio-cultural and Religious Issues

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction activities near residential areas	Disturbance from construction activities (dust, noise, traffic, conflicts with contractor's work force etc.)	The Contractor shall Establish a system for receiving complaints from the community and address them (the community can also make complaints to the GRM established under the project) Shall ensure all the construction workers follows the following code of conduct: All workers are strictly forbidden to establish any kind of relationship with local women bring any un-related women to the project site. All workers should avoid sexual harassment and child abuse. All workers must not leave the camps or work sites unless a written authorization is issued by the respective supervisor The contractors will advise and prohibit the local population and its authorities or representatives not to enter the project operation areas (camp sites, colonies, etc.) in order to minimize the potential risk of incidents related to the operations.
Construction activities near religious and cultural sites	Disturbance from construction works to the cultural and religious sites, and contractors lack of knowledge on cultural issues cause social disturbances.	The Contractor shall Communicate to the public through community consultation and newspaper announcements regarding the scope and schedule of construction, as well as certain construction activities causing disruptions or access restriction. Do not block access to cultural and religious sites, wherever possible Restrict all construction activities within the foot prints of the construction sites. Stop construction works that produce noise (particularly during prayer time) shall there be any mosque/religious/educational institutions close to the construction sites and users make objections. Take special care and use appropriate equipment when working next to a cultural/religious institution. Stop work immediately and notify the site manager if, during construction, an archaeological or burial site is discovered. It is an offence to recommence work in the vicinity of the site until approval to continue is given by the CSC/PMU. Provide separate prayer facilities to the construction workers. Show appropriate behavior with all construction workers especially women and elderly people Allow the workers to participate in praying during construction time

		Resolve cultural issues in consultation with local leaders and supervision consultants Establish a mechanism that allows local people to raise grievances arising from the construction process. Inform the local authorities responsible for health, religious and security duly informed before commencement of civil works so as to maintain effective surveillance over public health, social and security matters

ECOP 17: Worker Health and Safety

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Best practices	Construction works may pose health and safety risks to the construction workers and site visitors leading to severe injuries and deaths. The population in the proximity of the construction site and the construction workers will be exposed to a number of (i) biophysical health risk factors, (e.g. noise, dust, chemicals, construction material, solid waste, waste water, vector transmitted diseases etc), (ii) risk factors resulting from human behavior (e.g. STD, HIV etc) and (iii) road accidents from construction traffic.	The Contractor shall Implement suitable safety standards for all workers and site visitors which shall not be less than those laid down on the international standards (e.g. International Labor Office guideline on 'Safety and Health in Construction; World Bank Group's 'Environmental Health and Safety Guidelines') and contractor's own national standards or statutory regulations, in addition to complying with the national standards of the Government of Pakistan (Provide the workers with a safe and healthy work environment, taking into account inherent risks in its particular construction activity and specific classes of hazards in the work areas, Provide personal protection equipment (PPE) for workers, such as safety boots, helmets, masks, gloves, protective clothing, goggles, full-face eye shields, and ear protection. Maintain the PPE properly by cleaning dirty ones and replacing them with the damaged ones. Safety procedures include provision of information, training and protective clothing to workers involved in hazardous operations and proper performance of their job Appoint an environment, health and safety manager to look after the health and safety of the workers Inform the local authorities responsible for health, religious and security duly informed before commencement of civil works and establishment of construction camps so as to maintain effective surveillance over public health, social and security matters
	Child and pregnant labor	The Contractor shall not hire children of less than 16 years of age and pregnant women or women who delivered a child within 8 preceding weeks, in accordance with the national Labor Laws
Accidents	Lack of first aid facilities and health care facilities in the immediate vicinity will aggravate the health conditions of the victims	Provide health care facilities and first aid facilities are readily available. Appropriately equipped first-aid stations shall be easily accessible throughout the place of work Document and report occupational accidents, diseases, and incidents.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		Prevent accidents, injury, and disease arising from, associated with, or occurring in the course of work by minimizing, so far as reasonably practicable, the causes of hazards. In a manner consistent with good international industry practice. Identify potential hazards to workers, particularly those that may be life-threatening and provide necessary preventive and protective measures. Provide awareness to the construction drivers to strictly follow the driving rules Provide adequate lighting in the construction area and along the roads
Construction Camps	Lack of proper infrastructure facilities, such as housing, water supply and sanitation facilities will increase pressure on the local services and generate substandard living standards and health hazards.	The Contractor shall provide the following facilities in the campsites to improve health and hygienic conditions as mentioned in ESCOP 15 Construction Camp Management Adequate ventilation facilities Safe and reliable water supply. Hygienic sanitary facilities and sewerage system. The toilets and domestic waste water will be collected through a common sewerage. Treatment facilities for sewerage of toilet and domestic wastes Storm water drainage facilities. Recreational and social facilities Safe storage facilities for petroleum and other chemicals in accordance with ESCOP 2 Solid waste collection and disposal system in accordance with ESCOP 1. Arrangement for trainings Paved internal roads. Security fence at least 2 m height. Sick bay and first aid facilities
Water and sanitation facilities at the construction sites	Lack of Water sanitation facilities at construction sites cause inconvenience to the construction workers and affect their personal hygiene.	The contractor shall provide portable toilets at the construction sites, if about 25 people are working the whole day for a month. Location of portable facilities shall be at least 6 m away from storm drain system and surface waters. These portable toilets shall be cleaned once a day and all the sewerage shall be pumped from the collection tank once a day and shall be brought to the common septic tank for further treatment. Contractor shall provide bottled drinking water facilities to the construction workers at all the construction sites.
Other ESCOP s	Potential risks on health and hygiene of construction workers and general public	The Contractor shall follow the following ESCOP s to reduce health risks to the construction workers and nearby community ESCOP 2: Fuels and Hazardous Goods Management ESCOP 4: Drainage Management ESCOP 10: Air Quality Management

Project Activity/ Impact Source	**Environmental Impacts**	**Mitigation Measures/ Management Guidelines**
		ESCOP 11: Noise and Vibration Management ESCOP 14: Road Transport and Road Traffic Management
Trainings	Lack of awareness and basic knowledge in health care among the construction workforce, make them susceptible to potential diseases.	The Contractor shall Train all construction workers in basic sanitation and health care issues (e.g., how to avoid malaria and transmission of sexually transmitted infections (STI) HIV/AIDS. Train all construction workers in general health and safety matters, and on the specific hazards of their work . Training shall consist of basic hazard awareness, site specific hazards, safe work practices, and emergency procedures for fire, evacuation, and natural disaster, as appropriate. Commence the malaria, HIV/AIDS and STI education campaign before the start of the construction phase and complement it with by a strong condom marketing, increased access to condoms in the area as well as to voluntary counseling and testing. Implement malaria, HIV/AIDS and STI education campaign targeting all workers hired, international and national, female and male, skilled, semi- and unskilled occupations, at the time of recruitment and thereafter pursued throughout the construction phase on ongoing and regular basis. This shall be complemented by easy access to condoms at the workplace as well as to voluntary counseling and testing.