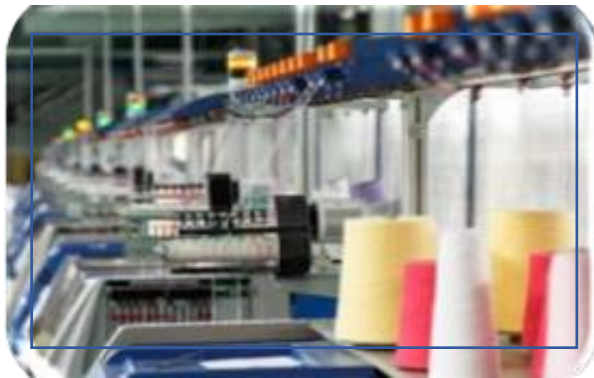




IMPROVING WORKFORCE READINESS IN PUNJAB PROJECT (IWRPP)



ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

REHABILITATION & ADDITIONAL WORKS AT

- i. Government Staff Training College, Murree
- ii. Government Technical Training Institute for Women, Murree

PROJECT IMPLEMENTATION UNIT (PIU)
INDUSTRIES COMMERCIAL INVESTMENT & SKILLS DEVELOPMENT DEPARTMENT

ABBREVIATIONS AND ACRONYMS

ADB	–	Asian Development Bank
COE	–	Center of Excellence
ECA	–	Employment of Child Act
EIA	–	Environmental Impact Assessment
EPD	–	Environment Protection Department
EPA	–	Environmental Protection Agency
EIA	–	Environmental Impact Assessment
EMP	–	Environmental Management Plan
GCT	–	Government College of Technology
GoPb	–	Government of Punjab
GRM	–	Grievance Redress Mechanism
GRC	–	Grievance Redress Cell
GRS	–	Grievance Redress System
GTTI	–	Government Technical Training Institute
ICISDD	–	Industries, Commerce, Investment, and Skills Development Department
NEQS	–	National Environmental Quality Standards
NOC	–	No Objection Certificate
PAM	–	Project Administration Manual
PEPA	–	Punjab Environmental Protection Agency
PEQS	–	Punjab Environmental Quality Standards
PIU	–	project implementation unit
PPE	–	personal protective equipment
PSC	–	project steering committee
PSDA	–	Punjab Skills Development Authority
PSDF	–	Punjab Skills Development Fund
PVTC	–	Punjab Vocational Training Council
SSEMP	–	Site specific environmental management plan
SSC	–	Sector Skills Council
TEVTA	–	Technical Education and Vocational Training Authority
TVET	–	Technical and Vocational Education and Training

WEIGHTS AND MEASURES

Ha	–	Hectare
Km	–	Kilometer
Mm	–	Millimeter
Mg/L	–	Milligrams per liter
°C	–	Celsius or centigrade
°F	–	Fahrenheit

Contents

1.	INTRODUCTION.....	1
1.1.	Project Background.....	1
1.2.	Project Objective.....	3
1.3.	Environmental Safeguard Category of the Project.....	4
1.4.	Methodology of EIA Report.....	4
1.5.	Proponent of Project.....	5
1.6.	Structure of the Report.....	6
1.7.	Applicability and Scope of EIA study.....	6
2.	POLICY AND LEGAL FRAMEWORK.....	7
2.1.	General.....	7
2.2.	Statutory Framework.....	7
2.3.	National Policy and Legal Framework.....	7
2.4.	Comparison of International and Local Environmental Legislations.....	12
2.5.	ADB Requirements.....	16
2.6.	United Nation’s Sustainable Development Goals.....	18
2.7.	IFC Performance Standards.....	18
2.8.	International Protocols and Conventions.....	19
3.	PROJECT DESCRIPTION.....	22
3.1.	Project Overview.....	22
3.2.	Project Need.....	25
3.3.	Project Scope of Work.....	26
3.4.	Implementation Arrangements.....	32
3.5.	Project Cost.....	33
3.6.	Project Benefits.....	34
3.7.	Construction Camps.....	35
3.8.	Water Requirement.....	35
3.9.	Wastewater Generation.....	36
3.10.	Solid Waste Estimation.....	36
4.	ANALYSIS OF ALTERNATIVES.....	37
4.1.	Overview.....	37
4.2.	No Project Option.....	38
4.3.	Site Alternatives.....	38
4.4.	Technology Alternatives.....	38
4.5.	Design Alternatives.....	39
5.	DESCRIPTION OF THE ENVIRONMENT.....	40
5.1.	General.....	40
5.2.	Socio Economic Profile of Punjab.....	40
5.3.	Physical Resources.....	42
5.4.	Baseline Environmental Monitoring.....	53
5.5.	Biological Resources.....	72
5.6.	Protected Areas/National Sanctuaries.....	79
5.7.	Socioeconomic Resources.....	79

5.8. Project Sensitive Receptors	81
6. Climate Change Assessment.....	82
6.1. Climatic Regions of Pakistan.....	82
6.2. Climate Change in Pakistan.....	82
6.3. Future Projections of Climate:	85
6.4. Punjab Zonal Distribution:	85
6.5. Climate Change Impacts:.....	86
6.6. Impacts of Climate Change on Project:	87
7. POTENTIAL ENVIRONMENTAL IMPACTS & MITIGATION MEASURES	88
7.1. Impact Assessment Process	88
7.2. Notion of Significance	88
7.3. Positive Impacts.....	90
7.4. Design Phase Negative Impacts	90
7.5. Construction Phase Impacts	93
7.6. Operation Phase Negative Impacts.....	104
7.7. CUMULATIVE AND INDUCED IMPACT ASSESSMENT	106
7.8. Residual Impacts of Project.....	107
8. STAKEHOLDERS CONSULTATION AND INFORMATION DISCLOSURE	123
8.1. Introduction.....	123
8.2. Objectives of Consultations.....	123
8.3. Identification and Selection Criteria for Proposed Project Stakeholders.....	124
8.4. Consultations – Concerns & Responses (Primary Stakeholders)	124
8.5. Disclosure Requirement and Procedures (Awareness, dissemination etc.)	130
9. ENVIRONMENTAL MANAGEMENT PLAN	131
9.2. Objectives of EMP	131
9.3. EMP Reporting Requirements	131
9.4. Institutional Arrangement for Implementation, Monitoring, and Reporting of EMP during Construction Phase.....	132
9.6. Contractor’s SSEMPs	181
9.7. Environmental Monitoring and Reporting	181
9.8. Waste Management Framework	185
9.9. Environmental Training	188
9.10. Health & Safety Management Framework.....	188
9.12. Environmental Enhancement Measures.....	192
9.13. Environmental Management Costs	192
10. GRIEVANCE REDRESS MECHANISM.....	195
11. CONCLUSION AND RECOMMENDATIONS	198
11.2. Recommendations.....	199
REFERENCES:.....	200
APPENDICES	203
ANNEX-I: Punjab Environmental Quality Standards for Drinking Water	204
ANNEX-II: Punjab Environmental Quality Standards for Ambient Air	208
ANNEX-III: Punjab Environmental Quality Standards for Noise	211
ANNEX-IV: PROPOSED CIVIL WORKS LAYOUT DRAWINGS	213
ANNEX-V: Environmental Monitoring Report	214
ANNEX-VI Impact Assessment Matrix	255

ANNEX-VII Government of Pakistan Guidelines for Construction amid COVID-19.....	257
ANNEX-VIII: Proposed National and International Guidelines on Environmental Parameters ..	261
ANNEX-IX: Latest Picture Profile of COEs visited during May-June 2022.....	262
GOVERNMENT STAFF TRAINING COLLEGE, MURREE	262
GOVERNMENT TECHNICAL TRAINING INSTITUTE (W), MURREE	263
ANNEX-X: DULY FILLED FORMSRECORD of	264
RAPID ENVIRONMENTAL ASSESSMENT	264
A Checklist for Preliminary Climate Risk Screening.....	268
A Checklist for Preliminary Climate Risk Screening.....	272
Institute Name: GOVT. TECHNICAL TRAINING INSTITUTE (W) MURREE	272

EXECUTIVE SUMMARY

I. INTRODUCTION

1. In Punjab, the Industries, Commerce, Investment, and Skills Development Department (ICISDD) has overall responsibility for the technical and vocational education and training (TVET) sector, although many departments and agencies are involved in the sector. There are two principal public TVET providers in Punjab: Technical Education and Vocational Training Authority (TEVTA) has some 400 institutes, while Punjab Vocational Training Council (PVTC) has some 217 institutes. TEVTA and PVTC are government funded. TEVTA is financed through ICISDD, while PVTC is funded through the Zakat and Ushr Department and the Planning and Development Department. The size of the TVET sector in Punjab dwarfs that in other provinces. In 2018, there were 1,672 TVET institutes and 238,331 TVET enrolments in Punjab, representing 46.0% of TVET institutes and 56.8% of TVET enrolments in Pakistan.

2. Improving the performance of the TVET sector in Punjab can help lift Pakistan's development prospects given that it is the country's most populous province—its economic powerhouse—and has several industrial and economic centers including Lahore, Faisalabad, Sialkot, Multan, and Rawalpindi. Improved skills development is a critical part of the GoPb's Punjab Growth Strategy (PGS) 2023. The GoPb has also developed the Punjab Spatial Strategy 2047, a spatial and regional planning framework that will guide investments in the province.¹ In response to the COVID-19 pandemic, the GoPb released the Responsive Investment for Social Protection and Economic (RISE) Stimulus Framework, which sets out 7 critical pillars to help Punjab address the health, economic and social protection challenges of COVID-19.² The PGS 2023 is currently being reformulated to account for the effects of the COVID-19 pandemic.

3. The COVID-19 pandemic has added significantly to the challenges facing the province. Since February 2020, the spread of the COVID-19 virus has had a severe impact on economic activity in Pakistan, with much of the country placed under partial lockdown. The closure of non-essential businesses and disruptions to supply chains have had a significant impact on all economic sectors, but particularly on the service sector. A recent survey of the impact on small and medium enterprises in Pakistan by Karandaaz found that 58% had laid off employees as a result of the pandemic and 31% claimed potential insolvency within the month.³ According to the World Bank, real gross domestic product (GDP) in Pakistan contracted by 1% in fiscal year (FY) 2020. However, effective use of localized lockdowns to curb the spread of the virus allowed economic activity to continue and recover. Supportive macroeconomic and financial policies in tandem with the expansion of the national cash transfer program resulted in growth of real GDP growth at constant factor 2015-16 prices increasing to 5.6% in FY21.⁴ Recent macroeconomic adjustment measures alongside with stronger inflation see real GDP growth slowing to 4.3% in fiscal year (FY)2022 and 4% in FY2023.

4. A well-performing TVET sector can improve the matching of skills needed in the labor market and those produced by TVET institutes, thus playing a key role in supporting economic recovery and job creation by (i) facilitating the retraining of displaced workers and new entrants to the labor market; (ii) improving the perception and employability of TVET graduates; (iii) supplying the workers needed by firms to improve productivity, product quality, and

¹ World Bank. [Punjab Spatial Strategy 2047](#). [brochure]. Lahore.

² Government of Punjab, Planning and Development Board. 2020. *Responsive Investment for Social Protection and Economic Stimulus*. Lahore.

³ Karandaaz. 2020. [Impact of COVID-19 on SMEs \(April 2020\) Survey Findings](#). [PowerPoint slides].

⁴ The World Bank. [The World Bank in Pakistan](#) (accessed 29 May 2020).

competitiveness; (iv) enabling firms and entrepreneurs to expand their technological capability and move up value chains where profit margins are often higher; and (v) removing a key constraint to firm growth and operation by addressing skills gaps in critical areas.⁵ Improved TVET sector performance would have a number of benefits, including increasing foreign direct investment.⁶ These positive economic effects would have wider impacts in terms of keeping kids in school, reducing poverty and fostering lifelong learning.

5. The project will be implemented from 2022 to 2028 (6 years). A Project Steering Committee (PSC) will be established to guide the executing agency and monitor overall project performance and outcome. The PSC will be chaired by the Chairman, Planning and Development Board, and will be composed of Secretaries of ICISDD, Planning and Development and Finance, as well as the PIU Director and private sector representatives. It will (i) provide guidance on policy development/overall project implementation and on identification of investment activities based on prioritized targets; (ii) ensure coordination with relevant government agencies and stakeholders; and (iii) monitor the achievement of project outcomes. The PSC will also have the authority to recommend changes to priority economic sectors and programs to allow adjustments based on changes in skills demand.

6. An Environmental Impact Assessment (EIA) has been prepared in compliance with EIA/EIA Regulation, 2022 Schedule II (I).

II. POLICY AND LEGAL FRAMEWORK

7. The 18th Amendment in the Constitution of Pakistan has fundamentally altered the division of legislative powers between National and the Provincial Assemblies, resulting in a significant increase in the extent of Provincial autonomy. For the subject project, Environment Protection Department (EPD), Punjab is the concerned authority. The EIA report has been prepared keeping in view the following national policies, laws, regulations and guidelines:

- (i) Pakistan Environmental Protection Act (PEPA), 1997;
- (ii) Punjab Environmental Protection (Amendment) Act, 2012;
- (iii) Punjab Environmental Protection Agency Review of EIA and Environmental Impact Assessment (EIA) Regulations;
- (iv) National Environmental Quality Standards (NEQS);
- (v) Punjab Environmental Quality Standards (PEQS);
- (vi) The Punjab Wildlife Protection Ordinance, 1972;
- (vii) The Forestry Act, 1927;
- (viii) The Antiquities Act of 1975;
- (ix) Government of Punjab Growth Strategy;
- (x) Lahore Development Authority Land Use (Classification, Reclassification and Redevelopment) Rules, 2014;
- (xi) Land Acquisition Act, 1894;
- (xii) The Cutting of Trees (prohibition) Act, 1992;
- (xiii) ADB's Safeguard Policy Statement, 2009;
- (xiv) ADB's Access to Information Policy (AIP) 2018;

⁵ World Bank. 2013. *What Matters for Workforce Development: A Framework and Tool for Analysis*. SABER Working Paper Series Number 6. Washington, DC; A. Fatima and R. Saleem. 2016. [The Impact of Vocational Education on Economic Growth of Pakistan](#). *Bulletin of Business and Economics*. Vol. 5(2); and European Centre for the Development of Vocational Training. 2014. [Macroeconomic Benefits of Vocational Education and Training](#). *Research Paper No. 40*. Luxembourg: Publications Office of the European Union.

⁶ K. Hornberger et al. 2011. [Attracting FDI](#). *Viewpoint*. The World Bank Group: Washington DC. August.

- (xv) ADB's Accountability Mechanism Policy 2012;
- (xvi) United Nation's Sustainable Development Goals;
- (xvii) IFC Performance Standards;
- (xviii) Equator Principles;
- (xix) IUCN Red List;
- (xx) The Rio Declaration, 1992;
- (xxi) Convention on Biological Diversity, 1994;
- (xxii) Kyoto Protocol;
- (xxiii) Occupational Safety and Health Convention (OSHC), 1981;
- (xxiv) Factories Act, 1934;
- (xxv) Employment of Child Act, 1991; and
- (xxvi) Cutting of Trees (Prohibition) Act, 1975,

III. DESCRIPTION OF THE PROJECT

8. The Improving Workforce Readiness in Punjab Project (IWRPP) has three main areas of implementation i.e.,

(i) **Output 1: Quality and Relevance of TVET in Priority Economic Sectors Improved.** It includes upgrading of 19 institutes (16 TEVTA institutes and 3 PVTC institutes) into COEs in 8 priority economic sectors; 4 selected COEs (ICT & Textile) will use high-level technology for training (focusing on girls) with private sector participation; and Work Based Training through Build 4 Skills (2 COEs - Construction).

(ii) **Output 2: Equitable access to TVET Increased.** Provincial wide market relevant and gender focused skills training in priority economic sectors; and social marketing campaigns to improve the image of TVET, and encourage more female participation on non-traditional skills areas.

(iii) **Output 3: TVET sector institutional framework strengthened.** Develop a strategy, policy of TVET development in Punjab; capacity and developing the regulatory framework for Punjab Skills Development Authority; and develop a comprehensive TVET Management Information System (MIS) and Labor Market Information System (LMIS).

9. Under output 1, the project will upgrade 20 TVET institutes including 17 Institutes managed by TEVTA and 3 institutes managed by PVTC into Centers of Excellence (COEs). The 19 COEs will deliver CBTA-approach training programs in eight priority economic sectors. Six of these priority economic sectors are *vertical sectors*: (i) tourism and hospitality [3 COEs]; (ii) automobile and motorbike assembly, parts and repair [2 COEs]; (iii) construction [2 COEs]; (iv) textiles and garments [2 COEs]; (v) food processing (including agriculture, dairy and livestock products) [2 COEs]; and (vi) health [1 COE]. The remaining two are *cross-cutting sectors*: (i) light engineering (renewable energy, surgical instruments, farm machinery, and general) [6 COEs]; and (ii) information communication technology (ICT) [3 COEs].

10. The project will be implemented from 2022 to 2028 (6 years). A PSC will be established to guide the executing agency and monitor overall project performance and outcome. The PSC will be chaired by the Chairman, Planning and Development Board, and will be composed of Secretaries of ICISDD, Planning and Development and Finance, as well as the PIU director and private sector representatives. The executing agency will be ICISDD, while the ICISDD project implementation unit (PIU) will be the implementing agency and will have its own advance account.

TEVTA, PVTC and PSDF will be implementing partners. The project is estimated to cost \$110 million. Detailed cost estimates by expenditure category and by financier are included in the project administration manual. The project cost includes physical and price contingencies and a Government of Punjab (GoPb) in-kind contribution of \$10.0 million that covers project implementation costs. ADB will finance taxes and duties, establishment of PIU office and salaries of PIU staff. Most spending is on workshop and hi-technology equipment, energy efficient materials, civil works and purchase of training providers. **Sub-Project will involve rehabilitation and additional works of buildings of Government Staff Training College, Murree and Government Technical Training Institute for Women, Murree.**

IV. ANALYSIS OF ALTERNATIVES

11. Different alternatives considered for the project include the no project option, site alternatives, technology alternatives and design alternatives. The project has economic and social benefits and a team of expert finalized 02 COEs in consultation with TVET sector. A combination of rehabilitation work at existing COEs, construction of need based building blocks, procurement of standard equipment and investment on training component is the most suitable alternative.

V. DESCRIPTION OF ENVIRONMENT

12. The project activities will be performed in major cities of Punjab which are: Lahore, Sheikhpura, Gujranwala, Sialkot, Faisalabad, Rawalpindi, Murree, Multan, Sahiwal, Khanewal, and Bahawalpur. Punjab's landscape is diverse i.e., from mountains in north to salt range in central upper part and vast agricultural plain fields to desert in south. Most areas in Punjab experience extreme weather with foggy winters, often accompanied by rain. By mid-February, the temperature begins to rise; springtime weather continues until mid-April, when the summer heat sets in. The onset of the southwest monsoon reaches Punjab by May, but since the early 1970s, the weather pattern has been irregular. In August, the oppressive heat is punctuated by the rainy season, referred to as *barsat*, which brings relief in its wake. The hardest part of the summer is then over, but cooler weather does not come until late October. Recently the province experienced one of the coldest winters in the last 70 years. Punjab's region temperature ranges from -2° to 45° °C, but can reach 50° °C (122° °F) in summer and can touch down to -10° °C in winter. Climatically, Punjab has three major seasons: hot weather (April to June) when temperature rises as high as 110° °F, rainy season (July to September) with average annual rainfall between 96 cm sub-mountain region and 46 cm in the plains, and cooler/foggy/mild weather (October to March).

13. Geology in Punjab mainly comprise clayey soils. Geological formation in Lahore and Multan are loamy soils. Soil in Bahawalpur are sandy in nature. The Gujranwala is plain area, the land is fertile and fit for agriculture purposes. Rawalpindi district is mixture of hilly and plain land resources.

14. The land use pattern of Punjab comprises land cover, snow cover and water bodies, forest, pasture and range land, agriculture, and waste land.

15. The baseline environmental monitoring was originally conducted in July 2020 following all the required SOPs and guidelines. An independent environmental monitoring laboratory i.e. M/s Environmental Services of Pakistan Private Limited (ESPAK) was engaged for this purpose. Two teams of ESPAK conducted the baseline environmental monitoring at 19 COEs including these Sub-Projects. The baseline environmental monitoring report prepared and submitted by M/s ESPAK is also annexed as Appendix-V to the EIA. Additionally, the baseline monitoring data was compared and reinforced with extracted information from other secondary sources i.e., other EIA reports and research papers at that stage. The baseline monitoring for air, noise and water quality at all COE sites will

be conducted again through an independent, EPA approved laboratory to determine the most recent baseline levels at the detail design stage and prior to the start of construction works. The environmental monitoring needs to be conducted through an independent, EPA approved laboratory.

16. Mostly, the ambient air quality parameters are within permissible limits of Punjab Environmental Quality Standards (PEQS), except the parameters for pollutants such as SO₂, NO₂, O₃, PM₁₀, PM_{2.5} are not within the allowable limits of WHO, IFC standard limits. Higher values of PM₁₀ and PM_{2.5} may be due to vehicular emissions, open burning of solid waste and gaseous emissions of industries and brick kilns.

17. Groundwater is the sole source of potable water exploited in all cities of Punjab. The ground water is extracted by means of different private and Government installed wells. The depth of these wells varies from 120-700 feet and greater quantities of good quality groundwater are available in deep wells, and this is where the cities' supplies are derived (PCRWR, 2021; PCRWR, 2014).

18. Some project sites i.e., COEs situated in Southern and Central Punjab (Bahawalpur, Multan, Khanewal, Sahiwal, Lahore, Faisalabad, Sheikhpura, Gujranwala, Sialkot) have ornamental plants and common urban flora in their vicinity. Some common trees found in or around these 16 COEs are: Shisham (*Dalbergia sisso*), Sufeda (*Eucalyptus camelduleusis*), Neem (*Azedarachta indica*), Bakain (*Melia azedarach*), Sukh Chain (*Pongamia glabra*), Mulberry (*Morus alba*), Bohr (*Ficus bengalensis*), Amaltas (*Cassia fistula*), Peepal (*Ficus relifosa*); and Ber (*Ziziphus mauritiana*). In Murree, Pinus is found.

19. The common urban avifauna in vicinity or surroundings of COEs is: Shikra (*Accipiter badius*), Crow (*Corvus splendens*), Common kite (*Milvus migrans*), Sparrow (*Passer domesticus*), Pigeons (*Columba livia*), Dove (*Stratopielia SSP.*), Parrot (*Psittacula krameri*), Mynah (*Acridotheres tristis*) whereas Cheer Pheasant and Kalij pheasant are common in Murree.

20. There are no migratory birds reported in or around the project area. Domestic animals of significance include cows/ bulls, buffaloes, goats, donkeys, and sheep. There is no endangered species reported in the project area by the Wildlife Department of Punjab.

21. Fishery sector is moderate on account of precious fertile land for agriculture production. Not much variety of fish is found, except Gulfam fish (*Cyprinus carpio*) which is basically cold-water species but has adapted to harsh conditions. However, dependency of local people on fish as economic activity is very limited, because of the non-existence of large fish farms in the area.

22. Agriculture is the main source of income of the inhabitants of Punjab. Due to the most sophisticated canal irrigation system and supporting ecological and climate characteristics, this area has a good potential for producing almost all kinds of food commodities. The area has a diverse cropping pattern because of its heterogeneity in agro-climatic conditions.

23. Agriculture is by far the main economic activity in the project area. The main crops, during Rabi, are wheat, gram, rapeseed, mustard, barley, and oil seeds. During Kharif, crops include cotton, jawar, sugarcane, bajra, maize, and rice. In addition, there are subsidiary crops known as Zaid Rabi, such as Kharboosa, tobacco and potatoes, and Zaid Kharif crops, such as potatoes and chilies. The main fruits grown are oranges, watermelon, muskmelon, guava, citrus, falsa, jaman, and pomegranate. When cultivation began, the inhabitants are pilu and bair, the only wild fruits that grows, intermittently, in the region. With the introduction of canal irrigation, other fruits

are now being grown on a commercial basis. However, wheat, cotton, sugarcane, and rice remain the major crops.

24. Interruptions are frequent, forcing industries, other businesses, and many of the residents who can afford it to rely on back-up diesel generators and uninterrupted power supply systems. Punjab has a lot of industrial activity ranging from large scale to small and medium scale enterprises. Water and Sanitation Agency supplies water in urban areas and ground water tube wells and domestic pumps are installed in abundance.

25. The labor force participation is the highest either in construction or agro-related, followed by industry. Service workers, in shops and market sales workers come at third, business personnel at fourth and then unskilled workers at fifth with sixth rank of high professionals. Main source of formal employment are factories, of varying size, and its environs.

VI. POTENTIAL ENVIRONMENTAL IMPACTS & MITIGATION MEASURES

26. As a first step, the screening of the subprojects was conducted using the ADB's rapid environment assessment (REA) checklist. The construction and renovation work in the 02 COEs fall under Category B as per ADB Safeguard Policy Statement (2009) and so require IEE study but EIA has been prepared in the light of IEE/EIA Regulations, 2022 Schedule II (I).

27. The project has several positive impacts from generating a large and skilled workforce to upgradation of COEs into quality institutes. The impact would be positive as need based trainings will create job opportunities and workforce readiness for local and global markets.

28. The negative impacts are site specific and mainly will be generated during construction phase of the project. During design phase, impacts from procurement of hazardous consumables, over designing of COEs i.e., more than required, parking arrangements in design, EIA inclusion in contractors bidding documents and preparation of contractor's site-specific environmental management plans (SSEMPs) would be a challenge that can be addressed through collaboration with design team. During construction, emissions from construction activities, wastes from camps, loss of trees at 3 COEs (Murre and Faisalabad), impact on air quality, load on sanitation, drinking water, exploitation traffic congestion, higher noise levels, land contamination, vibrations, occupational health and safety, public health and safety, contractor's laborer conflicts with students/staff, mishandling of equipment and impact on surrounding educational institutes in Multan, Lahore, Bahawalpur, Sialkot, Gujranwala are the major impacts. These impacts can be controlled through management plans, SOPs, stringent monitoring for implementation of SSEMPs and compliance check. During operation, major impacts will be noise and vibration from equipment, health and safety issues, load on building structure, power requirements, etc. The impacts can be reduced through improved designs and measures such as shock absorbers, health and safety management, installation of solar panels as an alternate energy resource.

VII. STAKEHOLDERS CONSULTATION AND INFORMATION DISCLOSURE

29. Amid COVID-19 situation, the consultations were not done on regular procedures of ADB's ADB's Safeguard Policy Statement (2009). Considering new normal and lockdown factors, consultations with government departments, TVET public and private sector organizations and COEs was done through phone calls. Some information was acquired from COEs focal points during due diligence in March 2020. The consultations with Planning & Development, Environment Protection Department Punjab, Public Sector Development Program (PSDP), Punjab Skills Development Foundation, Technical Education and Vocational Training Authority, Punjab Vocational Training Council, Chambers of Commerce and Industry in

Lahore/Multan/Rawalpindi, All Pakistan Textile Mills Association (APTMA), Association for Builders and Developers (ABAD), Hunar Foundation, Infinity, COTHM, Rubitrons Lab and Atlas Honda proved to be fruitful as most of them were happy with the structure of project which will address the training gaps, improve the existing COEs' infrastructure and will upgrade the curricula. However, in this year, during May-June 2022 almost all of the COEs were visited by the environmental experts for an in-depth and in-person stakeholder consultation with all 19 COEs' staff and students, and collection of site-specific environmental information to completely cover the site due diligence and capture all the input information for this EIA. Follow up consultations with the stakeholders from each COEs, immediate local neighborhood of COEs, tehsil or district offices, FGDs communities including vulnerable groups will be carried out prior to preparing site-specific EMPs and throughout the implementation phase. During these consultations the major concerns were related to drinking water, sewerage, and waste situation, building conditions, building designs, and security. The findings of these efforts and baseline monitoring results are duly incorporated in preparing this EIA and EMP, and shall be addressed by the design team.

30. The project executing agency, ICISDD will disclose this EIA and EMP to all the stakeholders before the commencement of the proposed project. The EIA report will be made available to the stakeholders at the sites designated by the Punjab EPD, in accordance with the Pakistan Environmental Protection Act (PEPA) 2012 legislation. In addition, the executive summary of the EIA will be translated into Urdu language (if necessary) and made available to the affected people (and also kept at the project sites).

VIII. ENVIRONMENTAL MANAGEMENT PLAN

31. Environmental Management Plan (EMP) provides a mechanism to address the adverse environmental impact of a project during its construction, to accelerate project benefits, and to introduce standards of good practice to be adopted for all project works.

32. The EA (Secretary ICISDD) will establish a PIU to discharge day to day project implementation functions. The PIU, headed by the project director, will be supported by a full-time Deputy Director (Environment) along with other specialists including financial management, monitoring & evaluation, procurement and contract management, senior engineer, social safeguard team, etc.

prepared by the contractor and approved by the Deputy Director (Environment)-PIU with endorsement of ADB Environment Team. The Contractor's SSEMP will be submitted and approved at least ten days prior to the start of any civil work at each COE. The relevant personnel of consulting firm will also be responsible for training PIU staff in environmental management to assist them to own the project.

33. EPD-Punjab is the regulatory authority for issuance of no objection certificate (NOC) for this proposed project. As part of its mandate, protection of environment (water, air and noise) is its responsibility. Therefore, this agency may inspect the site at any time to check the compliance of EMP. ADB team would make sure the compliance with ADB Safeguards Policy Statement and this EIA's recommendations. Project Director (PD) will have overall responsibility for assuring implementation of EMP.

34. Environmental monitoring provides timely and useful information to the project management and implementation agencies. Conceptually, "monitoring" means to check and balance, on a regular basis, the status of the project activities and realization of various developmental targets during construction mainly. It helps in timely identification/analysis and removal of the bottlenecks and expedites actions. Certain environmental parameters (physical,

chemical, and ecological) are selected and quantitative analysis is carried out. The results of analysis are compared with the guidelines; standards and pre-project condition, to investigate whether the EMP and its implementation are effective for the mitigation of impacts or not.

IX. GRIEVANCE REDRESS MECHANISM

35. The formation of a Grievance Redress Committee (GRC) will be constituted at project level as part of institutional arrangements for successful implementation of the project. The Committee will meet at least twice a month and provide decision to resolve the issues at the end of the meeting. The non-official members will be provided logistics for the committee meetings. The committee may request the complainant to attend and present his case. The representative of the Contractor will attend the proceedings of the Committee if some matter relating to the Contractor's EMP non-compliance is put before the committee. In case of disagreement of the complainants with the decision of the GRC, the case will be referred to the project director (PD), PIU by the Committee with their observations and recommendations. The PD, PIU is the final authority at the project level to decide a case. However, the aggrieved person will have the right to go to proper court of law, in case he is not satisfied with the decisions of the PD.

X. CONCLUSION AND RECOMMENDATIONS

36. The development of the proposed project work on 19 COEs is of provincial significance and is of critical importance considering the significant TVET sector weaknesses and serious shortage of skilled workers in Punjab for the past several years.

37. Stakeholder Consultation including with focal persons of all COEs, teaching and support staff, and students was completed in May-June 2022 during the site visits for Rapid Environmental Assessment (REA). Follow up consultations with the stakeholders from each COEs, immediate local neighborhood of COEs, tehsil or district offices, FGDs communities including vulnerable groups will be carried out prior to preparing site-specific EMPs and throughout during implementation phase. Since the project activities would comprise of construction of new components and renovation within the existing premises of COEs, it is anticipated that the project will have less adverse and only site-specific environmental impacts during the construction phase including air and water pollution, solid waste, noise, traffic disruptions, utilities relocation, and occupational and community health and safety caused by construction of new buildings such as workshops and hostels and renovation of existing buildings. Adequate mitigation measures are included in, and will be implemented through, an EMP. The EMP and its mitigation and monitoring programs will be included within the bidding documents for project works. The EMP will include the provision of training in environmental management. In the light of stakeholder consultations completed during project preparation the grievance redress mechanism (GRM) is also included in this EIA and will be followed during project implementation.

38. This EIA concludes that no significant negative environmental impacts are likely to occur due to construction and normal operations of the proposed project, provided mitigation measures are implemented and the proposed monitoring program is adequately carried out. The project has been assigned environmental category 'B' in accordance with the ADB's Safeguard Policy Statement (2009) and Schedule II as per Pakistan Environmental Protection Act (PEPA) review of IEE/EIA Regulations, 2022. Thus, this EIA report with the associated EMP is regarded as sufficient environmental assessment of the project.

1. INTRODUCTION

1.1. Project Background

1. Since the passage of the 18th Constitutional Amendment in 2010, provincial governments are responsible for delivering, funding and regulating technical and vocational education and training (TVET). In Punjab, the Industries, Commerce, Investment, and Skills Development Department (ICISDD) has overall responsibility for the TVET sector, although many departments and agencies are involved in the sector. There are two principal public TVET providers in Punjab: Technical Education and Vocational Training Authority (TEVTA) has some 400 institutes, while Punjab Vocational Training Council (PVTC) has some 217 institutes. TEVTA and PVTC are government funded. TEVTA is financed through ICISDD, while PVTC is funded through the Zakat and Ushr Department and the Planning and Development Department.

2. The size of the TVET sector in Punjab dwarfs that in other provinces. In 2018, there were 1,672 TVET institutes and 238,331 TVET enrolments in Punjab, representing 46.0% of TVET institutes and 56.8% of TVET enrolments in Pakistan. By comparison, Sindh had only 17.0% of TVET institutes and 18.1% of TVET enrolments in Pakistan.⁷ The labor market in Punjab is characterized by low levels of skills, low female participation and a large informal sector.⁸ Women's labor force participation is around one-third that of men. There is substantial occupational segregation, with females more likely to work in traditional jobs such as dressmakers and beauticians.⁹ Over 60% of the Pakistan population is under 25 and youth have low levels of education and little exposure to TVET. The unemployment rate for youth is also high.¹⁰ The TVET sector's challenges limit its ability to support competitiveness and inclusive economic growth through the supply of skilled workers. These challenges include:

- (i) **Quality and relevance of TVET in priority economic sectors improved.** The TVET sector in Punjab faces several challenges that limit its ability to promote competitiveness and inclusive economic growth through the supply of skilled workers. One core challenge is the poor quality and relevance of training imparted by the TVET sector. This is due to several factors which include (i) outdated training methods, assessment techniques, curricula, and equipment; (ii) shortages of trained and qualified TVET instructors; (iii) weak linkages between the TVET sector and industry, including limited private sector participation in curriculum development; (iv) minimal scope for on-the-job training for trainees; and (v) limited private sector delivery of TVET.
- (ii) **Equitable access to TVET increased.** TVET trainees represent only 4–5% of the population aged 16–20 years in Punjab. This is due to lack of TVET provision in some areas, low government and private sector spending on TVET, inadequate female labor force participation rates, and restrictive education requirements for accessing TVET. TVET participation is particularly limited for women and people in rural areas. In 2016-2017, females made up 22.8% of enrolments and 24.0% of teachers at TEVTA institutes. They made up 48% of enrolments and 46% of teachers in PVTC institutes in 2017.¹¹ Women in TVET usually enroll in traditional

⁷ National Skills Information System. 2019. [TVET Sector- Statistical Overview](#). Pakistan.

⁸ Informality refers to paid work that is not recognized, regulated, or protected by existing legal or regulatory frameworks, or to unpaid work in income-producing enterprises.

⁹ World Bank. 2018. [Female Labor Force Participation in Pakistan: What do we Know?](#)

¹⁰ World Bank. 2015. [Project Appraisal Document: Punjab Skills Development Project](#). Washington, DC.

¹¹ Punjab Commission on the Status of Women. 2018. [Punjab Gender Parity Report](#). Lahore.

female courses, with little encouragement to enter male-dominated programs. The poor quality and relevance of TVET in Punjab also constrains TVET demand as potential trainees see little benefit from TVET in terms of higher future incomes or increased job opportunities.

- (iii) **TVET sector institutional framework strengthened.** In Punjab, the TVET policy and institutional framework also require substantial strengthening. Until recently, there was no agency with overall responsibility for the planning, governance, regulation, and financing of TVET in the province; the responsibility for quality assurance is also fragmented. Although a Punjab Skills Development Authority (PSDA) has been established last year, it is yet to be fully operational. Importantly, the authority will require critical assistance during its initial phase to appropriately implement these tasks. Skills certification is spread across various agencies. Further, there is a lack of systemic information collection and there is no centralized database on the TVET sector. The capacity of TVET institute management is also of concern.¹²

3. Weaknesses in the TVET sector have led to a serious shortage of skilled workers in Punjab, which constrains economic growth and adversely affects the performance of industry. According to one survey, 60% of firms said that the TVET system did not produce enough people with the skills required by employers, and more than 50% of firms said that the TVET system did not produce enough people with up-to-date knowledge of methods, materials and technology.¹³ A survey of Lahore-based manufacturers identified inadequately trained workers as a key impediment to industrial performance. While skill shortages affected both large and small/medium enterprises, the impact was greater on the latter.¹⁴ Improving TVET¹⁵ can help close the skills gap, reduce unemployment, increase productivity,¹⁶ lift competitiveness and promote foreign direct investment.¹⁷

4. Improving the performance of the TVET sector in Punjab can help lift Pakistan's development prospects given that it is the country's most populous province—its economic powerhouse—and has several industrial and economic centers including Lahore, Faisalabad, Sialkot, Multan, and Rawalpindi. Improved skills development is a critical part of the GoPb's Punjab Growth Strategy (PGS) 2023. The GoPb has also developed the Punjab Spatial Strategy 2047, a spatial and regional planning framework that will guide investments in the province.¹⁸ In response to the COVID-19 pandemic, the GoPb released the Responsive Investment for Social Protection and Economic (RISE) Stimulus Framework, which sets out 7 critical pillars to help Punjab address the health, economic and social protection challenges of COVID-19.¹⁹ The PGS 2023 is currently being reformulated to account for the effects of the COVID-19 pandemic.

¹² World Bank. 2015. [Project Appraisal Document: Punjab Skills Development Project](#). Washington DC; and A. Raza and M. I. Khalid. 2017. [Obstacles in the Enhancement of Technical Education in Pakistan: Views and Reviews](#). *Bulletin of Education and Research*. 39 (1). pp. 117-127.

¹³ World Bank. 2015. [Project Appraisal Document: Punjab Skills Development Project](#). Washington DC.

¹⁴ S.T. Hussain and others. 2012. [The Constraints to Industry in Punjab, Pakistan](#). *The Lahore Journal of Economics*. 17: SE. pp. 135-189. September.

¹⁵ European Centre for the Development of Vocational Training. 2014. [Macroeconomic Benefits of Vocational Education and Training](#). *Research Paper No. 40*. Luxembourg: Publications Office of the European Union.

¹⁶ A. Fatima and R. Saleem. 2016. [The Impact of Vocational Education on Economic Growth of Pakistan](#). *Bulletin of Business and Economics*. Vol. 5(2).

¹⁷ K. Hornberger et al. 2011. [Attracting FDI](#). *Viewpoint*. The World Bank Group: Washington DC. August.

¹⁸ World Bank. [Punjab Spatial Strategy 2047](#). [brochure]. Lahore.

¹⁹ Government of Punjab, Planning and Development Board. 2020. [Responsive Investment for Social Protection and Economic Stimulus](#). Lahore.

5. The COVID-19 pandemic has added significantly to the challenges facing the province. Since February 2020, the spread of the COVID-19 virus has had a severe impact on economic activity in Pakistan, with much of the country placed under partial lockdown. The closure of non-essential businesses and disruptions to supply chains have had a significant impact on all economic sectors, but particularly on the service sector. A recent survey of the impact on small and medium enterprises in Pakistan by Karandaaz found that 58% had laid off employees as a result of the pandemic and 31% claimed potential insolvency within the month.²⁰ According to the World Bank, real gross domestic product (GDP) in Pakistan contracted by 1% in fiscal year (FY) 2020. However, effective use of localized lockdowns to curb the spread of the virus allowed economic activity to continue and recover. Supportive macroeconomic and financial policies in tandem with the expansion of the national cash transfer program resulted in growth of real GDP growth at constant factor 2015-16 prices increasing to 5.6% in FY21.²¹ Recent macroeconomic adjustment measures alongside with stronger inflation see real GDP growth slowing to 4.3% in fiscal year (FY)2022 and 4% in FY2023.

6. COVID-19 has also had a direct effect on the TVET sector in Pakistan and internationally, as it has on the education sector more generally. The suspension of classes during the lockdown period has meant that most TVET institutes in Pakistan have been unable to deliver face to face teaching, with little capacity for remote delivery of classes. In addition, the impact of the economic crisis on employers has seen opportunities for on-the-job training dry up.²²

7. A well-performing TVET sector can improve the matching of skills needed in the labor market and those produced by TVET institutes, thus playing a key role in supporting economic recovery and job creation by (i) facilitating the retraining of displaced workers and new entrants to the labor market; (ii) improving the perception and employability of TVET graduates; (iii) supplying the workers needed by firms to improve productivity, product quality, and competitiveness; (iv) enabling firms and entrepreneurs to expand their technological capability and move up value chains where profit margins are often higher; and (v) removing a key constraint to firm growth and operation by addressing skills gaps in critical areas.²³ Improved TVET sector performance would have a number of benefits, including increasing foreign direct investment.²⁴ These positive economic effects would have wider impacts in terms of keeping kids in school, reducing poverty and fostering lifelong learning.

1.2. Project Objective

8. The project impact is increased access to quality employment for workers in Punjab (Punjab Skills Development Sector Plan 2018). The project outcome is a market-driven and inclusive skills development system improved. Proposed project outputs are as follows: (i) quality and relevance of TVET in priority economic sectors improved; (ii) equitable access to TVET increased; and (iii) TVET sector institutional framework strengthened. These are summarized in Table 1.1 and discussed in more detail below.

²⁰ Karandaaz. 2020. [Impact of COVID-19 on SMEs \(April 2020\) Survey Findings](#). [PowerPoint slides].

²¹ The World Bank. [The World Bank in Pakistan](#) (accessed 29 May 2020).

²² World Education Blog. [TVET and Skills Development in the Time of Covid-19](#).

²³ World Bank. 2013. *What Matters for Workforce Development: A Framework and Tool for Analysis*. SABER Working Paper Series Number 6. Washington, DC; A. Fatima and R. Saleem. 2016. [The Impact of Vocational Education on Economic Growth of Pakistan](#). *Bulletin of Business and Economics*. Vol. 5(2); and European Centre for the Development of Vocational Training. 2014. [Macroeconomic Benefits of Vocational Education and Training](#). *Research Paper No. 40*. Luxembourg: Publications Office of the European Union.

²⁴ K. Hornberger et al. 2011. [Attracting FDI](#). *Viewpoint*. The World Bank Group: Washington, DC. August.

Table 1.1: Summary Project Impact, Outcome and Outputs

Project Impact Increased access to quality employment for workers in Punjab (Punjab Skills Development Sector Plan 2018)		
Project Outcome Market relevance and inclusiveness of skills development system improved		
Output 1 Quality and relevance of TVET in priority economic sectors improved	Output 2 Equitable access to TVET increased	Output 3 TVET sector institutional framework strengthened
<ul style="list-style-type: none"> Upgrade 19 institutes (16 TEVTA institutes and 3 PVTC institutes) into COEs in 8 priority economic sectors 4 selected COEs (ICT & Textile) will use high-level technology for training (focusing on girls) with private sector participation Work Based Training through Build 4 Skills (2 COEs - Construction) 	<ul style="list-style-type: none"> Provincial wide market relevant and gender focused skills training in priority economic sectors Social marketing campaigns to improve the image of TVET, and encourage more female participation on non-traditional skills areas 	<ul style="list-style-type: none"> Develop a strategy, policy of TVET development in Punjab Capacity and developing the regulatory framework for Punjab Skills Development Authority Develop a comprehensive TVET MIS and LMIS

COE = center of excellence, LMIS = labor market information system, MIS = management information system, PVTC = Punjab Vocational Training Council, TEVTA = Technical Education and Vocational Training Authority, TVET = technical and vocational education and training

Note: Focus sectors are ICT, light engineering, automobile/motorbike assembly, parts and repair, food processing, tourism and hospitality, construction, textiles and garments, and health.

Source: Asian Development Bank.

1.3. Environmental Safeguard Category of the Project

9. According to ADB's Safeguard Policy Statement (2009), a Rapid Environmental Assessment (REA) was conducted (Annex VI). The Pakistan Environmental Protection Agency's Guidelines for the Preparation and Review of Environmental Reports (2000) were also consulted. Based on the initial findings, it was ascertained that limited adverse environmental impacts are expected due to construction of the proposed Centers of Excellence (COEs) and thus it has been classified as Category 'B' from environmental safeguards perspective and this EIA report has been prepared according to EIA/IEE Regulations, 2022 Schedule II (I).

1.4. Methodology of EIA Report

The following methodology was employed for this EIA study:

10. Primary data was collected from the field visits to proposed COEs sites. Standard protocols for sampling and analysis of environmental matrices were adopted. In addition, preliminary scoping through surveys and assessment activities to establish the potential impacts and categorization of activities and the rapid environmental assessment (REA) was completed. The key receptors and stakeholders within the project area were identified.

11. Secondary data was collected by reviewing the different reports, published articles, web resources and other documents relevant to the environmental assessment of this proposed project.

12. Considering the prevailing COVID-19 pandemic situation, the initial consultations during July 2020 were conducted through phone calls with key stakeholders such as Planning and Development Department, PSDA, TEVTA, PVTC, 19 COEs focal persons, and TVET private sector, in line with the national and ADB requirements. The second round of consultations and field data collection at all sites were conducted in-person during May-June 2022.

13. The significance of impacts from the proposed project are assessed through primary and secondary data and for those impacts requiring mitigation, suitable measures were proposed to reduce impacts to within acceptable limits as per local and international applicable regulations.

14. A detailed environmental management and monitoring plan is developed to ensure compliance to the proposed measures during the project development.

1.5. Proponent of Project

15. The project will be implemented from 2022 to 2028 (6 years). A Project Steering Committee (PSC) will be established to guide the executing agency and monitor overall project performance and outcome. The PSC will be chaired by the Chairman, Planning and Development Board, and will be composed of Secretaries of ICISDD, Planning and Development and Finance, as well as the Project Implementation Unit (PIU) Director and private sector representatives. It will (i) provide guidance on policy development/overall project implementation and on identification of investment activities based on prioritized targets; (ii) ensure coordination with relevant government agencies and stakeholders; and (iii) monitor the achievement of project outcomes. The PSC will also have the authority to recommend changes to priority economic sectors and programs to allow adjustments based on changes in skills demand.

16. The executing and implementing agency will be ICISDD. A PIU will be established in ICISDD, and will operate its own assignment account and ADB's advance fund. PSDA, TEVTA and PVTC will be implementation partners. The EA/IA will be responsible for overall management and coordination of the project.

17. The PIU will be responsible to ensure timely delivery of the project. The PIU staff will be appointed through internal government postings and/or recruitment from the market through competitive process against qualification criteria. The proposed PIU setup is in Figure 9.1. The PIU will be supplemented by the respective specialized consulting firms and individual consultants. The PIU responsibilities include but not limited to prepare and monitor annual implementation plans; annual disbursement and procurement plans; annual financial and accounting plans and schedules; procurement of equipment, works, and services for all project components; establishing and managing the advance finance account; processing withdrawal applications and replenishing the advance finance account; coordination and liaison with all stakeholders; establish and implement the project performance monitoring information system; evaluation and reporting on program implementation progress; preparing all project reports; and organizing and managing training programs. Project implementation arrangements are in Figure 9.1. The ICISDD will be fully responsible for the implementation of all project components except for civil works component, where they will get implementation support from communication and works department (C&WD)

1.6. Structure of the Report

18. The EIA report format is as follows:

- (i) Executive Summary
- (ii) Introduction
- (iii) Policy and Legal Framework
- (iv) Description of the Project
- (v) Analysis of Alternatives
- (vi) Description of Environment
- (vii) Climate Change Assessment
- (viii) Assessment of Environmental Impacts and Mitigation Measures
- (ix) Environmental Management Plan
- (x) Stakeholders Consultation & Information Disclosure
- (xi) Grievance Redress Mechanism (GRM)
- (xii) Recommendations and Conclusions
- (xiii) References
- (xiv) Annexes

1.7. Applicability and Scope of EIA study

19. An environmental impact assessment (EIA) has been prepared as the project includes numerous sites. The work on drafting this EIA was initiated amid COVID-19 situation, therefore at that time an in-person "Stakeholders Consultations" were not conducted as per normal procedures. The initial consultations were mainly covered through phone calls. The baseline environmental monitoring was originally conducted in July 2020 following all the required SOPs and guidelines for COVID-19 prevention. An independent environmental monitoring laboratory i.e., M/s Environmental Services of Pakistan Private Limited (ESPAK) was engaged for this purpose. Two teams of ESPAK conducted the baseline environmental monitoring at 19 COEs. The baseline environmental monitoring report prepared and submitted by M/s ESPAK is also annexed as Appendix-V to the EIA. Additionally, the baseline monitoring data was compared and reinforced with extracted information from other secondary sources i.e., other EIA reports and research papers at that stage. However, in recent months, during May-June 2022 almost all of the COEs were visited by the environmental experts for an in-depth and in-person stakeholder consultation and collection of site-specific environmental information to completely cover the site due diligence and to capture all the input information for this EIA. The findings of these efforts and baseline monitoring results are duly incorporated in preparing this EIA. Follow up consultations with the stakeholders from each COEs, immediate local neighborhood of COEs, tehsil or district offices, FGDs communities including vulnerable groups will be carried out prior to preparing site-specific EMPs and during implementation phase. The baseline monitoring for air, noise and water quality (at least) at all COE sites will be conducted again through an independent, EPA approved laboratory to accurately setup the baseline levels at the detail design stage and prior to the start of construction works. The resulting Environmental Management Plan (EMP) covers the current full scope of IWRPP project and hence the EMP is applicable to all sites for all the site-specific scope. In case, of any major additions in the overall scope of IWRPP, an update in the EIA will be required to cover the new additions. The construction contractor at each site is required to prepare and submit site specific environmental management plan for the review and approval of the PIU DD Environment.

2. POLICY AND LEGAL FRAMEWORK

2.1. General

20. This section provides an overview of the policy framework and national legislation that applies to the scope of work to be conducted under the proposed project. The project is expected to comply with all national legislation relating to environment in Pakistan as well as ADB's Safeguard Policy and to obtain all the regulatory clearances required.

2.2. Statutory Framework

21. The Constitution of Pakistan distributes legislative powers between the federal and provincial governments through two 'lists' that are attached to the Constitution as Schedules. The Federal List covers the jurisdictions over which the federal government has exclusive legislative power, while the Concurrent List contains jurisdictions over which both the federal and provincial governments can enact laws. "Environmental pollution and ecology" is included in the concurrent list; hence, both the federal and the provincial governments can enact laws in this jurisdiction. However, to date, after the 18th Constitutional Amendment, the Federal Ministry of Environment was dissolved, and the provincial governments are now authorized to formulate environmental laws and regulations. The key environmental laws affecting the subprojects are discussed below.

2.3. National Policy and Legal Framework

22. The Pakistan National Conservation Strategy (NCS) that was approved by the federal cabinet in March 1992 is the principal policy document on environmental issues in the country (EUAD/IUCN, 1992). The NCS outlines the country's primary approach towards encouraging sustainable development, conserving natural resources, and improving efficiency in the use and management of resources. The NCS has 68 specific programs in 14 core areas in which policy intervention is considered crucial for the preservation of Pakistan's natural and physical environment. The core areas that are relevant in the context of the proposed project are pollution prevention and abatement and increasing energy efficiency while conserving biodiversity.

23. Prior to the adoption of the 18th Constitutional Amendment, the Pakistan Environmental Protection Act (PEPA) 1997 was the governing law for environmental conservation in the country. Under PEPA 1997, the Pakistan Environmental Protection Council (PEPC) and Pakistan Environmental Protection Agency (EPA) were primarily responsible for administering PEPA 1997. Post the adoption of the 18th Constitutional Amendment in 2011, the subject of environment was devolved, and the provinces have been empowered for environmental protection and conservation.

2.3.1. Pakistan Environmental Protection Act, 1997

24. The Pakistan Environmental Protection Act 1997, is the basic legislative tool empowering the government to frame regulations for the protection of the environment. The act is applicable to a wide range of issues and extends to air, water, soil, marine, and noise pollution, and to the handling of hazardous wastes. The key features of the law, in as far as it has a direct bearing on the proposed subprojects, relate to the requirement for an EIA and an EIA for development subprojects. Section 12 (1) requires that: "No proponent of a sub-project shall commence construction or operation unless he has filed with the Federal Agency an environmental impact assessment (EIA) or, where the subproject is likely to cause an adverse environmental effect, an environmental impact assessment (EIA), and has obtained from the Federal Agency approval in

respect thereof.” The Pakistan Environmental Protection Agency has delegated the power of review and approval of environmental assessments to the provincial environmental protection agencies, in this case the Punjab EPA.

2.3.2. Punjab Environmental Protection (Amendment) Act, 2012

25. After the 18th Constitutional Amendment in the Constitution of Pakistan, the Federal Ministry of Environment was dissolved, and the provinces were accorded jurisdiction over the environment. The EPA Punjab has formulated its own Act, the major content of which is the same as the PEPA, 1997. Minor amendments/changes have been made, as follows:

- (i) The name of the Act has been changed to “Punjab Environmental Protection (Amendment) Act, 2012”;
- (ii) For the words “Federal Government”, wherever they occur, the word “Government” shall be substituted; For the words “Federal Agency”, wherever they occur, the words “Provincial Agency” shall be substituted;
- (iii) For the word “National”, wherever it occurs, the word “Punjab” shall be substituted; and
- (iv) All the other clauses, sub-clauses, sections, and sub-sections are almost identical.

26. Since these subprojects fall within Punjab province, approval from Punjab province will be required if these fall under the category B.

2.3.3. Punjab Environmental Protection Agency Review of EIA and EIA Regulations, 2022

27. The Punjab Environmental Protection Act provides for two types of environmental assessments: IEEs and EIAs. EIAs are carried out for projects that have the potential for ‘significant’ environmental impacts, whereas IEEs are conducted for relatively smaller projects with relatively less potential for significant impacts. The Punjab Environmental Protection Agency Review of the IEE/EIA Regulations categorizes the subprojects that require an EIA as per Schedules II (I).

28. The Regulations also provide the necessary details on the preparation, submission, and review of IEEs/EIAs. The following is a brief step-by-step description of the approval process:

- (i) To determine whether a project is categorized as requiring an IEE/EIA, use the two schedules attached to the Regulations;
- (ii) An IEE/EIA is conducted as per the requirements outlined in the Pak-EPA guidelines;
- (iii) If the project is in the provinces, then the IEE or EIA is submitted to the concerned provincial EPA; if it is in Islamabad and federally administrated areas, then it is submitted to the Pak-EPA. The Fee (depending on the cost of the project and type of report) is submitted along with the IEE or EIA document;
- (iv) The IEE /EIA is also accompanied by an application in the format prescribed in Schedule IV of the Regulations;
- (v) The EPA conducts a preliminary review of the report and replies within 10 days of the submission. It either (a) confirms completeness, or (b) asks for additional information, if needed, or (c) returns the report and asks for additional studies, if necessary;

- (vi) If the issue is confirmation of completeness, then the EPA is required to make every effort to complete the IEE/EIA review process within 30 and 45 days, respectively;
- (vii) The EPA accords their approval, subject to certain conditions:
 - (a) Before commencing construction of the project, the proponent is required to submit an undertaking accepting the conditions.
 - (b) Before commencing operation of the project, the proponent is required to obtain from the EPA a written confirmation of compliance with the approval conditions and requirements of the EIA;
- (viii) An EMP is to be submitted with a request for obtaining confirmation of compliance;
- (ix) The EPAs are required to issue confirmation of compliance within 15 days of receipt of the request and complete documentation;
- (x) The IEE /EIA approval is valid for three years from the date of operational phase NOC; and
- (xi) After completion of construction, a monitoring report is to be submitted to the EPA, followed by annual monitoring reports, during operations.

29. As per Punjab Environmental Protection Act for the IEE/EIA, the sewerage treatment plant and solid waste disposal facility would fall under Schedule II (Review of IEE/EIA Regulations). Schedule II projects require an EIA, due to their anticipated adverse environmental impacts. Under 13 provincial requirements, the water supply, sewerage and drainage, and transport projects do not require either an IEE/EIA.

2.3.4. National Environmental Quality Standards

30. The National Environmental Quality Standards (NEQS) were first promulgated in 1993 and were amended in 1995 and 2000. Standards for the following types of effluent and emissions are specified in the NEQS and may be relevant to the specified projects:

- (i) Municipal and liquid industrial effluent parameters (32) for discharge to in land waters, sewage treatment facilities, and the sea;
- (ii) Industrial gaseous emissions (16 parameters) into the atmosphere;
- (iii) Motor and vehicle exhaust and noise (3 parameters);
- (iv) Ambient air quality (9 parameters);
- (v) Drinking water quality (33 parameters); and
- (vi) Noise for residential, commercial, industrial, and silence zones.

2.3.5. Punjab Environmental Quality Standards

31. The Punjab Environmental Quality Standards (PEQS) annexed as Appendixes-I, II & III, were promulgated in 2016. Specified standards include those for:

- (i) Municipal and liquid industrial effluents;
- (ii) Industrial gaseous emission;
- (iii) Motor vehicle exhaust and noise;
- (iv) National drinking water quality standards; and
- (v) Ambient air and noise standards.

2.3.6. Other Relevant Laws

32. Several other federal and provincial laws are important in the context of environmental management. The main laws that potentially affect the project are listed below.

a. The Punjab Wildlife Protection Ordinance, 1972

33. It empowers the government to declare certain areas to be reserved for the protection of wildlife and to control activities within in these areas. It also provides protection to endangered wildlife species. As no activities are planned in these areas, no provision of this law is applicable to the proposed project.

b. The Forestry Act, 1927

34. It empowers the government to declare certain areas as reserved forests. As no reserved forests exist in the vicinity of the proposed project, this law will not affect to the proposed project.

c. The Antiquities Act of 1975

35. It ensures the protection of Pakistan's cultural resources. The act defines 'antiquities' as ancient products of human activity, historical sites, or sites of anthropological or cultural interest, and national monuments, etc. The act is designed to protect these antiquities from destruction, theft, negligence, unlawful excavation, trade, and export. The law prohibits new construction in the proximity of a protected antiquity and empowers the Government of Pakistan to prohibit excavation in any area that may contain articles of archaeological significance. This project site is not in the proximity of a protected antiquity.

d. Safety Regulations

36. Safety regulations directly or indirectly govern occupational health and safety (OHS) issues during the currently studied production activities. These regulations mainly include three laws and regulations: (i) PEPA laws, 2000; (ii) labor laws; and (iii) Electricity Rules, 1937.

e. Government of Punjab Growth Strategy

37. It is based upon Punjab's vision of inclusive growth that sees the province as secure, economically vibrant, industrialized and knowledge-based province, which is prosperous and where every citizen can expect to lead a fulfilling life.

f. Lahore Development Authority Land Use (Classification, Reclassification and Redevelopment) Rules, 2014

38. These rules classify land in an area or any part thereof into one or more of the following land use classes: residential, commercial, industrial, institutional, mixed use, peri-urban, special development zone, agricultural, and notified area.

g. Land Acquisition Act, 1894

39. This legislation relates to land acquisition and compensation. The Land Acquisition Act 1894 is, however, limited to a cash compensation policy for the acquisition of land and built-up property and damage to other owned assets such as crops, trees, and infrastructure. The Land Acquisition Act does not consider the rehabilitation and resettlement of disrupted populations and the restoration of their livelihoods.

h. Factories Act, 1934

40. The clauses relevant to the proposed project are those that address the health, safety and welfare of the workers, disposal of solid waste and effluents, and damage to private and public property. The act also provides regulations for handling and disposing toxic and hazardous substances. The Pakistan Environmental Protection Act of 1997 (discussed above), supersedes parts of this act pertaining to environment and environmental degradation.

i. Employment of Child Act, 1991

41. Article 11(3) of the Constitution of Pakistan prohibits employment of children below the age of 14 years in any factory, mines, or any other hazardous employment. In accordance with this article, the Employment of Child Act (ECA) 1991 disallows child labor in the country. The ECA defines a child as a person who has not completed his/her fourteenth years of age. The ECA states that no child shall be employed or permitted to work in any of the occupation set forth in the ECA (such as transport sector, railways, construction, and ports) or in any workshop wherein any of the processes defined in the act is carried out. The processes defined in the act include carpet weaving, bidi (kind of a cigarette) making, cement manufacturing, textile, construction, and others.

42. The project contractors will be bound by the ECA to disallow any child labor at the project sites or campsites.

43. Pakistan National Labor Laws/policies were announced five times by the government since 1955 to 2002. All these polices basically laid-down the parameters for the growth of trade unionism, protection of workers' rights, settlement of industrial disputes, and redressal of worker grievances. After 2002, no labor policy has been introduced although a number of developments took place in the intervening period, which would have necessitated the same.

44. Social and economic well-being of the people is one of the principal objectives of the present people's government. Labor Policy, like policies in other fields, should also aim in attaining the objectives in a manner best suited to the resources of the country and the present state of economy. There is an urgent need to revitalize the economy, required sustained efforts, to increase the level of productivity, promotion of investment and maximization of employment. There is an equally genuine requirement to create among workers and employers, a better awareness of their obligations to the national objectives stated above. At the same time, the government recognizes that workers and employers must enjoy reasonable benefits as can be sustained by the economy without suffering setbacks. Keeping these priorities in view, the government considers that a balanced labor policy should be based on the following objectives:

- (i) Worker's right to form unions and unions should be protected and an institutional framework be made available to foster close cooperation between workers and employers at establishment level;
- (ii) Equitable adjustment of rights between workers and employers should be ensured in an atmosphere of harmony, mutually beneficial to the workers and the management;
- (iii) Consultations between workers and employers on matters of interest to the establishment and welfare of workers should be made more effective;
- (iv) Adequate security of jobs should be available to the workers and there should be expeditious redressal of their grievances;
- (v) Conditions should be created that workers and employers are committed in enhancing the labor productivity;

- (vi) Promotion to higher jobs be ensured at all levels based on suitability and merit and for this purpose arrangements should be made for in-service training facilities;
- (vii) Facilities for proper matching of job opportunities and the job seekers be strengthened and standard procedures be streamlined; and
- (viii) Social insurance schemes to be further strengthened.

j. Cutting of Trees (Prohibition) Act, 1975

45. This act prohibits cutting or chopping of trees without permission of the Forest Department. During the due diligence, environmental expert observed trees at COE site in Murree. Hence prior to the construction works at these sites, permission from the Forest Department would be required and contractor will be bound to obey the law and do compensatory plantations.

k. IUCN Red List

46. IUCN has published a red list; it includes those species that are under potential threat of extinction. These species have been categorized as endangered, vulnerable in decline, lower risk species and data deficient species that may be at risk of extinction in the wild. Special consideration will be given to them during project construction.

2.4. Comparison of International and Local Environmental Legislations

47. The ADB's Safeguard Policy Statement (2009) requires application of pollution prevention and control technologies and consistency with international good practice, as reflected in internationally recognized standards. The policy states that when host country regulations differ from these standards, the EA will achieve whichever is more stringent.

48. In order to select the most stringent standards applicable, a comparison of local (PEQS) and international i.e., International Finance Corporation (IFC)/ World Health Organization (WHO) and United States Environmental Protection Agency (USEPA) regulations have been made, as shown in Table 2.1 below. For air quality, comparison was only possible for pollutants having same averaging periods in PEQS, IFC and WHO. PEQS for ambient air quality are more stringent in comparison to USEPA and WHO/IFC standards, in the case of most pollutants.

Table 2.1: Comparison of International and Local Air Quality Standards

Pollutants	USEPA		WHO/IFC		PEQS	
	Avg.Time	Standard	Avg.Time	Standard	Avg.Time	Standard
SO ₂	3 hrs	0.5 ppm	24 hr	40 µg/m ³ (IT-1 ^a)	Annual Mean	80 µg/m ³
	1 hr	75 ppb	-	-	24 hr	120 µg/m ³
CO	8 hrs	9 ppm (11 mg/m ³)	24 hr	4	8 hrs	5 mg/m ³
	1 hr	35 ppm (43 mg/m ³)			1 hr	10 mg/m ³
NO ₂	Annual Mean	100 µg/m ³ (53 ppb)	Annual	10 µg/m ³	Annual Mean	40 µg/m ³
	1 hr	(100 ppb)	24 hr	25 µg/m ³	24 hrs	80 µg/m ³
O ₃	8 hrs	0.07 ppm (148 40 µg/m ³)	Peak Season 8 hrs	60 µg/m ³ 100 µg/m ³	1 hr	130 µg/m ³
PM ₁₀	24 hrs	150 µg/m ³	Annual	15µg/m ³ (IT-1*)	Annual Mean	120 µg/m ³

Pollutants	USEPA		WHO/IFC		PEQS	
	Avg.Time	Standard	Avg.Time	Standard	Avg.Time	Standard
			24 hr	45 µg/m ³ (IT-1*)	24 hrs	150 µg/m ³
PM ₂₅	Annual Mean	15 µg/m ³	Annual	5 µg/m ³	Annual Average (IT-1*)	15 µg/m ³
	24 hrs	35 µg/m ³	24 hr	15 µg/m ³	24 hrs (IT-1*)	35 µg/m ³
					1 hr	15 µg/m ³

CO = carbon monoxide, IFC = International Finance Corporation, NO₂ = nitrogen dioxide, O = ozone, PEQS = Punjab Environmental Quality Standards, PM₁₀ = particulates, PM₂₅ = Particulate Matter (Particle Size 2.5 micron), SO₂ = sulfur dioxide, USEPA = United States Environmental Protection Agency, WHO = World Health Organization.

^a IT-1 as specified by WHO Air Quality Guidelines 2005.

49. Similar to the standards for air quality, the comparison of noise standards provided in Table 2.2 clearly shows that PEQS for noise are more stringent in comparison to the WHO/IFC standards. The only exception is the daytime noise level standard for Industrial areas where the WHO/IFC standard is more stringent (70 dB [A]) in comparison to PEQS (75 dB [A]) and so for this particular parameter, the WHO/IFC standard will be used.

50. As far as regulations regarding other environmental parameters are concerned such as acceptable effluent disposal parameters, the local regulations i.e., PEQS are more stringent and would be preferred over any other international regulations such as WHO/IFC.

Table 2.2: Comparison of International and Local Noise Standards

Category of Area/Zone	Limit in dB(A) Leq			
	PEQS		WHO/IFC	
	Daytime	Nighttime	Daytime	Nighttime
Residential area (A)	55	45	55	45
Commercial Area (B)	65	55	70	70
Industrial Area (C)	75	65	70	70
Silence Zone (D)	50	45	55	45

dB(A) = decibel A, IFC = International Finance Corporation, PEQS = Punjab Environmental Quality Standards, WHO = World Health Organization.

51. Similar to the standards for air and noise quality, the comparison of water quality standards provided in Table 2.3 clearly shows that PEQS for biological and physical parameters of drinking water quality are same as for WHO standards except for total hardness as CaCO₃. PEQS for chemical, toxic inorganic and organic parameters are mostly similar/comparable zinc, residual chlorine, phenolic compounds (as Phenols) mg/l, poly-nuclear aromatic hydrocarbons (as PAHs) g/l. WHO for lead and Zn are more stringent comparatively.

Table 2.3: Comparison of Punjab and WHO Environmental Quality Standards for Drinking Water

Properties/Parameters	Standard values	WHO standards	Remarks
Biological			

Properties/Parameters	Standard values	WHO standards	Remarks
All water intended for drinking (E. Coli or Thermo-tolerant Coliform bacteria)	Must not be detectable in any 100 ml sample	Must not be detectable in any 100 ml sample	Most Asian countries also follow WHO standards
Treated water entering the distribution system (E. Coli or thermo tolerant coliform and total coliform bacteria)	Must not be detectable in any 100 ml sample	Must not be detectable in any 100 ml sample	Most Asian countries also follow WHO standards
Treated water distribution system (E. Coli or thermo tolerant coliform and total coliform bacteria)	Must not be detectable in any 100 ml sample In case of large supplies, where sufficient samples are examined, must not be present in 95% of the samples taken throughout any 12-month period.	Must not be detectable in any 100 ml sample In case of large supplies, where sufficient samples are examined, must not be present in 95% of the samples taken throughout any 12-month period.	Most Asian countries also follow WHO standards
Physical			
Color	≤15TCU	≤15TCU	
Taste	Non objectionable/ Acceptable	Non objectionable/ Acceptable	
Odor	Non objectionable/ Acceptable	Non objectionable/ Acceptable	
Turbidity	<5NTU	<5NTU	
Total hardness as CaCO ₃	<500mg/l	---	
TDS	<1000	<1000	
Ph	6.5 – 8.5	6.5 – 8.5	
Chemical			
Essential Inorganic	mg/Liter	mg/Liter	
Aluminum (Al) mg/l	≤0.2	0.2	
Antimony (Sb)	≤0.005 (P)	0.02	
Arsenic (As)	≤0.05 (P)	0.01	Standard for Pakistansimilar to most Asian developing countries
Barium (Ba)	0.7	0.7	
Boron (B)	0.3	0.3	
Cadmium (Cd)	0.01	0.003	Standard for Pakistan similar to most Asian developing countries
Chloride (Cl ⁻)	<250	250	
Chromium (Cr)	≤0.05	0.05	
Copper (Cu)	2	2	
Toxic Inorganic	mg/l	mg/l	
Cyanide (CN)	≤0.05	0.07	Standard for Pakistansimilar to most Asian developing countries
Fluoride (F)	≤1.5	1.5	
Lead (Pb)	≤0.05	0.01	Standard for Pakistan

Properties/Parameters	Standard values	WHO standards	Remarks
			similar to most Asian developing countries
Manganese (Mn)	≤0.5	0.5	
Mercury (Hg)	≤0.001	0.001	
Nickel (Ni)	≤0.02	0.02	
Nitrate (NO ₃)	≤50	50	
Nitrite (NO ₂)	≤3 (P)	3	
Selenium (Se)	0.01 (P)	0.01	
Residual chlorine	0.2-0.5 at consumer end 0.5-1.5 at source		
Zinc (Zn)	5.0	3	Standard for Pakistan similar to most Asian developing countries
Organic			
Pesticides mg/l			PSQCA No. 4639-2004, Page No. 4 Table No. 3 Serial No. 20-58 may be consulted. **
Phenolic compounds (as Phenols) mg/l		0.002	
Poly-nuclear aromatic hydrocarbons (as PAHs) g/l		0.01 (By GC/MS methods)	
Alpha Emitters bq/L or pCi	0.1	0.1	
Beta emitters	1	1	

GC = gas chromatography, MS = mass spectrometer, NTU = nephelometric turbidity units, PAHs = polycyclic aromatic hydrocarbons, PSQCA = Pakistan Standards and Quality Control Authority, WHO = World Health Organization.

Table 2.4: Punjab Environmental Quality Standards for Municipal and Liquid Industrial Effluents (mg/l, unless otherwise defined)

Parameter Standards	Value
Temperature	40 ^o C
pH value (acidity/basicity)	6-10 pH
5-days Biochemical Oxygen Demand (BOD) at 20 ^o C	80mg/L
Chemical Oxygen Demand (COD)	150 mg/L
Total Suspended Solids	150 mg/L
Total Dissolved Solids	3500 mg/L
Oil and Grease	10 mg/L
Phenolic compounds (as phenol)	0.1 mg/L
Chloride(as Cl ⁻)	1000mg/L
Fluoride (as F ⁻)	20mg/L
Cyanide (as CN ⁻)	2mg/L
An-ionic detergents (as MBAS)	20mg/L
Sulphate(SO ₄)	600mg/L
Sulfide (S ²⁻)	1.0mg/L
Ammonia (NH ₃)	40mg/L
Pesticides, herbicides, fungicides and insecticides	0.15mg/L
Cadmium	0.1mg/L

Parameter Standards	Value
Chromium trivalent and hexavalent)	1.0 mg/L
Copper	1.0mg/L
Lead	0.5mg/L
Mercury	0.01mg/L
Selenium	0.5mg/L
Nickel	1.0mg/L
Silver	1.0mg/L
Total toxic metals	2.0 mg/L
Zinc	5.0mg/L
Arsenic	1.0mg/L
Barium	1.5mg/L
Iron	2.0mg/L
Manganese	1.5mg/L
Boron	6.0mg/L
Chlorine	1.0mg/L

2.5. ADB Requirements

52. ADB safeguard policies require that:

- (i) avoid adverse impacts of projects on the environment and affected people,
- (ii) where possible—minimize, mitigate, and/or compensate for adverse project impacts on the environment and affected people when avoidance is not possible; and
- (iii) help borrowers/clients to strengthen their safeguard systems and develop the capacity to manage environmental and social risks.

53. The policies apply to all ADB-financed projects, including private sector operations, and to all project components. The implementation processes as follows:

- (i) screening and scoping of the main issues start as soon as potential projects for ADB financing are identified and continue throughout the project cycle;
- (ii) impacts are assessed, safeguard plans summarizing mitigation measures, monitoring program, and institutional arrangements are prepared, and arrangements are made to integrate safeguards into project design and implementation;
- (iii) affected people are consulted during project preparation and implementation and information is disclosed in a form, manner, and language accessible to them; and
- (iv) safeguard plans are disclosed to the general public and the information is updated at various stages in the project cycle.

54. ADB's safeguard policies require that both ADB's and developing member countries' (DMCs') safeguard requirements are complied with.

55. Applicable standards for air emissions for general application, ambient air condition at property boundary for general purpose, limits for process wastewater, domestic sewage and contaminated storm water discharges to surface water and ambient noise levels are given above in Table 2.2 & 2.3 and are based on the standards described in the World Bank Group (IFC) Environmental, Health and Safety Guidelines (EHS Guidelines). The Punjab Environmental Quality Standard (PEQS) values are also given as per local requirement.

2.5.1. ADB's Safeguard Policy Statement, 2009

56. The ADB's Safeguard Policy Statement (2009) requires that environmental considerations be incorporated into ADB funded projects to ensure that the project will have minimal environmental impacts and be environmentally sound. Occupational health & safety of the local population should also be addressed as well as the project workers as stated in ADB's Safeguard Policy Statement (2009). A GRM to receive application and facilitate resolution of affected peoples' concerns, complaints, and grievances about the project's environmental performance is also established.

57. All loans and investments are subject to categorization to determine environmental assessment requirements. Categorization is to be undertaken using rapid environmental assessment (REA) checklists, consisting of questions relating to (i) the sensitivity and vulnerability of environmental resources in project area, and (ii) the potential for the project to cause significant adverse environmental impacts. Projects are classified into one of the following environmental categories:

- (i) **Category A:** A proposed project is classified as category A if it is likely to have significant adverse environmental impacts that are irreversible, diverse or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. An environmental impact assessment (EIA) is required.
- (ii) **Category B:** A proposed project is classified as category B if its potential adverse environmental impacts are less adverse than those of category A projects. These impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for category A projects. An initial environmental examination (IEE) is required.
- (iii) **Category C:** A proposed project is classified as category C if it is likely to have minimal or no adverse environmental impacts. No environmental assessment is required although environmental implications need to be reviewed.
- (iv) **Category FI:** A proposed project is classified as category FI if it involves investment of ADB funds to or through a financial intermediary (FI).

58. Since the project activities would comprise of construction of new components and renovation within the existing premises of COEs, it is anticipated that less adverse site-specific environmental impacts (such as impact from construction machinery, excavation, emissions, solid waste, etc.). Therefore, the project falls in category B as per ADB's Safeguard Policy Statement (2009) and as per PEPA EIA/EIA regulations 2000, the project falls under the category of Schedule-II (I), hence an environmental impact assessment has been prepared for this project.

2.5.2. ADB's Access to Information Policy 2018

59. ADB's new Access to Information Policy (AIP), reflects the ADB's ongoing commitment to transparency, accountability, and participation by stakeholders. The policy contains principles and exceptions to information sharing with external stakeholders, led by a new overarching principle of "clear, timely, and appropriate disclosure."

2.5.3. ADB's Accountability Mechanism Policy 2012

60. The objective of the Accountability Mechanism of the Asian Development Bank (ADB) is to provide an independent and effective forum for those affected by ADB-assisted projects to voice their concerns and seek solutions to their problems and report alleged noncompliance with

ADB's operational policies and procedures. It consists of two separate but complementary functions: problem-solving function and compliance review function.

2.6. United Nation's Sustainable Development Goals

61. The project is implementation of Goal 4: Ensure inclusive and equitable quality education and promote lifelong opportunities for all. The project will also contribute to Goal 13 i.e., climate change mitigation through the solarization of TEVTA and PVTC institutes.

62. Goal-4 aims to ensure that all people have access to quality education and lifelong learning opportunities. The Goal focuses on the acquisition of foundational and higher-order skills at all stages of education and development; greater and more equitable access to quality education at all levels as well as technical and vocational education and training (TVET); and the knowledge, skills and values needed to function well and contribute to society.

63. The project is also an implementation of the Goal 8: Decent work and economic Growth. The goal focuses on encouraging entrepreneurship to enhance sustainable economic growth. Through job creations at local levels, many problems such as slavery, forced labor can be eradicated as well. Technical knowledge and skills will allow individuals to work independently and will help them to attain a better financial standing.

2.7. IFC Performance Standards

64. International Finance Corporation (IFC) applies the Performance Standards to manage social and environmental risks and impacts and to enhance development opportunities in its private sector financing in its member countries eligible for financing. The Performance Standards are also applied to the projects in emerging markets. Together, the eight Performance Standards as bulleted below, establish standards that the proponent is to meet throughout the project.

- (i) Performance Standard 1: Social & Environmental Assessment and Management System;
- (ii) Performance Standard 2: Labor and Working Conditions;
- (iii) Performance Standard 3: Pollution Prevention and Abatement;
- (iv) Performance Standard 4: Community Health, Safety and Security;
- (v) Performance Standard 5: Land Acquisition and Involuntary Resettlement;
- (vi) Performance Standard 6: Biodiversity Conservation and Sustainable Natural Resource;
- (vii) Performance Standard 7: Indigenous Peoples; and
- (viii) Performance Standard 8: Cultural Heritage objectives have been set in the IFC performance standards to achieve sustainable development.

65. The objectives of Performance Standards are given below:

- (i) To identify and assess social and environment impacts, both adverse and beneficial, in the project's area of influence;
- (ii) To avoid, or where avoidance is not possible, minimize, mitigate, or compensate for adverse impacts on workers, affected communities and the environment; and
- (iii) To promote improved social and environment performance of companies through the effective use of management systems.

2.7.1. Equator Principles

66. The Equator Principles are a set of guidelines, promoted by the International Finance Corporation (IFC) that address the environmental and social issues associated with major

development projects worldwide. They provide a common baseline and framework for the implementation of internal environmental and social procedures and standards for project financing activities across all industries. These are:

- (i) Principle 1: Review and Categorization (of projects);
- (ii) Principle 2: Social and Environmental Assessment;
- (iii) Principle 3: Applicable Social and Environmental Standards;
- (iv) Principle 4: Action Plan and Management System;
- (v) Principle 5: Consultation and Disclosure;
- (vi) Principle 6: Grievance Mechanism;
- (vii) Principle 7: Independent Review
- (viii) Principle 8: Covenants;
- (ix) Principle 9: Independent Monitoring and Reporting; and
- (x) Principle 10: Equator Principles Financial Institutions EPFI Reporting.

2.8. International Protocols and Conventions

67. As Pakistan is a member of a number of international organizations such as United Nations Organization (UNO), Organization of the Islamic Conference (OIC), South Asian Association for Regional Cooperation (SAARC), Economic Cooperation Organization (ECO) etc., so it has to follow the international protocols and obligations related to the environment. The major protocols, ratification dates by Pakistan and obligations related to the proposed project are given in below Table 2.5.

Table 2.5: International Agreements/ Conventions relevant to the Project

Sr. No.	Agreement/Convention	Ratification	Description/Relevance
1	Convention on Biological Diversity, 1994 Weblink: https://www.cbd.int/	Pakistan signed this treaty in 1992 and it was ratified by Cabinet in 1994.	The Convention on the Biological Diversity (CBD) has three main goals: conservation of biological diversity (or biodiversity), sustainable use of its components, and fair and equitable sharing of benefits arising from genetic resources. The proposed project intervention will be carried out within existing institutes. Few trees would be removed for construction of COEs in Murree and Faisalabad, hence the law is relevant.
2	The Rio Declaration, 1992	Pakistan signed the treaty on 13 June 1992 and ratified on 1 June 1994	The Rio Declaration comprises 27 principles which address important issues such as: sustainable development to integrate environmental protection into the development process; common but differentiated responsibilities to conserve, protect and restore the earth's ecosystems; public participation and information access at the national level, reduce and eliminate unsustainable patterns of production and consumption. The law is relevant as the project is proposed with a focus on incorporating environmental protection measures during construction and rehabilitation works.

Sr. No.	Agreement/Convention	Ratification	Description/Relevance
3	Kyoto Protocol, 1992 Weblink: http://unfccc.int/kyoto_protocol/items/2830.php	Pakistan has ratified Kyoto Protocol in 2005	The Kyoto Protocol is a protocol to reduce greenhouse gasses that cause climate change. It was agreed on 11th December, 1997 at the 3rd Conference of the countries to the treaty when they met in Kyoto, and entered into force on 16th February, 2005. As of November 2007, 175 countries have ratified the protocol. One hundred and thirty-seven (137) developing countries have ratified the protocol, including Brazil, China, India and Pakistan but have no obligation beyond monitoring and reporting emissions.
4	Stockholm Convention on Persistent Organic Pollutants (POPs), 2004 Weblink: http://chm.pops.int/TheConvention/Overview/tabid/3351/	The Stockholm Convention on Persistent Organic Pollutants was signed on 22 May 2001 and entered in to force on 17 May 2004. Pakistan signed the convention on 6 December 2001	Convention seeks to protect human health and the environment from POPs as set out in Article 1, which are chemicals that remain intact in the environment for long periods, become widely distributed geographically and accumulate in the fatty tissue of humans and wildlife. Since the project would not involve use of any pesticides, hence the law would not be relevant to the project.
5	UN Convention to Combat Desertification (UNCCD), 1994 Weblink: http://www.unccd.int/en/Pages/default.aspx	Pakistan signed the Convention on 15 October 1994 and ratified it on 24 February 1997	The UNCCD is a convention to combat desertification and mitigate the effects of drought through national action programs that incorporate long term strategies supported by international cooperation and partnership arrangements.
6	Convention on the International Trade of Endangered Species (CITES), 1975 Weblink: https://www.cites.org/	Pakistan signed the Convention in 1973 and ratified it in April 1976.	The convention entered in to force on 1 July 1975. The principal obligations of contracting parties to the CITES are to safeguard the trade in rare or endangered species and it established a permit system to control imports and exports of wild fauna and flora. According to this convention species threatened with extinction whose movement between countries is prohibited except for conservation purposes such as captive breeding, species whose commercial trade is permitted but export permits are needed. The project area in Murree provides habitat for different birds and wildlife species. During implementation of the project, construction camps would be established, which could interfere in the natural ecology of the area, if proper measures are not adopted.

Sr. No.	Agreement/Convention	Ratification	Description/Relevance
7	<p>UNESCO Convention on the Protection of the World's Cultural and Natural Heritage, 1972 Weblink: http://whc.unesco.org/en/convention text/</p>	Pakistan ratified this convention on 23 July 1976.	<p>Convention concerning the Protection of the World Cultural and Natural Heritage requires parties to adopt a general policy on the protection of the natural and cultural heritage, to set up services for such protection, to develop scientific and technical studies, to take appropriate legal, technical, scientific and administrative measures and to foster training and education for such protection.</p> <p>The project team paid due attention to archaeological sites and local norms. However, no archaeological site was reported in the project area.</p>
8	<p>Occupational Safety and Health Convention (OSHC), 1981</p>		<p>OSCH Convention is an International Labor Organization Convention, established in 1981. This convention comprises of thirty (30) articles divided in five (05) parts. In the view of proposed project establishment, Article 4, 5, 6, and 7 are more relevant which elaborate the “formulation, implementation and periodically review of coherent national policy on occupational safety, occupational health and the working environment to prevent accidents and injury to health arising out of, linked with or occurring in the course of work, by minimizing, so far as is reasonably practicable, the causes of hazards inherent in the working environment”.</p>

3. PROJECT DESCRIPTION

3.1. Project Overview

68. The IWRPP will finance the establishment of TVET COEs—institutes that deliver high quality and relevant training, as well as provide sector leadership, best practice, and support for other TVET institutes, in priority economic sectors. These COEs will be established in existing TEVTA and PVTC institutes. The establishment of COEs is consistent with Pakistan’s National Skills for All Strategy (2018), which recommended they be set up as a means of improving quality by showcasing best international practice.²⁵ COEs will help to increase the supply of skilled workers to meet industry demand by lifting the quality and relevance of TVET programs in priority economic sectors. In total, 19 training institutes, 16 in existing TEVTA institutes and 3 in existing PVTC institutes²⁶ will be transformed to COEs—among the TEVTA-based COEs, institutes will operate under revised funding and governance arrangements, including increased institutional budget and management autonomy; revised pay and staffing arrangements, including competitive recruitment of staff; intensive management training; and increased levels of institutional funding (discussed further below). Similarly, revised funding and governance arrangements will be made for PVTC institutes.

69. COEs will offer national vocational qualifications framework (NVQF) programs in the 8 priority economic sectors. COEs will offer competency-based programs linked to the NVQF. Programs include food processing technology, food quality assurance, graphic arts, freelancing, instrumentation (mechatronics), building technology, solar water heater instrumentation, laboratory technician and nursing assistant, and textile and digital design. All programs offered by COEs will employ a competency-based training and assessment (CBTA) approach to ensure that graduates have the practical skills and competencies that allow them to swiftly integrate into the workforce. Programs will include increased focus on work-based training, which will be provided through enhanced linkages with private sector firms.

70. COE programs will include a significant entrepreneurship component that will be developed and delivered as an add-on module to all COE courses. This will provide graduates who wish to start their own business post-graduation with the management skills required to establish and operate small businesses. The need for entrepreneurship training has been heightened by the COVID-19 pandemic which has caused a significant decrease in employment in the formal sector over the short- to medium-term. COEs will conduct student outreach to increase the popularity of TVET, and to lift girls’ enrolments in traditional and non-traditional courses. They will also offer comprehensive graduate placement services and vocational counselling.

71. COEs will receive upgraded facilities, such as workshops, and classrooms; updated equipment and furniture; training for institute management; pedagogical and technical training for teachers and master trainers; and development of an institute quality assurance system. To increase women and girls’ access to quality TVET services—particularly those coming from remote and rural areas—selected COEs will receive student dormitories. They will also provide curricular and teacher training support to surrounding TVET institutes, thus contributing to a more

²⁵ Government of Pakistan (GoP), Ministry of Federal Education and Professional Training. 2018. *National Skills for All Strategy*. Islamabad.

²⁶ Additional PVTC centers of excellence will be considered during the project’s midterm review mission.

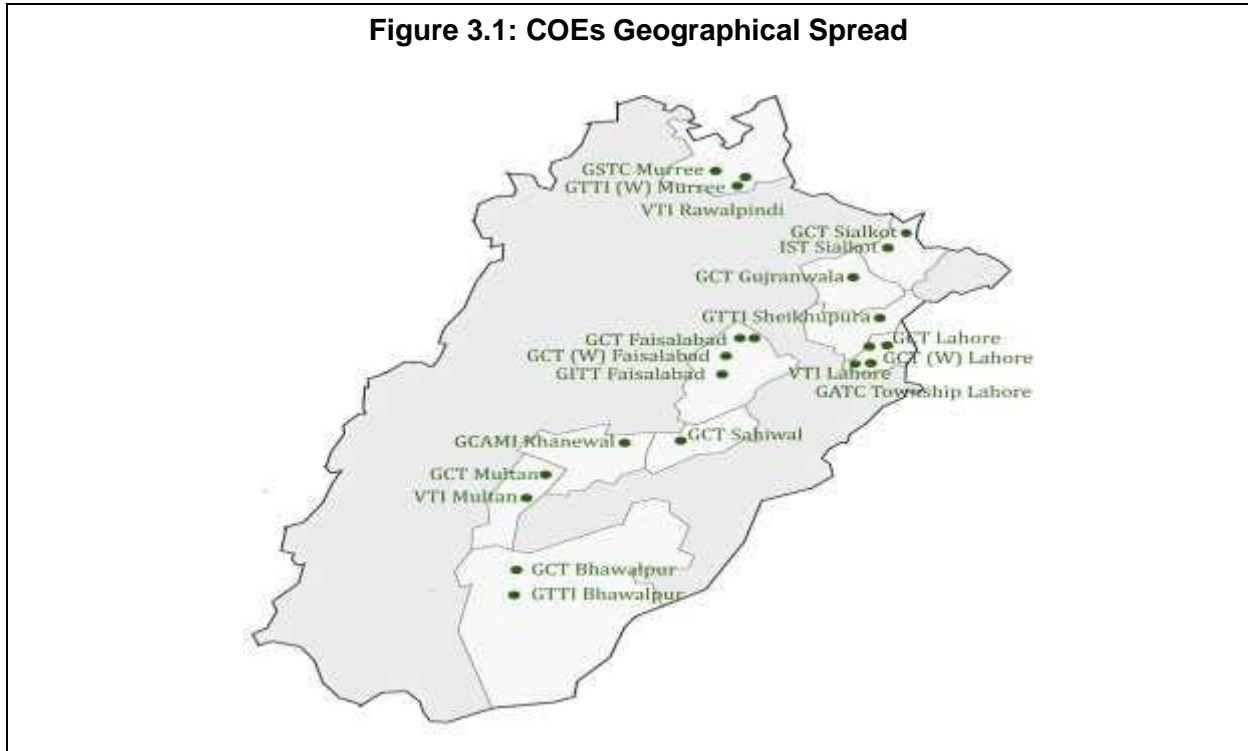
general improvement in the quality of TVET in the province. COEs will have close linkages to industry.

72. The 19 COEs will deliver 37 CBTA-approach training programs and 10 Diploma of Associate Engineering (DAE) in eight priority economic sectors. Six of these priority economic sectors are *vertical sectors*: (i) tourism and hospitality (3 COEs); (ii) automobile and motorbike assembly, parts and repair (2 COEs); (iii) construction (2 COEs); (iv) textiles and garments (2 COEs); (v) food processing (including agriculture, dairy and livestock products) (2 COEs); and (vi) health (1 COE). The remaining two are *cross-cutting sectors*: (i) light engineering (renewable energy, surgical instruments, farm machinery, and general) (6 COEs); and (ii) information communication technology (ICT) (3 COEs).

73. These sectors were selected based on several criteria: (i) alignment with government sector and skills priorities, (ii) economic growth trends, (iii) employment potential—both for men and for women, (iv) availability of firms, (v) export potential, (vi) existing development partner programs and projects, and (vii) availability of training service providers. Selection of the priority economic sectors is in line with Federal and provincial strategies, including the growth corridors and growth nodes set out in the Punjab Spatial Strategy 2047, and on those sectors where Punjab is seen as having a comparative advantage, as identified in the PGS 2023. The ADB also validated these proposed sectors with the government, industry representatives as well as TEVTA, and PVTC.

74. Figure 3.1 shows the locations of the proposed COEs, and the Punjab growth and investment corridors as set out in the Punjab Spatial Strategy 2047. From that, it can be seen that COE selection is strongly aligned to the priority investment areas, capturing the majority of the growth corridors and nodes and reflecting a similar geographical pattern across the province. All COEs were identified and selected in close consultation with TEVTA and PVTC.

Figure 3.1: COEs Geographical Spread



Source: Asian Development Bank and Punjab Spatial Strategy 2047.

75. The Government of Punjab (GoPb) will notify, on the recommendation of TEVTA Board, a new Board of Management (BOM) for managing the institutes established as COEs. The BOM will be an independent decision-making forum within TEVTA and will be fully empowered to take all human resources, financial, procurement and operational decisions to manage their institutes (a similar model to that operated by the Punjab Industrial Estate, where each of the industrial estates is managed by a board of management). However, this model is proposed for an overall reorganization of an institute into a completely redesigned COE rather than a partial upgrade. It is also assumed that COE model will consider explicit and implicit opportunity cost of this organization and will build in sustainability safeguards beyond support under the project.

76. The selected institutes qualifying under set of assumptions above will be handed over for complete management to the BOM. All existing staff in the priority economic sector program of these institutes will be assessed and transferred elsewhere in TEVTA (there is sufficient capacity to absorb such staff due to vacant positions), however, these staff are open to stay associated with the COEs if they meet the skill set and criteria. The BOM will take decisions on what equipment to retain and the rest will be transferred back to TEVTA. The BOM will take independent decisions and will report to the TEVTA Board based on an annual set of mutually agreed key performance indicators. The new BOM will be a body corporate with the Chairman of TEVTA as its Chairman and a maximum of six other members, half of whom would be from the private sector, selected on the basis of either a distinguished career as TVET professional/manager or from amongst the eminent industrialists/entrepreneurs engaged in businesses which are likely to absorb the graduates of such COEs. At least 2 of these members will be women.

77. At the institute level, the BOM may establish a School Advisory Committee headed by the principal to support the effective running of the institutes. The BOM will be supported by a chief executive officer and a small team of professionals in managing the COEs. BOM institutes will have their own human resources manual, enabling recruitment on market driven salary structure. Employees will be recruited on a contractual basis and will be governed by an annual performance review. The salary structure will be high-powered and will include a performance component. The BOM will have its own procurement manual and financial rules. The BOM will develop its own strategy on academic and training matters, including fee structures and course offerings, and will be responsible for soliciting required approvals from the PSDA.

78. For PVTC institutes, three dedicated BOMs will be set up – each associated with a particular PVTC institute. The BOMs will be notified by the GoPb, on the recommendation of PVTC Board, for managing the three institutes established as COEs with complete autonomy. Each BOM will be headed by a President, who will report to the Chairman PVTC regarding execution of the operational, financial and administrative matters of each institute. The President will be selected from the private sector. In addition, the Board will comprise between 6 to 8 members, who will be appointed by the Council based on their relevance to the respective economic sector, TVET or business community of the area. At least two of these members will be female. The BOM will manage the overall functioning of the institute including administrative, human resource, curriculum and financial aspects. It will also play a key role in forming linkages with the private sector for on-the-job trainings, graduate placement, delivering demand-driven courses.

3.2. Project Need

79. The IWRPP is closely aligned with the GoPb's PGS 2023, a five-year socio-economic plan that establishes the provincial government's economic strategy, highlights the GoPb's commitment to continued investment in, and support for, the skilling of youth, and the shift to a more growth-oriented TVET sector strategy.²⁷ The GoPb is also developing and supporting integration of industrial clusters into global value chains. This initiative seeks to create an enabling environment for industrial growth and prosperity, improve the quality of life through economic uplift, upgrade technology, and enhance productivity, quality and profitability of local industries.²⁸ The PGS 2023 is being revisited in light of COVID-19 pandemic and the RISE Stimulus Framework. The project is also closely aligned with the Federal National Skills for All (2018) Strategy and Kamyab Jawan program. The sectors for COEs were selected based on several criteria: (i) alignment with government sector and skills priorities, (ii) economic growth trends, (iii) employment potential—both for men and for women, (iv) availability of firms, (v) export potential, (vi) existing development partner programs and projects, and (vii) availability of training service providers. Selection of the priority economic sectors is in line with Federal and provincial strategies, including the growth corridors and growth nodes set out in the Punjab Spatial Strategy 2047, and on those sectors where Punjab is seen as having a comparative advantage.

80. The project supports three of the key operational priority areas in ADB's Strategy 2030: addressing remaining poverty and reducing inequalities, accelerating progress in gender equality, and strengthening governance and institutional capacity. The project will also contribute to climate change mitigation through use of energy efficient equipment to be used in the training institutes and introduction of climate change concerns in training. The IWRPP complements existing

²⁷ Government of Punjab, Planning and Development Board. 2019. *Punjab Growth Strategy 2023*. Lahore.

²⁸ [Punjab Cluster Development](#).

development partner initiatives by building on the governance reforms made under the World Bank's PSDP, helping to expand the coverage of CBTA programs in Punjab and nationally, increasing the number of SSCs, and helping to implement the German Government-ADB Build4Skills initiative.

3.3. Project Scope of Work

81. The IWRPP has three main areas of implementation i.e.,

- (i) **Output 1: Quality and Relevance of TVET in Priority Economic Sectors Improved.** It includes upgrading of 19 institutes (16 TEVTA institutes and 3 PVTC institutes) into COEs in 8 priority economic sectors; 4 selected COEs (ICT & Textile) will use high-level technology for training (focusing on girls) with private sector participation; and Work Based Training through Build 4 Skills (2 COEs - Construction).
- (ii) **Output 2: Equitable access to TVET Increased.** Provincial wide market relevant and gender focused skills training in priority economic sectors; and social marketing campaigns to improve the image of TVET, and encourage more female participation on non-traditional skills areas.
- (iii) **Output 3: TVET sector institutional framework strengthened.** Develop a strategy, policy of TVET development in Punjab; capacity and developing the regulatory framework for Punjab Skills Development Authority; and develop a comprehensive TVET MIS and LMIS.

The IWRPP scope under the respective Output is further explained below:

(i) Output 1: Quality and Relevance of TVET in Priority Economic Sectors Improved

82. **Establishment of centers of excellence.** The project will finance the establishment of TVET COEs—institutes that deliver high quality and relevant training, as well as provide sector leadership, best practice, and support for other TVET institutes, in priority economic sectors. These COEs will be established in existing TEVTA and PVTC institutes. In total, 19 training institutes, 16 in existing TEVTA institutes and 3 in existing PVTC institutes²⁹ will be transformed to COEs—Among the TEVTA-based COEs, institutes will operate under revised funding and governance arrangements, including increased institutional budget and management autonomy; revised pay and staffing arrangements, including competitive recruitment of staff; intensive management training; and increased levels of institutional funding (discussed further below). Similarly, revised funding and governance arrangements will be made for PVTC institutes.

83. The project encourages private sector engagement at COEs for enhanced relevance of training and promote sustainability. This may include involvement of the private sector in training of master trainers or teachers, particularly for courses with use of high technologies, as well as collaborations to facilitate work-based training for COE trainees. While COEs remain public institutes and hence will not charge tuition or other fees, they may experiment with other forms of additional revenue generation such as contract training for firms, allowing access to labs and equipment to external training providers and other mechanisms to promote financial sustainability.

²⁹ Additional PVTC centers of excellence will be considered during the project's midterm review mission.

84. COEs will not necessarily cover all programs offered within a given institute. Based on physical infrastructure and equipment assessments of the proposed COEs, the project will upgrade workshops and classrooms that are used for COE programs, and undertake major or minor renovations and re-construction of certain buildings. The purpose is to ensure an upgraded physical feel to the entire institute. However, within each institute, the focus on upgrading equipment and curriculum will be targeted to the relevant courses associated with the priority economic sectors.

85. **Use of High-Level Technology for Training Targeting Girls.** ADB has been undertaking a regional study³⁰ on how economies can transition effectively to Fourth Industrial Revolution (4IR). The study takes an evidence-based approach towards understanding the opportunities and challenges posed by 4IR and includes the case of Punjab with specific focus on illustrative industries which is crucial for growth, employment, and 4IR. Among the key findings are an urgent need to equip young people, especially girls with training on latest high technology, and the promotion of industry-Institute cooperation is a key to ensure the relevance. Adoption of 4IR can increase efficiency and productivity. The application of 4IR technologies can help Punjab move up the value chain in their products and services. Timely skills development can ensure that 4IR can benefit workers at large. The project supports development of a gender focused training with the use of high-level technology in ICT sectors including business processing operations and textile and garments sector. Four (4) COEs will develop a course with strong private sector participation in responding to emerging trends of use of industry 4.0 including use of Internet of Things, Artificial Intelligence, Cloud Computing and Cyber Security.

86. **Build4Skills.** Build4Skills (B4S) is a cooperative venture between the German Government and ADB which aims to strengthen the practical/on-the-job component of TVET training in infrastructure projects. The IWRPP will incorporate B4S through the (i) establishment of COEs in the construction technology sector, and (ii) inclusion of an on-the-job training component in all architectural/construction supervision consultancies and civil works contracts under the IWRPP. The calls for tender for the IWRPP architectural/construction supervision and construction contracts will require winning firms or consortia to provide both architectural/construction supervision services or construction services and provide on- and off-job training to an agreed number of trainees (at least 200 students).

(ii) Output 2: Equitable Access to TVET Increased

87. The objective of this training is to increase the number of skilled workers, especially women in priority economic sectors (non-traditional sectors for women) through a competitive training fund for public and private sector training providers. The project funds will be used to purchase training from technical and vocational education and training (TVET) providers based on market demand. EA will set out a five-year training program and annual plan which will be adjusted annually. Training programs will cover National Vocational Qualifications Framework (NVQF) recognized qualifications, and include more entrepreneurship and work-based training. Payments to providers would be performance-based, with payments linked to labor market outcomes of graduates. The project funds will be paid through the project implementation unit (PIU) and be managed by the Industries, Commerce, Investment and Skills Development Department (ICISDD).

³⁰ ADB. Forthcoming. *Assessing the Implication of Industry 4.0 on Jobs and Skills in High-Growth Industries in Central Asia*. Manila.

88. The contracting of training providers will be administered by the IWRPP, which would select providers on a competitive basis through public and private and not for profit training providers. The training provider for a given course would be competitively selected on a cost and quality basis once the provider has met certain screening criteria. The public training providers eligible to compete would include the Punjab Technical Education and Vocational Training Authority (TEVTA), the Punjab Vocational Training Council (PVTC), and any other public sector training provider. All private and not-for-profit training providers will be eligible to compete. Contracts would cover variable course-related costs, including tuition, training materials, uniform and certification examination fee. In total, this training would ensure the training for at least 40% of which will be female. Moreover, targeting women would be done: (i) during selection, the training provider applying for funds under the competitive scheme will receive a higher score for having outreach mechanisms for the poor; and, (ii) from the pool of applicants who meet course entry requirements, training providers will be required to give preference to individuals with demonstrable poor socio-economic conditions. Key aspects pertaining to courses selection and the contracting of training providers will be detailed³¹ with support of consultants during the project implementation.

89. **Social marketing campaigns.** The project will finance the development and implementation of a communication plan and branding aimed at (i) increasing the status of TVET in the eyes of the general public, parents, potential trainees and firms; and (ii) increasing girls' participation in TVET. A variety of marketing campaigns could be considered, including:

- (i) Campaign in schools about employment and career opportunities for TVET graduates;
- (ii) Campaign to attract low-skilled adults back to TVET institutes to further their professional careers;
- (iii) Campaign among employers/HR managers highlighting benefits of recruiting TVET graduates;
- (iv) Campaign focused on increasing girls' TVET and labor force participation in non-traditional skill areas; and
- (v) Campaign aimed at employers to educate them on the benefits of CBTA.

90. Campaigns can be carried out through various media channels—print, electronic and social media. Design and implementation of the campaigns would be financed by the project and would be outsourced to professional media/advocacy organizations. These campaigns could include (i) documentation of real-life stories of successful TVET graduates and involve role models in advocating for TVET, (ii) undertaking roadshows in different parts of the province, (iii) arranging and financing participation in district, provincial, national and international skills competitions.

(iii) Output 3: TVET Sector Institutional Framework Strengthened

³¹ These will include: (i) identification and selection of training providers eligible to compete in the contracting process administered by the ICISDD; (ii) guidelines which would govern women targeting in specific training programs; (iii) criteria by which a training provider is assigned to the public or private training providers; (iv) technical and financial selection criteria; (v) procedures governing certification of course graduates; (vi) decision rules regarding penalties for non-performance in regard to contractual terms (for example, dropout rates from individual training programs would be monitored in order to ensure the training providers meets the completion rate stipulated as part of the eligibility criteria for TP financing); and (vii) third party monitoring of the training program.

91. **Support for TVET reforms.** This output will finance a number of sub-outputs focused on supporting the implementation of the TVET reforms to improve management of, and strategic planning in, the TVET sector in Punjab. These include (i) strengthening the policy and analytical capacity of the PSDA; and (iii) introducing a TVET management information system (MIS) and labor market information system (LMIS) to improve the quality and timeliness of information available to sector planners, TVET institutes, employers, graduates, and students.

92. **MIS and LMIS.** Upgrading of the existing TVET MIS and the LMIS is a key activity under this output given the poor state of sector information. The project would first prepare a detailed plan for upgrading the TVET MIS and LMIS. It would then finance the introduction of a supply-side TVET MIS and LMIS that integrate information from TEVTA, PVTC, and private institutes. It would be linked to the Federal National Skills Information System. The project would also introduce demand-side TVET MIS that links trade associations/chambers of commerce, employer associations, the Bureau of Overseas Employment, and job portals.

93. Outputs 2 & 3 are soft interventions, however, output 1 includes the construction activities at 19 COEs and provision/operation of equipment. The institute specific design details are given in Appendix 4. The summary of construction activities for each COE are given below in Table 3.1.

Table 3.1: Summary of Civil Works at each Center of Excellence

Sr. No.	Name of COEs	Location	Major Scope of New Civil Works	Scope of Work (Repair/Renovation)
1.	Government Technical Training Institute (GTTI) for Women	Murree	<ul style="list-style-type: none"> • 06 Labs • 04 Adjacent Stores • 04 Adjacent Offices • 04 Classrooms • 04 Washrooms • 01 Daycare Center • 01 Common Room Hostel for 25 Trainees 	<ul style="list-style-type: none"> • Distemping/painting work • Weather shield on exterior surface. • Repair of student lavatory complete • Replacement of windows/doors • Electrical items replacement <ul style="list-style-type: none"> • Replacement of washroom accessories
2.	Government Staff Training College (GSTC)	Murree	<ul style="list-style-type: none"> • 06 Labs • 04 Adjacent Stores • 04 Adjacent Offices • 04 Classrooms • 04 Washrooms • 01 Daycare Center • 01 Common Room 	<ul style="list-style-type: none"> • No Repair Work

94. The civil work will be carried out at all COEs that includes both new construction and renovation work as described in Table 3.1. The existing and planned layout of each COE are attached in Appendix 4. The construction work would involve building new blocks i.e., day care centers, laboratories, hostels, and parking sheds. The construction material would mainly be comprised of crushes, cement, bricks, marble and granite tile, porcelain, glass, wood, aluminum etc.

95. Another major physical intervention would be the procurement and installation of equipment at COEs. The equipment will be used for capacity building and training of skilled workforce. The list of equipment proposed at this stage is given in Table 3.2 below:

Table 3.2: List of Equipment for Each COE

Sr. No.	General Description	Details About Equipment	Proposed for COEs
1.	RO Plant	Filters, Plant Machinery, etc.	All COEs
2.	Generator	Lubricants including Fuel, Electric Cables, etc.	All COEs except VTI (Green Town) Lahore, VTI Multan and VTI Rawalpindi
3.	CCTV	Cameras, Electric Cables, LEDs, etc.	All COEs
4.	Solar	PV Panels, Batteries, Electric Cables, etc.	All COEs
5.	Furniture	Chairs, Tables, Boards, etc.	All COEs
6.	Consumables	Stationary Items, Soaps, Tissue Papers, Floor Cleaners, etc.	All COEs
7.	Health and Safety Items	Fire Extinguishers, First Aid Boxes, Fire Blanket, Smoke Alarm, Safety Helmets, Gloves, Masks, etc.	All COEs
8.	Training Equipment for Automobile & Motorbike Assembly, Parts & Repair	Tool Kits, Roller, Welding Plants, Drill Machines, Lubricants, Auto Spare Parts, etc.	GTTI Sheikhpura & GCT Faisalabad
9.	Training Equipment for Food Technology	Allen Key Set, Spanner Set, Ovens, Freezer, Pans, Mixers, Knives, Scrappers, Toasters, etc.	GCT Faisalabad & GCT Sahiwal
10	Training Equipment for Information Communication Technology (ICT)	Projector, Printers, Scanners, Graphic Design Software, etc.	GCT (PGA) Lahore & GCT (W) Lahore
11	Training Equipment for Hospitality & Tourism	Freezer, Pans, Mixers, Scrappers, Toasters, Ovens, Stoves, Vacuum Cleaners, etc.	GTTI (W) Murree, GATC Township Lahore & VTI Rawalpindi
12	Training Equipment for Construction	HVAC Equipment, Bomb Calorimeter, Hammers, Tool Kits, etc.	GCT Bahawalpur & GCT Multan

13	Training Equipment for Textile & Garments	Plotter, Digitizer, Printer, Computer, Software, UPS, Circular Knitting Machines, Flat Bed Machines, Fabric Cutter, v-Belt Machines, Plotters, Scissors, Jacquard Machines, Yarn Trolley, Scales, Irons, Clothing, etc.	GCT (W) Faisalabad & GTTI Faisalabad
14	Training Equipment for Light Engineering	Milling Machine, Lathe Machine, Grinding and Drilling Machines, CNC Machines, Tools, etc.	CAMI Mian Channu, GCT Gujranwala, GCT Sialkot, GTTI Bahawalpur, IST Sialkot & VTI Multan
15	Training Equipment for Health	Thermometers, BP Apparatus, Glucometers, etc.	GCT (PGA) Lahore
16	Training Equipment for Computer Information Technology (CIT)	Projector, Printers, Scanners, Relevant Software, LEDs, Laptops, CPUs, Plotters, etc.	VTI Green Town Lahore
<p>CAD = computer aided design, CAMI = Center for Agricultural Machinery Industries, COE = center of excellence, GCT= Government College of Technology, GITT = Government Institute of Textile Technology, ICT = information and communications technology, IST = Institute of Surgical Technology, PV = photo voltaic, VTI = Vocational Training Institute.</p> <p>Source: Equipment Specialist/Procurement Plan - IWRPP</p>			

3.4. Implementation Arrangements

96. The project will be implemented from 2022 to 2028 (6 years). A Project Steering Committee (PSC) will be established to guide the executing agency and monitor overall project performance and outcome. The PSC will be chaired by the Chairman, Planning and Development Board, and will be composed of Secretaries of ICISDD, Planning and Development and Finance, as well as the PIU Director and private sector representatives. It will (i) provide guidance on policy development/overall project implementation and on identification of investment activities based on prioritized targets; (ii) ensure coordination with relevant government agencies and stakeholders; and (iii) monitor the achievement of project outcomes. The PSC will also have the authority to recommend changes to priority economic sectors and programs to allow adjustments based on changes in skills demand.

97. The executing and implementing agency will be ICI & SDD. A project implementation unit (PIU) will be established in ICISDD, and will operate its own assignment account and ADB's advance fund. PSDA, TEVTA and PVTC will be implementation partners. The EA/IA will be responsible for overall management and coordination of the project.

98. The PIU will be responsible to ensure timely delivery of the project. The PIU staff will be appointed through internal government postings and/or recruitment from the market through competitive process against qualification criteria. The proposed PIU setup is in Figure 9.1. The PIU will be supplemented by the respective specialized consulting firms and individual consultants. The PIU responsibilities include but not limited to prepare and monitor annual implementation plans; annual disbursement and procurement plans; annual financial and accounting plans and schedules; procurement of equipment, works, and services for all project components; establishing and managing the advance finance account; processing withdrawal applications and replenishing the advance finance account; coordination and liaison with all stakeholders; establish and implement the project performance monitoring information system; evaluation and reporting on program implementation progress; preparing all project reports; and organizing and managing training programs. Project implementation arrangements are in Figure 9.1. The ICISDD will be fully responsible for the implementation of all project components except for civil works component, where they will get implementation support from communication and works department (C&WD). The following broader roles are responsible are identified for the implementation of civil works component.

99. Following are the roles and responsibilities for civil works component:

- (i) The PIU will be overall responsible to ensure timely delivery of civil works component;
- (ii) The detailed design, BOQs, cost estimates etc. will be prepared by C&WD (completion of design within 60 days);
- (iii) Recruitment of supervision consultant will be led by PIU (Respective C&WD staff will be part of Consultant Selection Committee);
- (iv) The procurement of civil works will be led by PIU (Respective C&WD staff will be part of procurement committee);
- (v) Supervision consultant and civil work contractors will work directly under respective C&WD field staff;
- (vi) C&WD will be responsible for quality assurance; and
- (vii) Interim Payment Certificates (IPCs) /Final Bills will be generated by contractors, reviewed and endorsed by supervision consultant (the firm), then endorsed by respective C&WD field staff for onward submission to PIU for payment.

(i) Procurement will involve civil works (rehabilitation/upgradation/construction of training institute classrooms, workshops and dormitories including installation of energy efficient materials as climate change mitigation measures); various types of equipment and furniture for workshops; ICT and high-level technology equipment; and furniture.

Final equipment requirements/update shall be agreed during project implementation once consultants have confirmed with each of the COEs. Workshop equipment, furniture and fixtures, energy efficient material, generators, CCTV, reverse osmosis (RO) plant filters, consumables and high technology equipment packages shall be procured. About 28 PIU staff will also be recruited to implement the project. The construction supervision firm shall ensure that all the works are carried out in full compliance with the approved architectural and engineering designs, drawings, technical specifications, approved EIA/EMP and SEMP, agreed work schedule, quality and within the terms and conditions of the contract(s) and approved engineering practices. An educational partnership firm shall be recruited for the preparation of a preliminary feasibility study (PFS), and support to the Project Implementation Unit (PIU) with regard to private sector engagement (referred to as public-private partnerships) for the respective Centers of Excellence (COEs). Services of local social marketing and advertising firm shall be used to create awareness and promote importance of TVET sector. An internal audit firm shall be engaged to undertake internal audits of the IWRPP covering, inter alia, the operational processes of budgeting and planning, funds management, internal controls, procurement and payables, and reporting. All procurement activities under the project shall be carried out in conformity with ADB Procurement Policy (2017, as amended from time to time) and ADB Procurement Regulations for ADB Borrowers (2017, as amended from time to time).

3.5. Project Cost

100. The total project is estimated to cost \$110 million (Refer Table 3.3). Detailed cost estimates by expenditure category and by financier are included in the project administration manual. The project cost includes physical and price contingencies and a GoPb in-kind contribution of \$10.0 million that covers capacity building of COE staff, staff salary and related operational expenses. ADB will finance taxes and duties and establishment of PIU office and salaries of PIU staff. Most spending is on workshop and hi-technology equipment, energy efficient materials, civil works and purchase of training providers. Sub-Project cost would be approximately **520,810,000/-** PKR. This Sub-Project cost would be capitalized during civil works activities.

Table 3.3: Summary of Project Cost

Item	Amount (\$)
A. Base Cost	
1. Quality and relevance of TVET in priority economic sectors improved	73.30
2. Equitable access to TVET increased	25.71
3. TVET sector institutional framework strengthened	1.56
Subtotal (A)	100.57
B. Contingencies	9.43
Total (A+B)	110.00

Source: Asian Development Bank.

101. ADB will finance expenditures on civil works, energy efficient materials, generators and water filters, workshop and classroom equipment, furniture, consulting services, training, workshops, and physical and price contingencies. The GoPb has assured ADB that it will make up any shortfall in the finances required for the project. The summary financing plan is in Table 3.4.

Table 3.4: Summary Financing Plan

Source	Amount (\$ million)	Share of Total (%)
Asian Development Bank		
Ordinary capital resources (regular loan)	100.00	91.0
Government	10.00	9.0
Total	110.00^a	100.0

Notes:

1. The interest and commitment charge payments estimated to be \$10.45 million will be paid by the State budget/Federal, thus not charged to the loan. The calculation will be finalized at loan negotiation stage.
2. The government has assured ADB that it will make up for any shortfall in the finances required for the project.
3. Government's in-kind contribution worth \$10 million in staffing cost for COEs and governance structure.

^a Includes taxes and duties of \$10.2 million which will be financed by ADB.

Source: Asian Development Bank.

3.6. Project Benefits

102. The project will support the rehabilitation and upgrading of existing TEVTA and PVTC institutes into COEs. These will have improved features compared with existing TEVTA and PVTC institutes, including renovated classrooms and workshops, updated equipment, gender-inclusive design, drinking water, and solar power. COEs will be operated under updated governance arrangements, including increased management autonomy and accountability. This will include stronger private sector participation. These improved governance arrangements will ensure the sustainable use of facilities and equipment. All facilities will meet or exceed national construction codes.

103. The project will generate economic benefits as a result of (i) increased enrollments and completion rates for TVET programs in COEs due to project investments that improve quality and expand access in priority economic sectors; (ii) a bigger wage premium for COE graduates of

long term diploma courses as well as short term courses due to the improved quality and relevance of TVET programs; (iii) minor increases in completion rates for TVET programs in non-COE and systemic institutional improvements; and (iv) increased employment rates for graduates of COE and training programs. Improved quality and more relevant TVET will lift the lifetime incomes of the increased number of students who graduate, given the estimated 20% wage differential in earnings of TVET graduates compared to those without TVET for 15–29-year-olds in Pakistan.³⁴ Improved TVET can also generate nonmonetary benefits such as reduced social unrest due to lower youth unemployment.

3.7. Construction Camps

104. The construction camps will constitute all the temporary facilities for the construction workers residence, kitchen, toilets, material and machinery workshops, material storage, equipment and machinery yard, machinery service station and washing stations. The construction camps will be established outside the premises of COEs. Following criteria will be followed for the establishment of construction camp for each COE sites:

- The contractor will seek approval from the Lead EHS Specialist and DD environment-PIU on the location of construction camp site;
- The contractor will sign a written agreement for the entire duration of the lease of land or premises with the owner for establishment of construction camp;
- A copy of lease agreement will be kept on file at each site with the supervision consultant staff and with the PIU;
- There will be no resettlement issues for the location of the camps;
- Camp site will be away from the residential areas and sensitive receptors;
- Selection of sites for construction camps will be near the COE sites;
- The camp site will have access to the nearby link road;
- The camp site will have proper supply of utilities and municipal services;
- The camp site will be fit for use as a camp site in terms of local laws, norms, practices, and immediate surroundings, and free from any potential social and environmental risks;
- The camps will be located in a place where the drainage from and through the camps will not threaten any domestic or public water supply;
- The camp site will not be a source of nuisance and disturbance to the immediate neighborhood;
- Camp site will be adequate in size to prevent overcrowding of necessary structures, facilities, personnel, equipment, machinery, and materials;
- The camp site will avoid any damage of property, vegetation, irrigation, and drinking water supply systems; and
- The camp site will be free from any potential flooding risk.
- Contractor will be recommended to hire any house on rent for labor accommodation OR accommodate labore in fully equipped potable containers.

3.8. Water Requirement

105. The source of water during the construction phase will be from water bowser tanks, arranged by the construction contractor. The water consumption is estimated to be 1,000 liters

³⁴ World Bank. 2015. *Project Appraisal Document: Punjab Skills Development Project*. Washington, DC.

/day³⁵ for 25 construction workers³⁶ for each COEs.

3.9. Wastewater Generation

106. The wastewater generation is estimated to be 800 liters/day for 25 construction workers for each COEs and will be linked with nearby sewerage system OR sewage will be treated through septic tanks and soakage pits in remote areas.

3.10. Solid Waste Estimation

107. Due to construction activities, waste will be generated at construction site and contractors camp. The contractor will provide the estimated quantity of excavation material during the construction phase. These wastes will be generated due to the construction activities and the up to the extent possible the excavated materials will be reused, where applicable, for construction purpose. Solid waste generated during construction and camp sites shall be safely disposed in demarcated waste disposal sites.

108. The municipal solid waste generation is estimated to be 12.5 kg/day (as per 0.5 kg/capita/day waste generation)³⁷ for 25 construction workers at each COE. Municipal solid waste will be carried out by local TMA by agreement.

³⁵ Tentative Work Force Requirements
 = (25) x (40) = 1,000 liters/day
 = 80% of water consumption = 800 liters/day

³⁶ Construction workers are decided based on consultant's experience

³⁷ D. Hoorweg and P. Bhada-Tata. 2012. What a Waste : A Global Review of Solid Waste Management. *Urban Development Series; Knowledge Papers*. No. 15. World Bank, Washington, DC. Based on UNEP estimates for waste generation in the Asia Pacific. Average is 0.5 kg/capita/day.

4. ANALYSIS OF ALTERNATIVES

4.1. Overview

109. This chapter outlines the analysis of alternatives which were considered for priority sector selection of 19 COEs for this project. A team of experts was engaged by ADB and ICI & SDD who visited more than 30 institutes under TEVTA and PVTC. Some private institutes such as Hunerkada, Fauji Foundation, ABAD, COTHM etc. were also visited for consideration and need assessment. The experts shortlisted 19 COEs which are to be upgraded or renovated under IWRPP. The proposed COEs are spread across the province, with 11 in Central Punjab, 4 in Northern Punjab, and 5 in Southern Punjab. The proposed COEs and their program sectors of specialization are under Table 4.1.

Table 4.1: List of Shortlisted COEs

Geographical Location	Institute	Type of Institute	Region	Growth Corridor/Nodal Alignment
Automobile and Motorbike Assembly, Parts, and Repair				
Sheikhupura	Government Technical Training Institute	TEVTA	Central Punjab	Yes
Faisalabad	Government College of Technology ^a	TEVTA	Central Punjab	Yes
Food Processing (including agriculture, dairy and livestock products)				
Sahiwal	Government College of Technology	TEVTA	Central Punjab	Yes
Faisalabad	Government College of Technology ^a	TEVTA	Central Punjab	Yes
Information Communication Technology				
Lahore	Government College of Technology Printing and Graphic Arts, Allama Iqbal Town ^a	TEVTA	Central Punjab	Yes
	Government College of Technology (Women) Lytton Road	TEVTA	Central Punjab	Yes
	Vocational Training Institute Green Town	PVTC	Central Punjab	Yes
Tourism and Hospitality				
Rawalpindi/Murree	Government Staff Training College Murree	TEVTA	Northern Punjab	Yes
	Government Technical Training Institute (Women) Murree	TEVTA	Northern Punjab	Yes
	Vocational Training Institute (Teacher Training) Rawalpindi	PVTC	Northern Punjab	Yes
Construction				
Multan	Government College of Technology Multan	TEVTA	Southern Punjab	Yes
Bahawalpur	Government College of Technology Bahawalpur	TEVTA	Southern Punjab	Yes

Geographical Location	Institute	Type of Institute	Region	Growth Corridor/Nodal Alignment
Textiles and Garments				
Faisalabad	Government College of Technology (Women) Faisalabad	TEVTA	Central Punjab	Yes
	Government Institute of Textile Technology	TEVTA	Central Punjab	Yes
Light Engineering (Renewable Energy, Surgical Instruments, Farm Machinery and General)				
Sialkot	Government College of Technology Sialkot	TEVTA	Central Punjab	Yes
	Institute of Surgical Technology	TEVTA	Central Punjab	Yes
Khanewal	Government Center for Agricultural Machinery Industries	TEVTA	Southern Punjab	No
Bahawalpur	Government Technical Training Institute Bahawalpur	TEVTA	Southern Punjab	Yes
Gujranwala	Government College of Technology Gujranwala	TEVTA	Central Punjab	Yes
Multan	Vocational Training Institute Multan	PVTC	Southern Punjab	Yes
Health				
Lahore	Government College of Technology Printing and Graphic Arts, Allama Iqbal Town ^a	TEVTA	Central Punjab	Yes

^a Government College of Technology, Faisalabad; and Government College of Technology Printing and Graphic Arts, Allama Iqbal Town, Lahore have been selected for two priority sectors each.

Source: Asian Development Bank.

4.2. No Project Option

110. In case there is no Project, the TVET sector improvement will not take place and GoPb will be deprived of all the upgradations and renovation of TEVTA/PVTC institutes. Hence, there will be no positive impact on TVET sector. This no project option must not be considered.

4.3. Site Alternatives

111. Within Punjab, there are 386 institutes under TEVTA and 214 institutes under PVTC, where traditional governance arrangements are made. However, the institutes which were selected as COEs have great potential for upgradation and have proximity to the relevant industry and urban zones. The experts considered broad geographic distribution of COEs around industry clusters (4 in Northern Punjab, 5 in Southern Punjab and 11 in Central Punjab). COEs will be developed within premises of existing institute on a vacant land.

4.4. Technology Alternatives

112. COEs are selected in a range of emerging and existing sectors i.e., vertical and cross cutting sectors which may serve the purpose to upgrade a workforce who may deliver in the right

areas. The other alternatives such as mainstream engineering disciplines were not considered as they have enough saturation. COEs³⁸ will cover the following priority economic sectors:

- (i) Information communication technology (3)
- (ii) Automobile/motorbike assembly, parts and repair (2)
- (iii) Food processing (2)
- (iv) Tourism and hospitality (3)
- (v) Construction (2)
- (vi) Textiles and garments (2)
- (vii) Light engineering (6)
- (viii) Health (1)

4.5. Design Alternatives

113. Design team investigated several options including financial, engineering, social and environmental alternatives as summarized in Table 4.2 below:

Table 4.2: Comparative Analysis of Design Alternatives

Design Options	Financial Aspects	Engineering Aspects	Environment & Social Aspects
Investment on Building new COEs	High Cost involved on purchasing land	More construction work	Resettlement and social constraints, construction impacts on virgin environment
Renovation and building only few components	Moderate cost on COEs construction, balanced program for training and capacity building	Rehabilitation and retrofitting of existing institutes, need based design for construction of institutes	No social risks, less impact on environment
Investment on Equipment and Training components only	Moderately high cost on engaging high-quality trainers and arrangement of resources	No construction work, safe space required for equipment handling and conducting trainings	Minimum impact on environment and community

114. Considering the above-mentioned alternatives, a balanced approach was followed to upgrade the existing institutes and to make best use of them for high quality training and capacity building of youth.

³⁸ Government College of Technology, Faisalabad; and Government College of Technology Printing and Graphic Arts, Allama Iqbal Town, Lahore have been selected for two priority sectors each.
Source: Asian Development Bank.

5. DESCRIPTION OF THE ENVIRONMENT

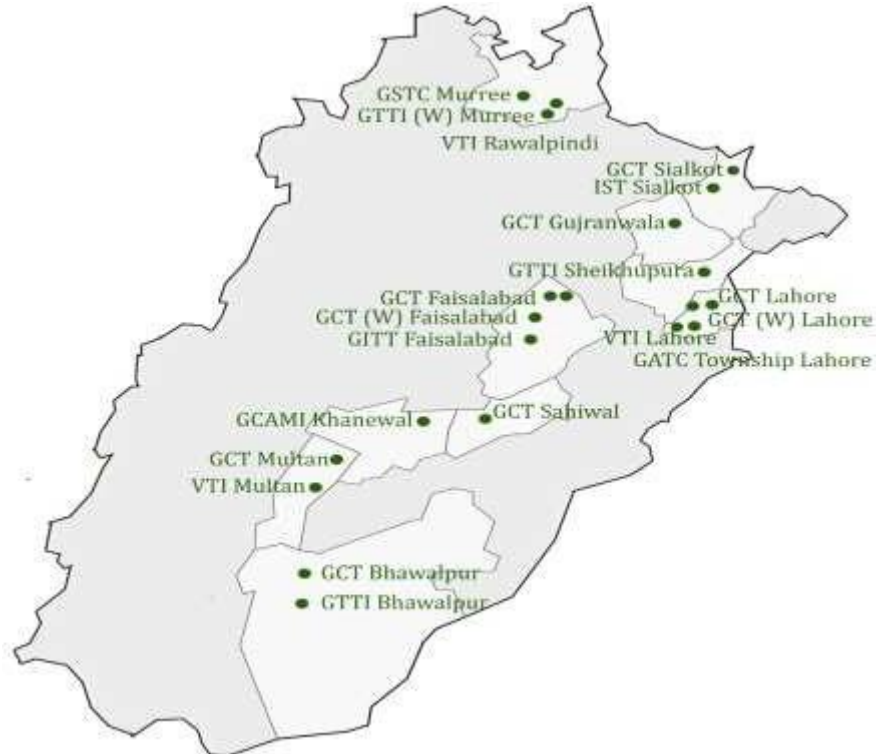
5.1. General

115. This chapter describes the environmental setting in the project Area of Influence (AOI). The project will be implemented in main cities of Punjab which are: Lahore, Rawalpindi, Multan, Faisalabad, Sialkot, Gujranwala, Bahawalpur, Sheikhupura, Sahiwal and Murree as shown in Figure 5.1. The Project will have 20 sites in these cities which include building construction hence the AOI will be limited to the 19 COEs vicinity. Punjab has all the natural resources in abundance and is the most populated province of Pakistan. The landscape comprises agricultural fields, irrigation system, densely populated cities, hills, deserts, salt ranges etc. However, the 20 sites of Project are within main cities. In following sections, the overall description of Punjab's physical resources, environmental settings and social setup would be described, unless or until there is specific need of mentioning any landscape adjacent to 20 sites of IWRPP.

5.2. Socio Economic Profile of Punjab

116. In terms of population, Punjab houses 110 million people, equivalent to 52.95 percent of the national population, down from 57.58 percent in 1972. This is attributable to Punjab's population growing slower (2.1%) than the national population (2.4%). Moreover, Punjab is blessed with a young population which offers a conditional advantage (PGS, 2023).

5.1: Locations of Centers of Excellence and Punjab Growth and Investment Corridors



117. In terms of its economic size, Punjab's share in national economy was at 54.2 percent in 2017-18. Given the share in population is just under 53 percent, the per capita income of Punjab is 2 percent higher than the national average. The performance of Punjab's economy has moved in tandem to national economy, and over the last five years the average annual provincial GDP growth rate was 4.9 percent. The economic structure of Punjab now comprises 62.4 percent of services, 20 percent of agriculture, and 17.6 percent of industry (PGS, 2023). The industrial share at the national level is 20.9 percent showing a structure difference between Punjab and the national economy. Furthermore, the Punjab's economy has a higher share in private and public investment and in net factor income from abroad. Punjab also has a significantly higher savings rate; however, the net trade deficit of Punjab is somewhat higher than that at the national level.

118. The labor force participation rate in Punjab is higher than the national average. This difference is primarily due to the higher labor force participation rates of females in Punjab. The employment level is also slightly higher in Punjab. The unemployment rate of Degree/Post-graduate holders, in particular, is as high as 18.9 percent, suggesting a sub-optimal use of Punjab's human capital. Table 5.1 provides key socioeconomic indicators of the Project cities.

Table 5.2.1: Socioeconomic Indicators of the Project Cities

COE location Districts	Population (000 Persons)	Crimes reported in 2018	Youth Literacy Rate 15-24 Years(%)		Health Institutes,2019		Under 5 mortality rate	Early Child Development Index	Access to Safe (Improved)Water (%)
			Male	Female	Hospitals	Dispensaries			
A	B	C	D	E	F	G	H	I	K
Lahore	11,126	63,053	85	84	54	151	44	51.4	45.6
Faisalabad	7,874	21,667	79.2	78	26	97	72	59	15.7
Murree	5,406	10,404	90.6	87.5	02	10	12	68.2	30
Sahiwal	5,018	5,130	74.2	70.9	12	21	76	84	6.8
Gujranwala	5,014	10,543	80.7	86.1	16	56	52	62.5	32.8
Multan	4,745	12,076	73.4	70.6	16	39	70	76.4	2.8
Sialkot	3,894	9,114	83.8	89.8	14	35	60	77.7	9.9
Bahawalpur	3,668	4,535	59.4	61.4	15	65	72	63.1	21.9
Sheikhupura	3,460	8,207	72.1	76.1	12	21	64	56.6	27.5
Khanewal	2,922	5,635	82.8	67.3	9	13	93	67.6	2.8

5.3. Physical Resources

1. Topography

119. Punjab's landscape is amongst the most heavily irrigated on earth. The province also includes several mountainous regions, including the Sulaiman Mountains in the southwest part of the province, the Margalla Hills in the north near Islamabad, and the Salt Range which divides the most northerly portion of Punjab, the Pothohar Plateau, from the rest of the province. Sparse deserts can be found in southern Punjab near the border with Rajasthan and near the Sulaiman Range. Punjab also contains part of the Thal and Cholistan deserts. In the South, Punjab's elevation reaches 2,327 meters (7,635ft) near the hill station of Fort Munro in Dera Ghazi Khan.

120. The central Punjab comprising Lahore is generally flat and slopes towards south and south-west at an average gradient of 1:3000. It can be divided into two parts i.e. the low-lying area along River Ravi and the comparatively upland area in the east away from Ravi. Sheikhupura is a renowned District of Punjab; Pakistan, which is located on coinciding boundary with Lahore and Hafizabad. Spatially it is located at the Latitude of 31°42'47" N and Longitude of 73°58'41" E and elevated about 209 meters (685 feet) above sea level.

121. The northern Punjab i.e., Murree lies 50 km northeast of the capital Islamabad. It is mountainous area, forming part of outer Himalayas and it is located at a comfortable altitude of 7500 feet (2286 meters) in the Himalayan foothills at 33 54' 30" north latitude and 73 26 east longitude.

122. The southern Punjab comprising Multan covers an area of 227 square kilometers (88 sq mi). The nearest major cities are Dera Ghazi Khan and Bahawalpur. Multan is located in a bend created by five rivers of central Pakistan. The Sutlej River separates it from Bahawalpur and the Chenab River from Muzaffargarh. The area around the city is a flat, alluvial plain that is used for citrus and mango farms.

123. Gujranwala is 226 meters (744 ft) above sea level, sharing borders with Ghakhar Mandi and several towns and villages. About 80 kilometers south is the provincial capital, Lahore. Sialkot and Gujrat lie to its north. Gujrat connects Gujranwala with Bhimber, Mirpur Azad Jammu and Kashmir, and Sialkot connects it with Jamming. About 160 kilometers southwest is Faisalabad. Rawalpindi is located only 14 kilometers south from the capital city of Islamabad, in the province of Punjab. It is in the northernmost part of the Punjab province, located 275 km to the north-west of Lahore.



Figure 5.3-1: Thematic map showing Ecological Rating of Districts in Punjab

124. Sheikhpura is a part of Rechna Doab and consists of sub-recent sediments brought by spill channel from the Chenab River. There are some old channel levees remnants and old basins filled up with clay materials. The material is probably of Late Pleistocene age derived from mixed calcareous sedimentary and metamorphic rocks of Lower Himalayas.

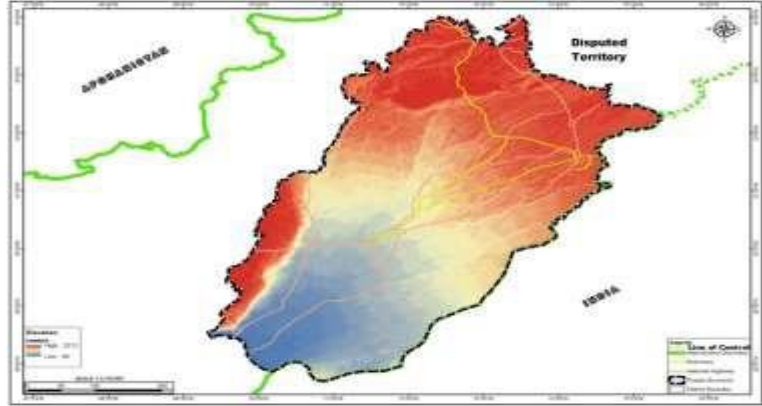


Figure 5.3-2: Topographical Map of Punjab Province

125. ³⁹ Topographically speaking, location of Bahawalpur division appeared as follows: in the north its boundaries were limited to River Sutlej, Panjnad and Indus River, which separates Multan and Dera Ghazi Khan, (where the adjacent districts of Sahiwal, Vehari, Multan, Lodhran, Muzaffargarh and Dera Ghazi Khan are located); while Sukkur Division of Sind province lies in south west. Three districts of Division Bahawalpur are integral part of it: Bahawalnagar, Raheemyar Khan and Bahawalpur District. Bahawalpur division was an administrative unit of the Punjab Province of Pakistan, until the reforms of 2000 when the third tier of government was abolished. Bahawalpur got the charge of district, and it was bound on North by Lodhran District, on the East by Bahawalnagar District and India, on the South by India and on the West by Rahimyarkhan and Muzafar Garh Districts. Bahawalpur is one of the largest districts of the Punjab covering an area of 24,830 square miles. It has peculiar demographic, topographic and geographical characteristics. The district is situated almost in the center of the country at an elevation of 152 meters from the sea levels. It has Five Tehsils; Bahawalpur, Ahmad Pur East, Yazman (i/c Cholistan), Khair pur Tamewali, Hasilpur.

126. The water level in Bahawalpur is higher than in the upland. The soil is sandy. The upland is flat plains. The general height of the area is from 118 to 127 meters above the sea level.

127. The topography of Sahiwal is one of a flat semi-arid plain that is fertilized with the use of its extensive irrigation canal. The Lower Bari Doab is the main source of irrigation in the area and it is fed by a link from the Chenab River. From a topographical point of view, the semi-arid plain is remarkably homogeneous. The only noticeable relief is that of the flood plain bluffs and the belts of ravines and bad land that were formed by gully erosion along the Lower Bari Doab and its distributaries. Generally, the natural slope runs northeast to southwest. Overall, the area is flat. Topographic map of Punjab is provided in Figure 5.3-2.

2. Meteorological Parameters / Climate / Weather

128. Most areas in Punjab experience extreme weather with foggy winters, often accompanied by rain. By mid-February the temperature begins to rise; springtime weather continues until mid-April, when the summer heat sets in. The onset of the southwest monsoon reaches Punjab by

³⁹ ESMF of World Bank's Punjab Resilient and Inclusive Agriculture Transformation (PRIAT) Project.

May, but since the early 1970s, the weather pattern has been irregular. The spring monsoon has either skipped over the area or has caused it to rain so hard that floods have resulted. June and July are oppressively hot. Heat records were broken in Multan in June 1993, when the mercury was reported to have risen to 54 °C. In August, the oppressive heat is punctuated by the rainy season, referred to as barsat, which brings relief in its wake. The hardest part of the summer is then over, but cooler weather does not come until late October. Recently the province experienced one of the coldest winters in the last 70 years. Punjab's region temperature ranges from -2° to 45 °C but can reach 50 °C (122 °F) in summer and can touch down to -10 °C in winter. Climatically, Punjab has three major seasons: Hot weather (April to June) when temperature rises as high as 43°C (110 °F). Rainy season (July to September). Average rainfall annual ranges between 96 cm sub-mountain region and 46 cm in the plains. Cooler/ Foggy / mildweather (October to March). Temperature goes down as low as 4.5 °C (40 °F). Weather extremes are notable from the hot and barren south to the cool hills of the north. The foothills of the Himalayas are found in the extreme north as well, and feature a much cooler and wetter climate, with snowfall common at higher altitudes.

129. Upper Punjab features a humid subtropical climate with hot and wet summers, a cooler and drier winter. Rawalpindi during the year experiences an average of 91 thunderstorms, which is the highest frequency of any plain elevation city in the country. Strong windstorms are frequent in the summer during which wind gusts have been reported by Pakistan Meteorological Department to have reached 176 km/h. In such thunder/windstorms, which results in some damage of infrastructure. The weather is highly variable due to the proximity of the city to the foothills of Himalayas.

130. Hilly area of features a subtropical highland climate. It is situated in the outer Himalayas, retaining high altitude. This type of area has cold, snowy winters, relatively cool summers with drastically escalated rain, in relation with lower altitudes, and frequent fog. Precipitation is received year-round, with two maxima, first one during winter and second one at summer, July–August. Total mean precipitation annually is 1,789 mm. Murree receives around 159 cm (62.6 inches) of snow per year according to a 13-year data.

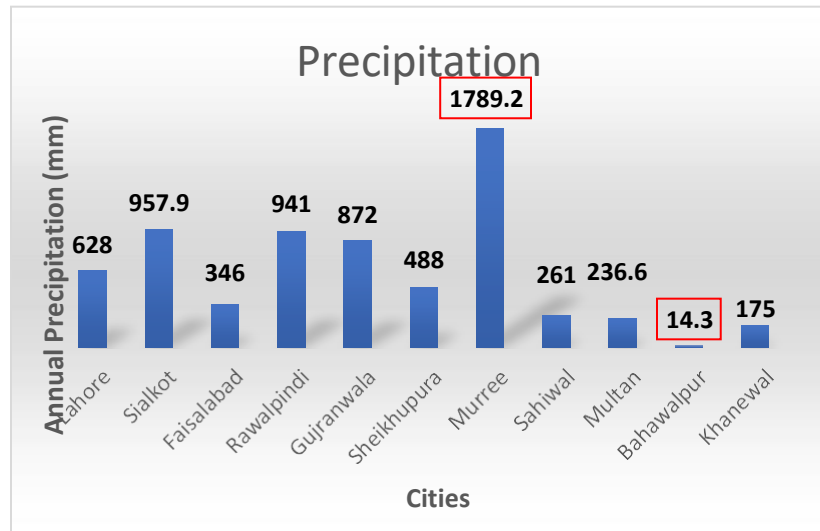


Figure 5.3-2: Precipitation of the Project Cities

131. Murree's economy and whole life is very much dependent on its weather conditions. It has four distinguishable seasons in whole year. Spring in Murree starts in March and ends in middle of May. Maximum temperature during this period hovers between twelve to twenty and minimum between four and ten. This season brings heavy rain and hailstorms in this area. The fruit trees laden with flowers gives a spectacular view. Summer starts from middle of June and last till end of August. The lowest temperature during this season is between 13 and 16 degree centigrade while highest temperature is between 20 and 25 °C. This is the best season in the area and that

is most of the people visit this area during this season. Autumn starts with the arrival of September and lasts till the starts of winter in early December. Temperatures remain mild in this season. Clear sky could be seen in the region during autumn when one can enjoy full view of mountains around without cloud hindrance. Winter starts in December and normally brings heavy snowfall. Murree and its surrounding areas are covered with thick sheet of snow during most part of the season. Temperature mostly drifts around the freezing point.

132. Punjab has four seasons: Winter, Summer, Autumn and Spring. The monsoon season also occurs in Summer. The winter season begins from the month of December and lasts till February. Western Disturbance influence the winter season. The average lowest January temperature in the season of winter is 4.5 °C (40.1 °F). While the average highest temperature in winter was recorded in the month of December which is of 22.7 °C (72.9 °F). Heavy rains occur in winter which decrease the temperature further. Hailstorms also occur due to Western Disturbance. The spring season begins from March and last till April. As soon as spring begins many flower shows are held across the city. The highest average temperature of 35 °C (95 °F) in spring season was recorded in April while the lowest is recorded in March that is 13.5 °C (56.3 °F). Rains are rare in the spring season. The summer season begins from May and last till September. Summer is the longest season in Punjab. Monsoon rains also occur in this

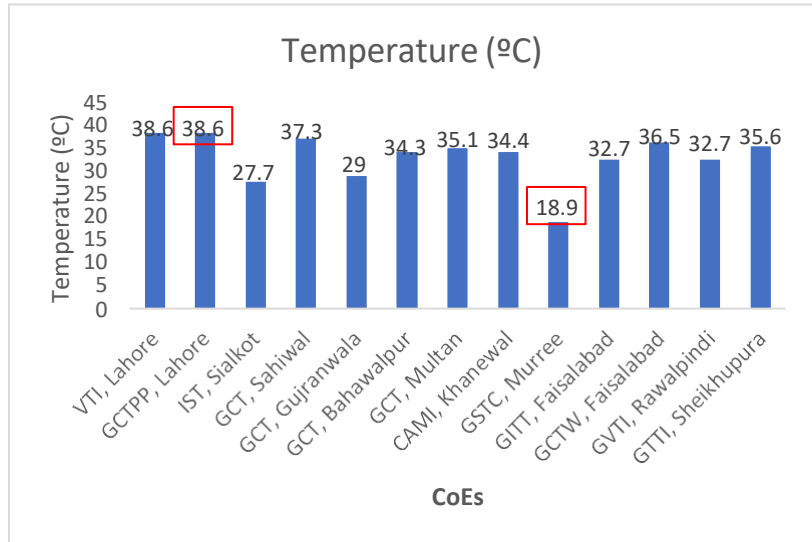


Figure 5.3-4: Temperature of the Project Cities

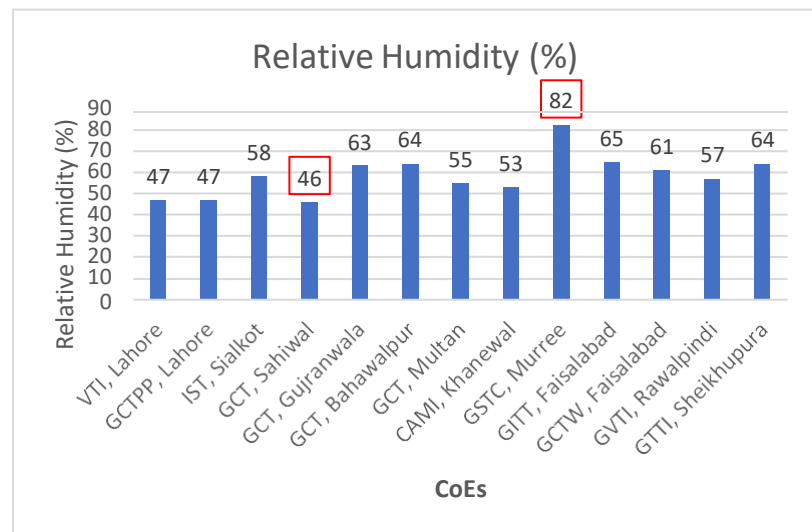


Figure 5.3-3: Relative Humidity of the Project Cities

season, these rains begin from June till September. Extremely high temperatures are recorded in summer. Violent dust storms occur in May and June while almost all the summer Loo blow that causes the traffic to remain thin. Heavy rains also occur during monsoon season. The highest average temperature recorded in Summer is recorded in June that is 42.3 °C (108.1 °F) while the lowest was recorded in September that is 24.9 °C (76.8 °F). The Autumn season begins from October and ends in November. Hazy and dry weather is the main factor of Autumn. The highest average temperature was record in the month of October that is 34 °C (93 °F) and the lowest average temperature is 10.9 °C (51.6 °F) recorded in November. Showers do occur in this season late in November.

133. Punjab features an arid climate with very hot summers and mild winters (see Table 5.2 & 5.3). The normal annual precipitation measures 186 millimeters. Multan is known for having some of the hottest weather in Pakistan. The highest recorded temperature is approximately 52 °C, and the lowest recorded temperature is approximately –1 °C.

134. South Punjab's climate is primarily influenced by:

- (i) Western Disturbances which generally occurs during the winter months between December and February. The Western Disturbance provokes moderate rainfall, with hailstorms also sometimes occurring.
- (ii) Dust storms occur during summer months. Dust storm sometimes produce violent wind.
- (iii) Heat waves occur during the hottest months of May and June, and can result in temperatures approaching 50° Celsius (122° Fahrenheit)
- (iv) South West Monsoon occurs following the hottest months of the year, and lasts between June and September. Monsoon rains moderate temperatures, and can sometimes produce heavy rain storms.
- (v) Continental air prevails during the remaining months generally yields clear weather with little to no precipitation.

Table 5.3.1: Meteorological Data of Project Cities⁴⁰

Cities	Mean Monthly Maximum Temperature (°C)	Mean Monthly Minimum Temperature (°C)	Annual Precipitation (mm)	Monthly Average Wind Speed (miles/hr)
Lahore	40.4	23	628	5.3
Sialkot	39.9	18.5	957.9	5.2
Faisalabad	40.5	26.9	346	6
Rawalpindi	33.7	23.8	941	6.2
Gujranwala	31.26	17.12	872	5
Sheikhupura	39.4	18	488	5.1
Murree	22	3	1789.2	5.3
Sahiwal	32.2	17.8	261.0	6.1
Multan	42.3	24.9	236.6	6.9
Bahawalpur	33	18.1	14.3	7.6
Khanewal	46	28	175	6

Table 5.3.2: Relative Humidity of Project Cities⁴¹

Cities	Relative Humidity (%)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lahore	65	61	56	43	36	44	67	73	65	59	63	67
Sialkot	70	65	60	47	39	45	69	76	69	61	65	70
Faisalabad	59	56	53	43	35	41	62	68	61	53	57	61
Rawalpindi	59	58	56	49	39	40	62	71	62	53	54	59
Gujranwala	66	62	57	45	37	44	67	74	66	59	62	67
Sheikhupura	63	59	55	43	36	42	65	72	64	56	60	64
Murree	62	61	58	53	45	44	63	69	60	53	54	61
Sahiwal	57	56	54	45	37	41	62	68	61	53	55	59
Multan	56	53	50	40	35	40	56	60	56	50	54	58

⁴⁰ Several EIAs and Research Articles referred in References

⁴¹ Several EIAs and Research Articles referred in References

Cities	Relative Humidity (%)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Bahawalpur	55	51	47	37	33	41	56	60	56	48	52	56
Khanewal	56	53	50	40	34	40	57	62	57	50	54	58

135. Central Punjab has a hot semi-arid climate (BSh), according to the Köppen-Geiger system, and changes throughout the year. During summer (June to September), the temperature reaches 36–42 °C (97–108 °F). The coldest months are usually November to February, when the temperature can drop to an average of 7 °C (45 °F). The highest precipitation months are usually July and August, when the monsoon reaches the Punjab. During the other months, the average rainfall is about 25 millimeters (0.98 in). The driest months are usually November to April, with little rainfall.

136. Upper Punjab features a humid subtropical climate (Köppen: Cwa) with long and very hot summers, a monsoon and short, mild and wet winters. Rawalpindi and its twin city Islamabad, during the year experience an average of 91 thunderstorms, which is the third highest in frequency after Murree and Kakul. Wind gusts have been reported by Pakistan Meteorological Department to have reached 167 km/h (105 mph) in such thunder/wind storms which results in damage of infrastructure especially electric poles, billboards and sometimes buildings too. Rawalpindi is chaotic but relatively dust-free. The weather is highly variable due to the location of the city. The average annual rainfall is 45 inches (1,100 mm), most of which falls in the summer monsoon season. However, frontal cloud bands also bring quite significant rainfall in the winter. In summer, the record maximum temperature has soared to 46.5 °C (116 °F), while it dropped to a minimum –3.9 °C (25 °F) in the winter.

137. The climate in south Punjab is harsh, sub-tropical hot and arid, and influenced by seasonal monsoons. One of the most remarkable features of the project area is the occurrence of dry years in clusters, i.e., for 4-6 years continually. Annual and even daily temperature varies greatly. Mean summer temperature varies from 35 to 50 °C during the month of May to June and winter from 15 to 20 °C during December to February. Annual rainfall is low and erratic, ranging from 100-250 mm annually, with its maximum during July to September in summer monsoons and January to March in winters. Owing to scanty rainfall the vast expanse of land in Bahawalpur remains largely uncultivated, but the banks of the river are lined with cultivation and vegetation. Some areas have been made cultivatable by means of canals and tube wells. The Lal Sohanra is almost barren and consist of small bushes and sand dunes.

3. Geology and Soils

138. Organic accumulation of soils in Murree varies with vegetation type and density, and the level of biological activity in the soil. Soil profile differentiation is limited due to slope instability and restricted water availability. At lower altitudes alkaline conditions prevail. The soils are classified as Entisols and Inceptisols, with more acid forms predominating above 2000 m and alkaline forms below this altitude. Rates of soil erosion are estimated to be around 150 ton per hectare per year ($t\ ha^{-1}\ y^{-1}$) on average in higher altitude areas of recent deforestation, and around 50–75 $t\ ha^{-1}\ y^{-1}$ in areas of overgrazing at lower altitude. Susceptibility to erosion is high due to steep slopes, high silt and/or fine sand contents and low organic matter contents. Erosion control is being attempted by replanting the lower areas and by policing illegal felling of the higher, forested areas, but these measures have met with limited success to date due to topographic and administrative difficulties.



Figure 5.3-5: Geological Map of Punjab Province⁴²

139. Geology in Punjab mainly comprise clayey soils. Geological formation in Lahore and Multan are loamy soils. Soil in Bahawalpur are sandy in nature. The Gujranwala is plain area, the land is fertile and fit for agriculture purposes. Rawalpindi district is mixture of hilly and plain land resources.

140. Most of the Punjab lies in the fertile alluvial plains of Punjab. The only hills found in the district are situated on the Chenab River between Chiniot and Rabwah. These hills are of the same formation as the Kirana hill of Sargodha District. The Sargodha-Chiniot - Shahkot-Sangla hill belt constitutes the northern outcrops of Indian shield of Pre-Cambrian era. These rock outcrops are not so high and can be used as gravel (crush) for construction when broken and crushed. The sand extracted from the riverbed is superior and is commonly used for building purposes. Pre-Cambrian basement rocks of iron ore deposits are found in Chiniot district. Apart from these rocks, the districts are alluvial plain. The surface soils are grey to brown in color and medium textured i.e. silty clay/ clay loamy or sandy loam at the site, at all the locations and generally continues up to depth of 3-10 feet. This sub stratum contains fine sand. Topographically the area is almost plain.

⁴² ESMF of World Bank's Punjab Resilient and Inclusive Agriculture Transformation (PRIAT) Project.

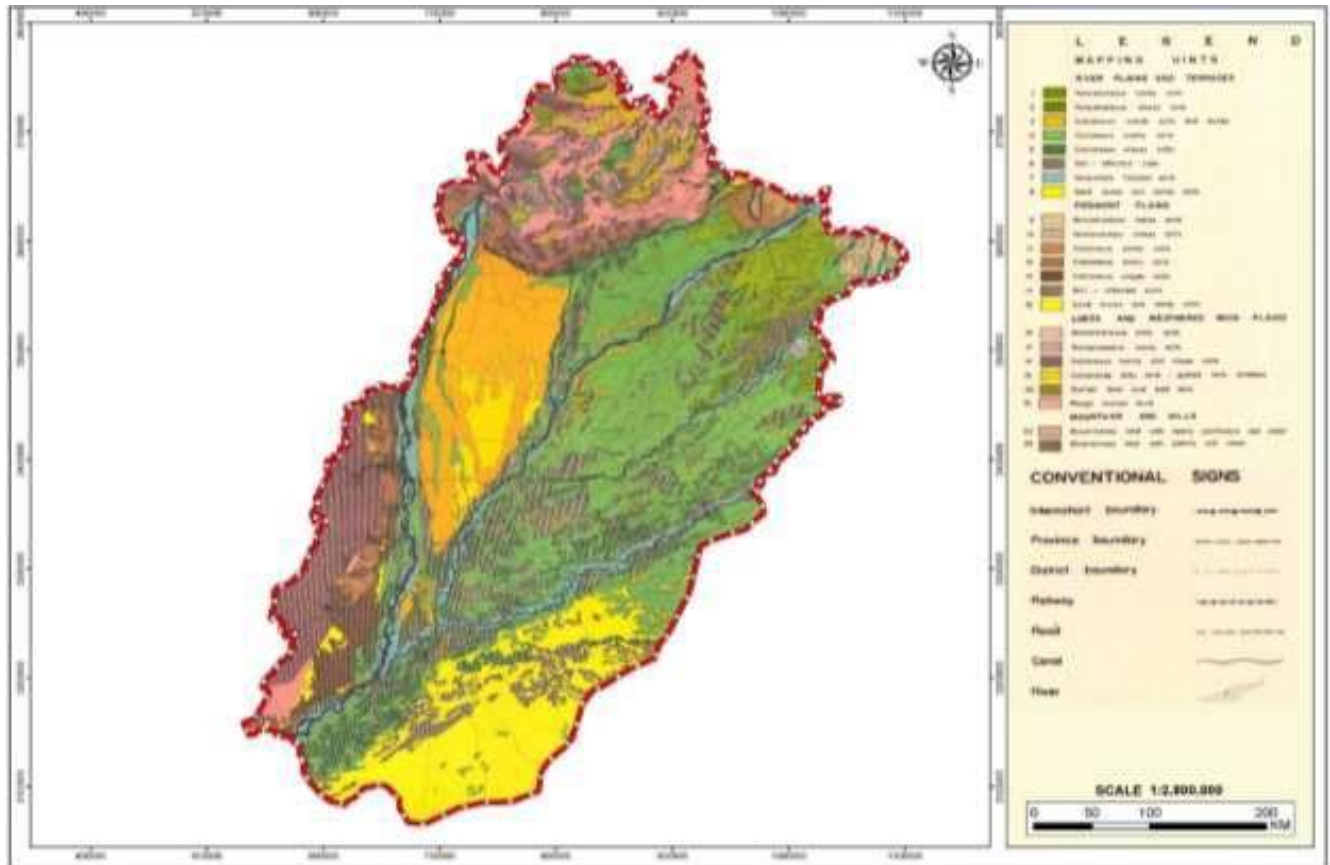


Figure 5.35.3-6: Soil Map of Punjab Province⁴³

141. Sialkot is underlain by Pleistocene deposits to a depth of several thousand meters. The first 200 meter of these deposits consist of approximately 70% silty sand interspersed with limited clay layers. The strata are generally heterogeneous with little vertical or lateral continuity. The historic center of Sialkot is located between two seasonal watercourses, the Bhaid Nullah and the Aik Nullah. It occupies land that is elevated up to about 10 meters above the surrounding areas. Apart from the central area, the city is generally flat. Overall, there is an east to west fall, from around 253 meters in the east to about 245 meters in the west, an average fall of about 1 in 1000.

142. Sheikhpura has both piedmont and floodplain deposits. The piedmont material originates from the Himalaya foothills. The foothills consist of sedimentary rocks that were eroded from igneous, metamorphic and old sedimentary rocks without much pre-weathering. The soil is alluvial and fertile. The types of soil commonly found in the project area are Gora, Rohi, Doshai, Maira, Tibba, Kallar and Riverine.

143. Bahawalpur topography comprises of sand dunes that are sparingly dotted with wild bushes.

144. Geologically, Sahiwal does not have any outstanding features. Saltpeter, which is made from saline earth called kallrar, is found when the water table is high. In the east of the town, there can be found common salt mixed with a lesser quantity of sulfate of soda and a very small quantity of lime and magnesium salt. Geology and soil morphology maps of the Punjab are provided in Figures 5.3-5 and 5.3-6 respectively.

4. Water Resources / Hydrology

145. Indus River and its four major tributaries in Pakistan, the Jhelum, Chenab, Ravi, and Sutlej rivers which traverse Punjab north to south – the fifth of the "five waters" of Punjab, the Beas River, lies exclusively in the Indian state of Punjab. The landscape is amongst the most heavily irrigated on earth and canals can be found throughout the province. Punjab also includes several mountainous regions, including the Sulaiman Mountains in the southwest part of the province, the Margalla Hills in the north near Islamabad, and the Salt Range which divides the most northerly portion of Punjab, the Pothohar Plateau, from the rest of the province. Sparse deserts can be found in southern Punjab near the border with Rajasthan and near the Sulaiman Range. Punjab also contains part of the Thal and Cholistan deserts. In the South, Punjab's elevation reaches 2,327 metres (7,635 ft) near the hill station of Fort Munro in Dera Ghazi Khan.

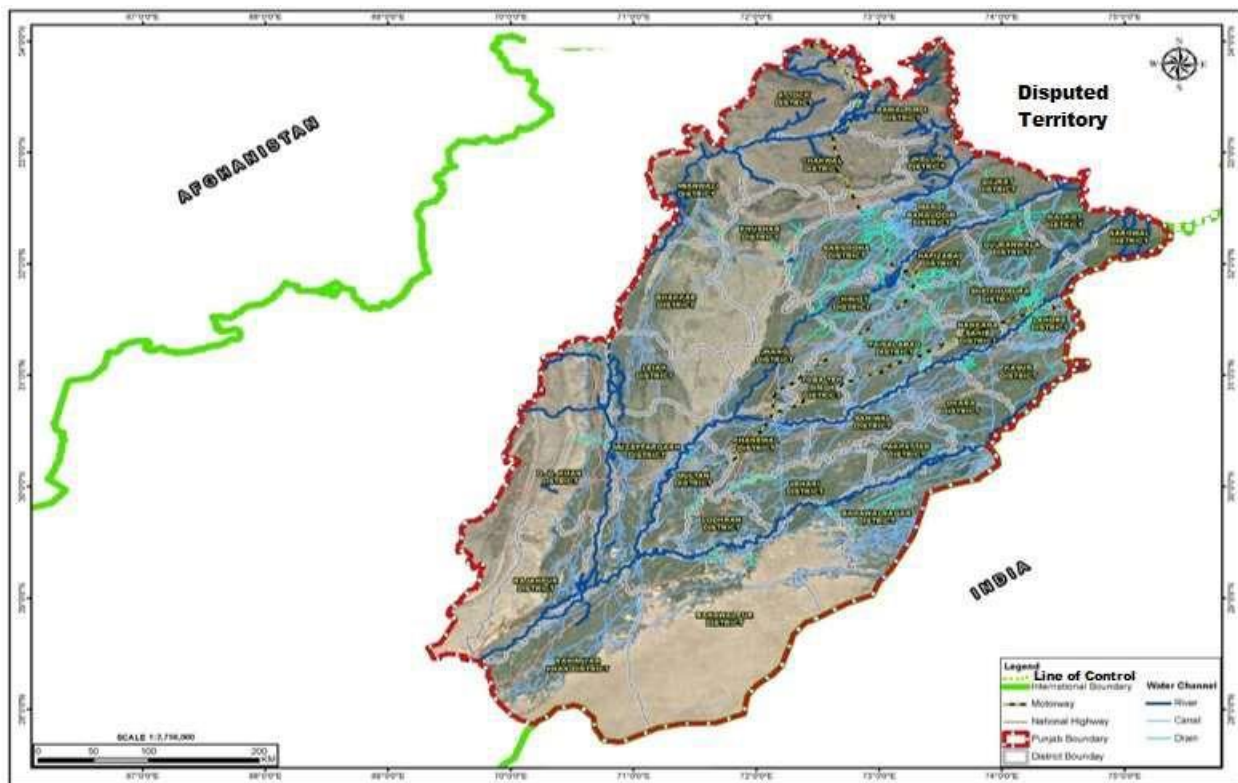


Figure 5.3-7: Surface Water Resource in Punjab⁴⁴

146. River Chenab and related canals are the major surface water source in Multan and Faisalabad. It is perennial and flows throughout the year. It also causes floods in the monsoon season, when it receives excessive rainfall water from upstream. River Jhelum has bounded Murree in the east. There are two canals in the Sialkot district namely, Upper Chenab and Marala Ravi Link. These canals were derived from River Chenab and Marala Head Works in 1937 and 1955. In 1949, B.R.B canal was derived from Upper Chenab at Bambanwala. Sialkot is situated in the Upper Rachna Doab, which is bounded by the Ravi and Chenab rivers. It sits over abundant shallow and deep groundwater aquifers which are used by both the city water supply system and inhabitants with wells for their water supplies. The Chenab River flows to the northwest of Sialkot,

and the Marala Ravi Link Canals flow to the west. Sialkot is traversed by three seasonal streams, comprising Aik Nala, to the south of the city, Bhaid Nala, between the Cantonment and the rest of the city, and Pahlu Nala, north of the Cantonment. The general slop of the land within the Doab is to the southwest and the area is an active flood plain, although floods are to a large extent controlled by irrigation and power generation works carried out on the Indian side of the border.

In Lahore, Ravi is the only river, which flows through the district. It enters the district from Amritsar. It is the smallest of five rivers of Punjab. There are no lakes or marshes in the district.

147. Punjab's terrain is one of relatively low- lying plains, with several rivers that traverse the area from the northeast to the southwest and feed into the Indus River. The Ravi River is closest to Sahiwal, but it is still a distance of nearly 20 KM. There is no history of the city being threatened by floods. The most challenging weather phenomenon in Sahiwal is the winds called 'Loo', which blow during the day in the predominately hot and dry summer. Lower Bari Doab canal passes close to the site at about 300 meters. Figure 5.3-7 shows the surface water resources of Punjab.

5. Seismology

148. As evident from the below picture, Punjab is mainly Zone 2A which depicts low risk, except Northern Punjab i.e., Rawalpindi and Murree which lie in the Zone 2B and depict moderate seismic risks. Figure below depicts seismic zoning of Pakistan.⁴⁵

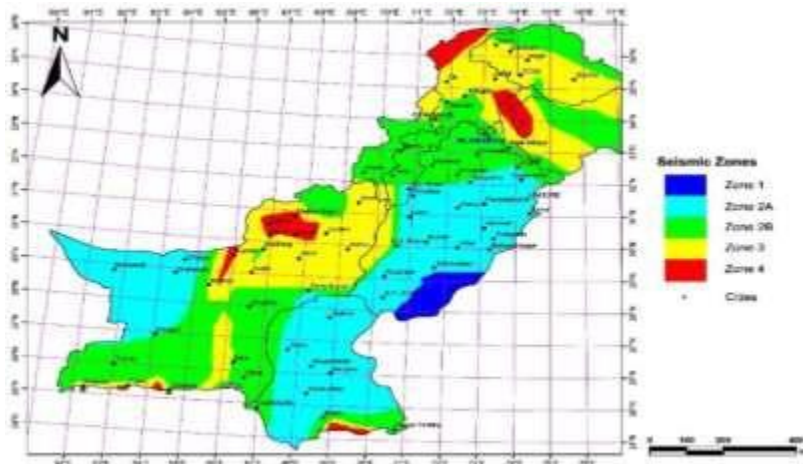


Figure 5.3-8: Seismic Zoning of Pakistan

6. Land Use

149. Punjab is the largest province of Pakistan in terms of population. The name Punjab is derived from Persian words Panj – ab meaning “five” (panj) “waters” (āb), i.e., Land of Five Rivers. These five rivers are the tributaries of the Indus River namely Chenab, Jhelum, Ravi, Beas and Sutlej. The province contains one of the largest irrigation systems of the world with about 3000 irrigated channels present all over the province. Due to the presence of extensive irrigated

⁴⁵ Building Code of Pakistan, Ministry of Housing and Works, Government of Pakistan

system, Punjab is rich with an agricultural production.. Cotton, wheat, rice, sugarcane, millet, corn, oilseeds, pulses, vegetables, and fruits such as kinoo (orange), mango etc are the major agricultural products. Along with the agricultural activities, the province developed significantly in industrial production also. Its manufacturing industries produce textiles, sports goods, Heavy machinery, electrical appliances, surgical instruments, cement, vehicles, auto parts, IT equipment, metals, sugar mill plants, aircraft, cement plants, agriculture machinery, bicycles and rickshaws, floor coverings, and processed foods etc.

150. The land use pattern of Punjab comprises land cover, snow cover and water bodies, forest, pasture and range land, agriculture and waste land.

151. In Punjab the forest cover is limited, only about 4 percent. It is predominantly scrub forest (2%). Riverain

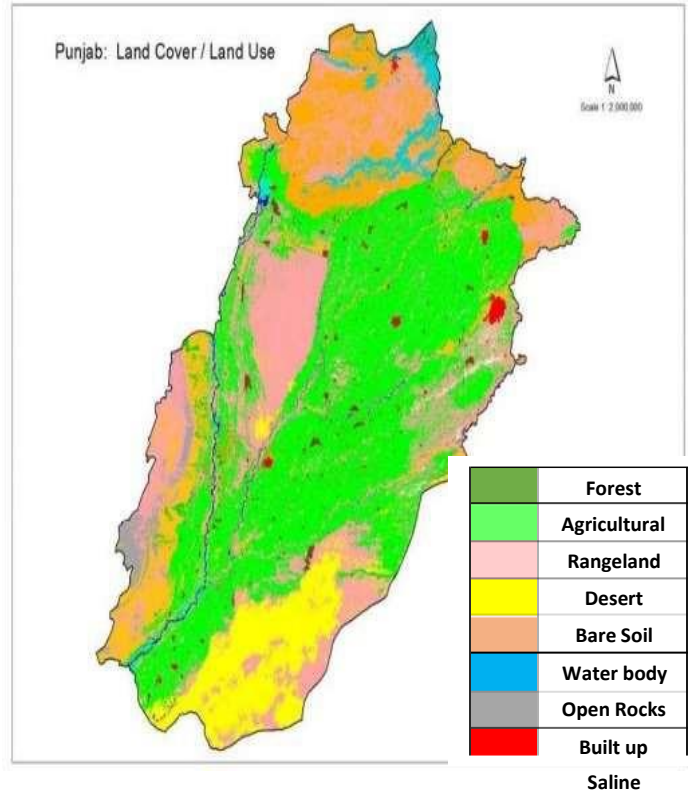


Figure 5.3-9: Land Cover / Land Use of Punjab

and broad leaf forests cover only 0.7% each. The coniferous forests are mainly present in the northern mountainous area. Almost half of the area of the Punjab province is under agricultural land use. Irrigated agriculture is predominant and is mainly in the area drained by the Indus River and its tributaries. Rangeland is another major land use type covering about 26% of the province. Desert covers about 9% whereas open ground/current fallow account for a little more than 7% area. It is mainly concentrated along the foothills of the western mountains where Rod Kohi agriculture is practiced in patches. Within the irrigated areas are pockets of waterlogged and saline lands which as a whole account for some 0.6% of the provincial area.⁴⁶ Land use of the Punjab province is depicted in Figure 5.3-9. The land use of Punjab is given below in Table.

Table 5.3.3: Land Use Pattern of Punjab⁴⁷

Land Use Types	Area (in 000' ha)	Percentage
Total Geographical Area	20625.1	100
Forest	855.1	4.2
Rangeland	5385.7	26.1
Agricultural Land	10143.4	49.2
Bare Soil	1618.8	7.9
Exposed Rocks	318.4	1.5
Desert	1796.9	8.7
Built-up Area	196.6	1
Waterlogged and Saline	130.4	0.6
Water Bodies	179.8	0.9

⁴⁶ [Land Use Atlas of Pakistan 2009](#)

⁴⁷ [Land Use Atlas of Pakistan 2009](#). Punjab Data.

5.4. Baseline Environmental Monitoring

152. Amid covid-19, the detail baseline environmental monitoring was originally conducted in July 2020 following all the required SOPs and guidelines. An environmental monitoring laboratory i.e. M/s Environmental Services of Pakistan Private Limited (ESPAK) was engaged for this purpose. Two teams of ESPAK conducted the baseline environmental monitoring at 19 COEs including Sub-Projects. The baseline environmental monitoring report prepared and submitted by M/s ESPAK is also annexed as Appendix-V to the EIA. The findings of the referred report are duly incorporated in preparing this EIA. However, the baseline monitoring for air, noise and water quality (at least) at all COE sites will be conducted again through an independent, EPA approved laboratory to accurately setup the baseline levels at the detail design stage and prior to the start of construction works. Below sections present the summary of baseline environmental results recorded during July 2020.

1. Air Quality

153. Due to Covid-19 lockdown like situation, the Environmental Monitoring Laboratory (M/s ESPAK) was engaged to perform air quality monitoring at 13 COEs including Sub-Projects. The COEs were selected on the basis of close proximity of two or more COEs within a range of 5-10 km radius (aerial distance) in the same city. COEs in Multan, Sialkot, Rawalpindi, Murree and Bahawalpur were also within 5 km range to each other. Hence, one monitoring point was selected in these project cities.

154. The ambient air monitoring was done continuously for 24 hours through monitoring van as per PEQS and international standards. The locations for air monitoring were selected within the premises of COEs. For this, a thumb rule was followed that monitoring van should be as much closer to the existing main buildings (class rooms and laboratories) as possible. The direction of monitoring was north-south in most of the cases. The baseline location maps are shown in log tables of Appendix-V. The ambient air baseline monitoring results are shown in Table 5.5 below. Almost all the values are within permissible limits of PEQS, except



for the criteria pollutants parameters such as SO_2 , NO_2 , O_3 , PM_{10} , $\text{PM}_{2.5}$ are not within the allowable limits of WHO, IFC standard limits. Higher values of PM_{10} and $\text{PM}_{2.5}$ may be due to vehicular emissions, open burning of solid waste and gaseous emissions of industries and brick kilns. However, Lead limits are different for urban and non-urban settings, considering the COEs to be

located in urban environment, the limits for 8 hours assessment are 0.5, however, the values were recorded for 24 hours and none of the value is below the limit.



Table 5.4.1: Air Quality Monitoring Results

COE	Parameter	SO ₂	NO	NO ₂	O ₃	SP M	PM ₁₀	PM _{2.5}	Pb	CO
	Units	ug/m ₃	Ppb	ug/m ₃	ppb	ug/m ₃	ug/m ₃	ug/m ₃	ug/m ₃	ppm
	PEQS Value (24 hours)	120	40	80	130 (1 hr)	500	150	35	1.5	10 (8 hour)
	WHO/IFC (24-hr)	40	-	25	100 (24 hr mean)	-	45	15	-	4
VTI, Lahore		20.9	13.8	22.7	1.9-13.7	228	123	29.3	1.35	1.1-1.3
GCTPP, Lahore		11.3	10.2	11.0	2.2-18.3	434	128	30.2	1.30	0.6-1.4
IST, Sialkot		10.3	9.5	11.2	2.0-30.5	271	120	29.0	1.10	0.6-1.3
GCT, Sahiwal		20.5	11.3	21.6	0.1-12.2	252	113.3	27.3	0.59	0.9-1.3
GCT, Gujranwala		9.2	9.8	16.3	1.4-13.1	265	109	25.9	0.88	0.6-0.7
GCT, Bahawalpur		19.6	10.9	20.3	0.1-14.8	232	110	24.2	0.75	0.7-1.4
GCT, Multan		20.4	12.8	21.8	0.1-13.9	251	108	25.4	0.75	0.9-1.4
CAMI, Khanewal		21.5	13.0	22.2	0.1-11.3	244	107	25.6	0.78	1.0-1.6
GSTC, Murree		10.1	10.5	17.4	2.6-35.7	117	115	26.7	1.12	0.7-1.1
GITT, Faisalabad		20.3	12.7	21.8	0.1-13.9	266	107	28.0	1.25	0.8-1.5
GCTW, Faisalabad		20.3	12.7	21.8	0.1-13.9	270	114	28.3	1.20	0.9-1.4
GVTI, Rawalpindi		11.1	10.6	15.3	1.3-32.1	231	129	30.0	1.40	0.6-1.1
GTTI, Sheikhpura		20.5	12.4	21.5	0.1-12.3	261	108	27.4	0.89	0.9-1.5

Particulate Matter (Particle Size 2.5 micron), SPM = Suspended Particulate Matter

155. The Environmental Monitoring Laboratory also measured meteorological parameters such as temperature, wind speed and humidity. Though, this report presents a whole description of meteorological settings generally throughout the year of all the project cities but the following table shows the exact weather conditions of project cities in the month of July. The baseline monitoring for air quality at all COE sites will be conducted again through an independent, EPA approved laboratory to determine the most recent baseline levels at the detail design stage and prior to the start of construction works.

Table 5.4.2: Baseline Weather Conditions

COE	Temperature (°C)	Wind Speed (m/s)	Relative Humidity (%)
VTI, Lahore	38.6	2.4	47

COE	Temperature (°C)	Wind Speed (m/s)	Relative Humidity (%)
GCTPP, Lahore	38.6	2.4	47
IST, Sialkot	27.7	1.5	58
GCT, Sahiwal	37.3	1.1	46
GCT, Gujranwala	29	0.5	63
GCT, Bahawalpur	34.3	2.4	64
GCT, Multan	35.1	2	55
CAMI, Khanewal	34.4	1.8	53
GSTC, Murree	18.9	0.5	82
GITT, Faisalabad	32.7	0.9	65
GCTW, Faisalabad	36.5	0.4	61
GVTI, Rawalpindi	32.7	2.2	57
GTTI, Sheikhpura	35.6	6	64

2. Noise Levels

156. The noise levels were monitored continuously for 24 hours (day/night). The values at night time were exceeding PEQS and WHO/IFC standard limits for residential area, for almost every location. These higher values is attributed to higher vehicular movement on adjacent roads. The Environmental Monitoring Laboratory (M/s ESPAK) selected the COEs existing buildings for measuring the noise levels. The baseline monitoring for noise at all COE sites will be conducted again through an independent, EPA approved laboratory to determine the



most recent baseline levels at the detail design stage and prior to the start of construction works. The maps of noise monitoring locations are in Appendix-v. Noise levels at all 19 COEs are mentioned in below table.

Table 5.4.3: Baseline Noise Monitoring Levels

COE	Noise (dB)	
	55	45
	Day time	Night time
VTI, Lahore	49	39
GCTW, Lahore	58	54
GCTPP, Lahore	50	52
IST, Sialkot	57	50
GCT, Sialkot	57	47
GCT, Sahiwal	59	53

GCT, Gujranwala	58	53
GTTI, Bahawalpur	58	54
GCT, Bahawalpur	56	51
GCT, Multan	56	49
VTI, Multan	55	46
CAMI, Khanewal	55	49
GSTC, Murree	53	49
GTTIW, Murree	53	49
GITT, Faisalabad	54	47
GCT, Faisalabad	55	50
GCTW, Faisalabad	55	49
VTI, Rawalpindi	56	55
GVTIW, Rawalpindi	54	54
GTTI, Sheikhpura	59	54

3. Drinking or Ground Water Quality

157. Groundwater is the sole source of potable water exploited in all cities of Punjab. The ground water is extracted by means of different private and Government installed wells. The depth of these wells varies from 120-700 feet and greater quantities of good quality groundwater are available in deep wells, and this is where the cities' supplies are derived (PCRWR, 2021; PCRWR, 2014). The Environmental Monitoring Laboratory (M/s ESPAK) collected the drinking water samples from COEs premises. For this, the sources i.e. tap water and water tanks which are mainly used for drinking water purposes by the COEs staff and students, were selected. The sampling location maps are shown under log tables of Appendix-V.



158. Drinking or groundwater samples from all 19 COEs were analyzed by monitoring teams. The results are mostly found to be under PEQS limits; however, TDS and total hardness were exceeding PEQS at Khanewal and Bahawalpur. The fecal contamination and E. Coli were found in Multan and Faisalabad. Groundwater results of all 19 COEs are summarized below in table 5.8, values exceeding PEQS are highlighted in pink. PEQS are mostly in line with WHO drinking water standards, however, lead thresholds were found to be more than WHO allowable limits at Sheikhpura, and Khanewal. Although arsenic was not detected in any site but studies have clearly shown the presence of high arsenic in



Ravi river flood plain and Lahore is situated in Ravi River Flood plain. As based on the blanket testing of more than 30, 000 water samples in and around 400 village of northern Punjab (van Geen et al., 2019) on both sides of Pakistan and India border came up with conclusion that As in drinking water is high along the Ravi Flood plain and low in Satluj, Chenab and Jhelum Flood plain. Similar results of high As along Ravi river flood plain and low As concentration along Chenab and Jhelum Flood, was also reported in irrigation wells of Punjab Plains. (Javed et al. 2020). Therefore, presence of high arsenic in Lahore cannot be ignored and for the selection of appropriate drinking water treatment unit removal of arsenic in addition to other site-specific contaminants should be given a due consideration. As such a "Reverse Osmosis (RO)" treatment plant of sufficient capacity could be a best fit as an all-in-one solution. The baseline monitoring for water quality at all COE sites will be conducted again through an independent, EPA approved laboratory to determine the most recent baseline levels at the detail design stage and prior to the start of construction works.

159.

4. Sewerage and Wastewater Analysis

160. The Environmental Monitoring Team collected sewerage and wastewater samples from all 19 COEs. For this, the samples were collected from the main drain of the COEs containing composite mixture of COE. The samples collection maps are shown in Appendix-V.



161. Team analyzed sewerage and wastewater samples collected from all 19 COEs and the summary of analysis report is presented below in Table 5.9. Most of the parameters are within PEQS limits, however, BOD and COD values were found more at Lahore, Faisalabad, Multan and Khanewal COEs. In addition, TSS, Cyanide, Sulphide and Ammonia were exceeding PEQS at some COEs in Lahore and Faisalabad. Values of exceeding wastewater parameters may be due to usage of chemicals in the laboratories of COEs and detergents being used in hostels, laundries, kitchen, etc. The high cyanide contamination in waste water may be attributed to its use as a process chemical. However, the natural processes mainly biodegradation results in the formation of by-product, such as cyanate, thiocyanate, sulphate, ammonia, nitrate and results in elevated concentration of sulphide and Ammonia in waste water. It must be noted that PEQS limits for remaining wastewater parameters are in line with international standards hence any emission exceeding PEQS must be considered as exceeding international allowable limits as well.



Parameter	pH	TDS	Chloride	Cadmium	Chromium	Copper
Units		mg/l				
PEQS Permissible Limit	6.5-8.5	<1000	<250	0.01	≤ 0.05	2
WHO Standards	6.5-8.5	<1000	250	0.003	0.05	2
VTI, Lahore	8.3	919	39	ND	0.004	0.029
GCTW, Lahore	7.8	336	35	ND	0.001	0.010
GCTPP, Lahore	8.0	108	17	ND	0.001	0.038
IST, Sialkot	7.8	393	31	ND	0.011	0.267
GCT, Sialkot	7.8	295	8.0	ND	0.009	0.019
GCT, Sahiwal	8.1	179	14	ND	0.015	0.009
GCT, Gujranwala	7.8	300	8.0	ND	0.003	0.126
GTTI, Bahawalpur	7.2	2514	357	ND	0.003	0.004
GCT, Bahawalpur	6.5	343	111	ND	0.036	0.411
GCT, Multan	8.0	423	47	ND	ND	0.311
VTI, Multan	8.3	866	84	ND	ND	0.550
CAMI, Khanewal	8.0	1807	208	ND	ND	0.285
GSTC, Murree	8.4	213	12	ND	ND	0.072
GTTIW, Murree	8.4	223	14	ND	ND	0.077
GTTI, Faisalabad	8.0	99	6	ND	ND	0.101
GCT, Faisalabad	8.0	467	47	ND	0.001	0.156
GCTW, Faisalabad	8.0	417	49	ND	ND	0.069
VTI, Rawalpindi	7.6	281	16	ND	ND	0.202
GVTIW, Rawalpindi	8.0	497	37	ND	0.018	0.104
GITT, Sheikhpura	7.9	901	45	ND	ND	0.070

Table 5.4.4: Baseline Ground Water Quality

Aluminum	Antimony	Zinc	Nickel	Manganese	Lead	Parameter
mg /l	mg /l	mg /l	mg /l	mg /l	mg /l	Units
≤ 0.2	≤ 0.005	5	≤ 0.02	≤ 0.5	≤ 0.05	PEQS Permissible Limit
0.2	0.02	3	0.02	0.5	0.01	WHO Standards
0.726	ND	0.056	0.001	0.009	0.001	VTI, Lahore
0.032	ND	0.033	0.002	0.007	ND	GCTW, Lahore
0.117	ND	0.081	0.002	0.009	ND	GCTPP, Lahore
0.11	ND	0.097	0.014	0.066	0.001	IST, Sialkot
0.138	ND	0.078	0.005	0.018	0.001	GCT, Sialkot
0.112	ND	0.084	0.008	0.010	ND	GCT, Sahiwal
0.11	ND	0.204	0.006	0.015	0.002	GCT, Gujranwala
0.108	ND	0.043	ND	0.083	ND	GTTI, Bahawalpur
0.135	ND	0.092	0.002	0.023	ND	GCT, Bahawalpur
0.112	ND	0.057	ND	0.012	ND	GCT, Multan
ND	ND	0.088	0.001	0.016	ND	VTI, Multan
0.029	ND	0.603	0.035	0.066	0.019	CAMI, Khanewal
0.172	ND	0.223	ND	0.007	ND	GSTC, Murree
0.200	ND	0.307	0.005	0.012	ND	GTTIW, Murree
0.076	ND	0.060	0.009	0.010	ND	GTTI, Faisalabad
0.051	ND	0.037	ND	0.009	ND	GCT, Faisalabad
0.058	ND	0.059	ND	0.008	ND	GCTW, Faisalabad
0.218	ND	0.507	0.014	0.056	ND	VTI, Rawalpindi
0.185	ND	0.217	0.003	0.020	ND	GVTIW, Rawalpindi
0.110	ND	0.047	0.005	0.007	0.043	GITT, Sheikhpura

Parameter	Arsenic	Boron	Barium	Mercury	Selenium	E.Coli
Units	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
PEQS Permissible Limit	≤ 0.05	0.3	0.7	≤ 0.001	0.01	Most not be in 100 ml
WHO Standards	0.01	0.3	0.7	≤ 0.01	0.01	Most not be in 100 ml
VTI, Lahore	ND	0.066	0.087	ND	ND	Negative
GCTW, Lahore	ND	0.098	0.172	ND	ND	Negative
GCTPP, Lahore	ND	0.068	0.112	ND	ND	Negative
IST, Sialkot	ND	0.153	0.199	ND	ND	Negative
GCT, Sialkot	ND	0.083	0.202	ND	ND	Negative
GCT, Sahiwal	ND	0.11	0.126	ND	ND	Negative
GCT, Gujranwala	ND	0.074	0.338	ND	ND	Negative
GTTI, Bahawalpur	ND	0.268	0.074	ND	ND	Negative
GCT, Bahawalpur	ND	0.072	0.041	ND	ND	Negative
GCT, Multan	ND	0.171	0.097	ND	ND	2.6 MP N/100 mL
VTI, Multan	ND	0.405	0.121	ND	ND	Negative
CAMI, Khanewal	ND	0.494	0.670	ND	ND	Negative
GSTC, Murree	ND	0.078	0.215	ND	ND	Negative
GTTIW, Murree	ND	0.079	0.231	ND	ND	Negative
GTTI, Faisalabad	ND	0.034	0.286	ND	ND	2.6 MP N/100
GCT, Faisalabad	ND	0.130	0.128	0.281	ND	2.6 MP N/100
GCTW, Faisalabad	ND	0.281	0.114	ND	ND	Negative
VTI, Rawalpindi	ND	0.107	0.215	ND	ND	Negative
GVTIW, Rawalpindi	ND	0.178	0.520	ND	ND	Negative
GITT, Sheikhupura	ND	0.053	0.067	ND	ND	Negative

Odor	Taste	Color	Total Coliform	Fecal Coliform	Parameter
		TCU			Units
Non Objection	Non Objection	≤15		Most not be in 100 ml	PEQS Permissible Limit
Non Objection	Non Objection	≤15		Most not be in 10 ml	WHO Standards
Acceptable	Acceptable	Nil	Negative	Negative	VTI, Lahore
Acceptable	Acceptable	Nil	Negative	Negative	GCTW, Lahore
Acceptable	Acceptable	Nil	Negative	Negative	GCTPP, Lahore
Acceptable	Acceptable	Nil	Negative	Negative	IST, Sialkot
Acceptable	Acceptable	Nil	Negative	Negative	GCT, Sialkot
Acceptable	Acceptable	Nil	Negative	Negative	GCT, Sahiwal
Acceptable	Acceptable	Nil	Negative	Negative	GCT, Gujranwala
Acceptable	Acceptable	Nil	Negative	Negative	GTTI, Bahawalpur
Acceptable	Acceptable	Nil	Negative	Negative	GCT, Bahawalpur
Acceptable	Acceptable	Nil	2.6 MP N/100	4.6 MP N/100	GCT, Multan
Acceptable	Acceptable	Nil	4.6 MP N/100	2.6 MP N/100	VTI, Multan
Acceptable	Acceptable	Nil	Negative	Negative	CAMI, Khanewal
Acceptable	Acceptable	Nil	Negative	Negative	GSTC, Murree
Acceptable	Acceptable	Nil	Negative	Negative	GTTIW, Murree
Acceptable	Acceptable	Nil	2.6 MP N/100	2.6 MP N/100	GTTI, Faisalabad
Acceptable	Acceptable	Nil	2.6 MP N/100	2.6 MP N/100	GCT, Faisalabad
Acceptable	Acceptable	Nil	Negative	Negative	GCTW, Faisalabad
Acceptable	Acceptable	Nil	Negative	Negative	VTI, Rawalpindi
Acceptable	Acceptable	Nil	Negative	Negative	GVTIW, Rawalpindi
Acceptable	Acceptable	Nil	Negative	Negative	GITT, Sheikhpura

Parameter	Turbidity	Total Hardness	Cyanide	Fluoride	Nitrate	Nitrite	Residual Chlorine
Units	NTU	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
PEQS Permissible Limit	≤ 5	<500	≤ 0.05	≤ 1.5	≤ 50	≤ 3	0.2 – 0.5
WHO Standards	≤ 5	<500	0.07	1.5	50	3	0.2 – 0.5
VTI, Lahore	0.41	168	0.01	0.36	0.27	0.01	ND
GCTW, Lahore	0.17	216	0.04	0.17	0.75	ND	ND
GCTPP, Lahore	0.51	12	0.01	0.10	0.37	ND	ND
IST, Sialkot	1.14	228	0.03	0.19	0.25	0.05	ND
GCT, Sialkot	0.55	228	0.05	0.16	0.17	ND	ND
GCT, Sahiwal	0.29	104	0.05	0.41	0.27	ND	ND
GCT, Gujranwala	0.36	228	0.04	0.22	0.27	ND	ND
GTTI, Bahawalpur	0.60	108	0.04	0.41	0.35	ND	ND
GCT, Bahawalpur	0.86	80	0.04	0.08	0.29	0.01	ND
GCT, Multan	2.01	212	0.02	0.08	0.60	0.01	ND
VTI, Multan	0.94	232	0.01	0.17	0.55	ND	ND
CAMI, Khanewal	1.98	636	0.01	0.11	1.28	0.01	ND
GSTC, Murree	0.63	184	0.02	0.15	3.95	0.01	ND
GTTIW, Murree	1.07	188	0.03	0.15	3.88	0.01	ND
GTTI, Faisalabad	0.63	92	0.03	0.15	1.55	0.02	ND
GCT, Faisalabad	0.35	364	0.02	0.54	26.4	0.10	ND
GCTW, Faisalabad	0.42	224	0.02	0.21	2.67	0.01	ND
VTI, Rawalpindi	1.68	188	0.02	0.22	0.32	0.01	ND
GVTIW, Rawalpindi	1.53	444	0.01	0.90	26.31	0.01	ND
GITT, Sheikhpura	0.54	204	0.04	0.49	0.15	0.02	ND

Phenolic Compound	Parameter
mg/l	Units
-	PEQS Permissible Limit
0.002	WHO Standards
ND	VTI, Lahore
ND	GCTW, Lahore
ND	GCTPP, Lahore
ND	IST, Sialkot
ND	GCT, Sialkot
ND	GCT, Sahiwal
ND	GCT, Gujranwala
ND	GTTI, Bahawalpur
ND	GCT, Bahawalpur
ND	GCT, Multan
ND	VTI, Multan
0.01	CAMI, Khanewal
ND	GSTC, Murree
ND	GTTIW, Murree
0.01	GTTI, Faisalabad
ND	GCT, Faisalabad
ND	GCTW, Faisalabad
ND	VTI, Rawalpindi
ND	GVTIW, Rawalpindi
ND	GITT, Sheikhpura

BDL = below detection limit, EC= electric conductivity, NTU = nephelometric turbidity unit; TCU, Total Color Unit; TDS = total dissolved solids, TSS =total suspended solids.

Parameter	Units	PEQS Permissible Limit	Temperature	pH	COD	TDS	Chloride
	°C				m g/l	m g/l	m g/l
VTI, Lahore	34.2		8.4	6-9	20	1474	74
GCTW, Lahore	34.2		7.4		280	786	82
GCTPP, Lahore	35.5		7.7		510	450	60
IST, Sialkot	34		7.9		21	285	6
GCT, Sialkot	32		7.5		103	422	37
GCT, Sahiwal	33		7.3		66	266	23
GCT, Gujranwala	29		7.8		97	316	12
GTTI, Bahawalpur	33		7.6		382	1569	237
GCT, Bahawalpur	33		7.9		197	317	449
GCT, Multan	33		7.1		229	583	66
VTI, Multan	35		7.6		106	1075	190
CAMI, Khanewal	36		7.3		859	1821	39
GSTC, Murree	25		8.5		17	257	10
GTTIW, Murree	23		8.4		34	236	19
GTTI, Faisalabad	33		7.5		1100	2400	684
GCT, Faisalabad	30		7.4		137	575	51
GCTW, Faisalabad	31		8.3		55	3297	682
VTI, Rawalpindi	26		8.4		10	263	16
GVTIW, Rawalpindi	27		8.0		76	256	14
GITT, Shekhupura	30		8.0		65	814	51

Table 5.4.5: Sewerage and Wastewater Monitoring Results

Manganese	Lead	Iron	Copper	Chromium	Cadmium	Parameter
/l	/l	/l	/l	/l	/l	Units
1.5	0.5	8	1	1	0.1	PEQS Permissible Limit
0.0 23	ND	0.1 24	0.0 49	0.0 07	ND	VTI, Lahore
0.4 03	0.0 20	6.2 9	0.0 82	0.0 17	0.0 03	GCTW, Lahore
0.0 89	ND	0.8 36	0.0 68	0.0 09	0.0 01	GCTPP, Lahore
0.0 65	0.0 16	0.6 36	0.0 66	0.0 21	0.0 07	IST, Sialkot
0.0 90	0.0 003	0.5 19	0.0 48	0.0 10	0.0 03	GCT, Sialkot
0.0 95	0.0 05	0.7 79	0.0 53	0.0 19	0.0 03	GCT, Sahiwal
0.0 62	0.0 27	0.2 65	0.0 82	0.0 02	0.0 02	GCT, Gujranwala
0.1 98	ND	1.0 6	0.0 64	0.0 21	0.0 03	GTTI, Bahawalpur
0.1 55	ND	1.4 1	0.0 47	0.0 09	ND	GCT, Bahawalpur
0.1 64	ND	2.5 2	0.1 18	0.0 01	0.0 07	GCT, Multan
0.2 55	ND	1.9 3	0.0 91	ND	0.0 15	VTI, Multan
0.3 18	ND	2.2 7	0.1 03	ND	ND	CAMI, Khanewal
0.0 15	0.0 03	0.1 33	0.0 91	ND	ND	GSTC, Murree
0.2 51	0.0 03	0.1 99	0.1 12	ND	ND	GTTIW, Murree
1.2	0.1 55	58	0.3 38	0.0 98	0.0 08	GTTI, Faisalabad
0.5 85	0.0 12	1.2 5	0.0 89	0.0 02	0.0 01	GCT, Faisalabad
0.1 00	ND	0.2 59	0.0 61	ND	0.0 01	GCTW, Faisalabad
0.0 12	0.0 10	0.0 79	0.1 09	ND	ND	VTI, Rawalpindi
0.1 11	0.0 15	1.6 9	0.1 36	0.0 03	0.0 30	GVTIW, Rawalpindi
0.1 26	0.0 08	0.3 39	0.0 69	ND	0.0 01	GITT, Sheikhpura

Arsenic	Zinc	Silver	Nickel	Selenium	Mercury	Parameter
/1	/1	/1	/1	/1	/1	Units
1	5	1	1	0.5	0.0 1	PEQS Permissible Limit
ND	0.1 29	ND	0.0 13	ND	0.0 03	VTI, Lahore
ND	0.4 62	0.0 04	0.0 17	ND	ND	GCTW, Lahore
ND	0.2 15	ND	0.0 11	ND	ND	GCTPP, Lahore
ND	0.1 01	0.0 03	0.0 06	ND	ND	IST, Sialkot
ND	0.1 07	0.0 03	0.0 10	ND	ND	GCT, Sialkot
ND	0.0 86	0.0 04	0.0 09	ND	ND	GCT, Sahiwal
ND	0.1 26	0.0 05	0.0 10	ND	ND	GCT, Gujranwala
ND	0.1 42	0.0 06	0.0 11	ND	ND	GTTI, Bahawalpur
ND	0.1 14	0.0 05	0.0 12	ND	ND	GCT, Bahawalpur
ND	0.1 46	0.1 85	0.0 04	ND	ND	GCT, Multan
ND	0.1 35	0.0 03	0.0 05	ND	ND	VTI, Multan
ND	0.3 97	0.0 03	0.0 02	ND	ND	CAMI, Khanewal
ND	0.1 13	0.0 03	0.0 04	ND	ND	GSTC, Murree
ND	0.0 71	0.1 88	ND	ND	ND	GTTIW, Murree
ND	0.1 44	0.2 04	0.1 12	ND	ND	GTTI, Faisalabad
ND	0.1 11	0.0 05	0.0 01	ND	ND	GCT, Faisalabad
ND	0.0 66	0.0 04	0.0 04	ND	ND	GCTW, Faisalabad
ND	0.0 72	0.2 21	ND	ND	ND	VTI, Rawalpindi
0.0 9	0.2 01	0.2 30	0.0 04	ND	ND	GVTIW, Rawalpindi
ND	0.0 98	0.0 04	0.0 02	ND	0.2 23	GITT, Sheikhpura

Phenolic	TSS	BOD	Total toxic Metals	Boron	Barium	Parameter
1	1	1	1	1	1	Units
0.1	200	80	2	6	1.5	PEQS Permissible Limit
0.02	15	14.5	0.833	0.638	0.123	VTI, Lahore
0.05	442	98	0.566	0.198	0.225	GCTW, Lahore
0.04	168	364	0.457	0.154	0.214	GCTPP, Lahore
0.03	26	16	1.512	0.259	1.2	IST, Sialkot
0.02	33	48	0.590	0.245	0.271	GCT, Sialkot
0.03	91	20	0.439	0.205	0.141	GCT, Sahiwal
0.04	30	32	0.598	0.181	0.289	GCT, Gujranwala
0.01	115	144	1.478	0.837	0.536	GTTI, Bahawalpur
0.02	100	79	2.0	1.850	0.127	GCT, Bahawalpur
0.02	191	107	1.523	0.261	0.946	GCT, Multan
0.05	108	63	0.731	0.398	0.219	VTI, Multan
0.02	419	379	0.793	0.566	0.119	CAMI, Khanewal
0.05	ND	11	0.505	0.097	0.327	GSTC, Murree
0.03	156	19	0.576	0.093	0.180	GTTIW, Murree
0.01	3476	726	1.635	0.640	0.080	GTTI, Faisalabad
0.01	97	59	0.484	0.205	0.169	GCT, Faisalabad
0.05	7	17	1.018	0.818	1.13	GCTW, Faisalabad
0.01	ND	8	0.747	0.114	0.293	VTI, Rawalpindi
0.01	187	53	1.865	0.130	1.2	GVTIW, Rawalpindi
0.01	ND	24	1.595	0.398	0.89	GITT, Sheikhpura

Sulphide	Sulphate	An-ionic detergent	Cyanide	Fluoride	Grease and Oil	Parameter
/	/	/	/	/	/	Units
1	600	20	1	10	10	PEQS Permissible Limit
0.1	273	0.14	0.07	0.35	0.4	VTI, Lahore
2.2	54	0.57	4.95	0.14	1.6	GCTW, Lahore
2.7	10	0.34	2.35	0.27	2.8	GCTPP, Lahore
0.1	12	0.06	0.03	0.23	4.4	IST, Sialkot
0.2	10	1.8	0.08	0.18	2.4	GCT, Sialkot
ND	25	1.73	0.08	0.44	5.2	GCT, Sahiwal
0.1	2	0.1	0.05	0.27	0.4	GCT, Gujranwala
0.1	491	1.7	0.91	0.53	3.2	GTTI, Bahawalpur
0.1	421	0.19	0.94	0.17	2.4	GCT, Bahawalpur
0.1	104	0.51	0.12	0.26	4	GCT, Multan
0.1	234	0.12	0.12	0.12	2	VTI, Multan
45.1	387	0.05	0.41	0.17	3.2	CAMI, Khanewal
ND	18	0.04	0.03	0.22	1.6	GSTC, Murree
ND	20	0.02	0.42	0.21	1.6	GTTIW, Murree
3.3	516	0.02	3.01	1.28	3.6	GTTI, Faisalabad
ND	35	0.1	3.48	0.64	4	GCT, Faisalabad
ND	842	0.07	1.0	0.52	5.2	GCTW, Faisalabad
ND	20	0.04	1.0	0.21	2.8	VTI, Rawalpindi
ND	20	0.03	1.0	0.22	1.6	GVTIW, Rawalpindi
ND	234	1.35	0.17	1.18	2.4	GITT, Sheikhpura

Parameter	Ammonia	Chlorine	Pesticide
Units	/l	/l	/l
PEQS Permissible Limit	40	1.0	1.5
VTI, Lahore	3.06	ND	ND
GCTW, Lahore	27.6	ND	ND
GCTPP, Lahore	42.3	ND	ND
IST, Sialkot	6.9	0.5	ND
GCT, Sialkot	27.40	ND	ND
GCT, Sahiwal	6.54	ND	ND
GCT, Gujranwala	21.6	ND	ND
GTTI, Bahawalpur	21.41	ND	ND
GCT, Bahawalpur	32.4	ND	ND
GCT, Multan	31.01	ND	ND
VTI, Multan	24.39	ND	ND
CAMI, Khanewal	93.9	ND	ND
GSTC, Murree	2.59	ND	ND
GTTIW, Murree	0.82	ND	ND
GTTI, Faisalabad	2.14	ND	ND
GCT, Faisalabad	16.4	ND	ND
GCTW, Faisalabad	44.9	ND	ND
VTI, Rawalpindi	1.65	ND	ND
GVTIW, Rawalpindi	1.15	ND	ND
GITT, Sheikhpura	17.9	ND	ND

COD: Chemical Oxygen Demand; BOD: Biological Oxygen Demand; TSS: Total Suspended Solids

5.5. Biological Resources

1. Flora

162. In central and southern part of Punjab, the most important urban flora is Kikar (*Acacia arabica*)⁴⁸; Shisham or Tahli (*Delbergia sissoo*)⁴⁸; Beri (*Zizyphus jujube*)⁴⁹; Toot (*Morus alba*)⁴⁸; Phulai (*Acacia modesta*)⁵⁰; Pipal (*Ficus religiosa*); and Bohr (*Ficus bengalensis*)⁵¹, which are planted for shade.



Photo 5.5-1: Shisham Tree



Photo 5.5-2: Beri Tree

163. Some project sites i.e. COEs situated in Southern and Central Punjab (Bahawalpur, Multan, Khanewal, Sahiwal, Lahore, Faisalabad, Sheikhpura, Gujranwala, Sialkot) have ornamental plants and common urban flora in their vicinity. Some common trees found in these 16 COEs are given below:

- (i) Shisham (*Dalbergia sissoo*)⁴⁸;
- (ii) Sufeda (*Euca lyptus camelduleusis*)⁴⁸;
- (iii) Neem (*Azedarachta indica*)⁴⁸;
- (iv) Bakain (*Melia azedarach*)⁵²;
- (v) Sukh Chain (*Pongamia glabra*)⁵³;
- (vi) Mulberry (*Morus alba*)⁵⁴.
- (vii) Bohr (*Ficus bengalensis*)
- (viii) Amaltas (*Cassia fistula*)⁵⁵
- (ix) Peepal (*Ficus relifosa*); and
- (x) Ber (*Ziziphus mauritiana*)



Photo 5.5-3: Kikar Tree



Photo 5.5-4: Bohr Tree



Photo 5.5-5: Bakain Tree



Photo 5.5-6: Neem Tree

164. The following common shrubs were also observed in the abovementioned 16 COEs:

⁴⁸ Government of Punjab, District Bahawalpur. <https://bahawalpur.punjab.gov.pk/agriculture>

⁴⁹ Government of Punjab, District Lodhran. <https://lodhran.punjab.gov.pk/agriculture>

⁵⁰ Government of Punjab, District Gujrat. <https://gujrat.punjab.gov.pk/agriculture>

⁵¹ CABI. Invasive Species Compendium. <https://www.cabi.org/isc/datasheet/24066>

⁵² CABI. Invasive Species Compendium. <https://www.cabi.org/isc/datasheet/33144>

⁵³ Afforestation Lahore. <https://afforestationlahore.com/2019/07/10/indian-beach-tree/>

⁵⁴ Pakistan Explorer. Home of world's sweetest Mulberries. <https://www.pakistan-explorer.com/2012/04/28/home-of-worlds-sweetest-mulberries/>

⁵⁵ Pakistan Today. Ode to the Amaltas. <https://archive.pakistantoday.com.pk/2018/06/19/ode-to-the-amaltas/>

- (i) Hibiscus (*Hibiscus rosa-sinensis*);
- (ii) Kaneer (*Cascabela thevetia*);
- (iii) Chandna (*Santalaceae*);
- (iv) Chandni (*Tabernaemontana divaricate*);
- (v) Gul e fanoos (*Lagerstroemia speciose*); and
- (vi) Gul e chain (*Plumeria pudica*)



Photo 5.5-7: Mulberry Tree



Photo 5.5-8: Sukh Chain Tree⁵³

165. The grass species found at COEs in southern and central Punjab are given below:

- (i) Dhaka grass (*Zoysia Matrella*); and
- (ii) Fine Dhaka grass (*Zoysia matrella*)



Photo 5.5-9: Toot Tree



Photo 5.5-10: Safaida Tree

166. The upper Punjab has been a part of the ecological zone called thorn forest but with the introduction of extensive irrigation network of canals for development of agriculture, industrial development and urbanization have changed its biological features. Most of the part of the upper Punjab is now agriculture zone with human related or human dependent flora. Common urban flora in upper Punjab is: Olive (*Olea europaea*)⁵⁶, Loquat (*Eriobotrya japonica*)⁵⁷, Pinus/Pine (*Pinus L.*)⁵⁸, Bottle Brush (*Callistemon citrinus*)⁵⁹, Gul e Nishter (*Erythrina*)⁶⁰ and Willow (*Salix babylonica*). There are no trees in



Photo 5.5-11: Amaltas Tree



Photo 5.5-12: Olive Tree

vicinity of two COEs in Rawalpindi. **The tree species found in the boundary of two COEs in MurreePinus/Pine (*Pinus L.*). (Fig 5.5-20).** Fruit trees are only available in surroundings of COEs i.e., orchards of Citrus, Guava⁶¹ and Mango fruits⁶², Dates⁶³, Pomegranate⁶⁴ and Bananas etc. None of the fruit tree is available within COEs boundaries.

⁵⁶ Tribune. 11m wild Olive trees in Bajaur <https://tribune.com.pk/story/2284158/11m-wild-olive-trees-in-bajaur>

⁵⁷ Bakhabarkissan. Loquat Production Technology. <https://bakhabarkissan.com/loquat/>

⁵⁸ UN Environment Programme. In Pakistan, a once-threatened pine tree is staging a comeback. <https://www.unep.org/news-and-stories/story/pakistan-once-threatened-pine-tree-staging-comeback>

⁵⁹ Dawn. Burst of Color. <https://www.dawn.com/news/1144095>

⁶⁰ Twitter. Raza Ahmad Rumi. <https://twitter.com/razarumi/status/587133875756892160>

⁶¹ Agriinfobank. Salient Features of Guava Cultivatio. <https://agrinfobank.com.pk/salient-features-of-guava-cultivation/>

⁶² Dawn. Mango Galore. <https://www.dawn.com/news/1504233>

⁶³ Dawn. Dynamics of Date Farming in Khairpur. <https://www.dawn.com/news/1354359>

⁶⁴ Pomegranate Tree. <https://plant.pk/product/pomegranate-tree/>



Photo 5.5-13: Lauqat Tree



Photo 5.5-14: Date Tree⁵³



Photo 5.5-15: Bottle Brush Tree⁵³



Photo 5.5-16: Mango Tree



Photo 5.5-17: Pomegranate Tree



Photo 5.5-18: Gule Nishtar Tree⁵³



Photo 5.5-19: Gauva Tree



Photo 5.5-20: Pine Trees

167. About 150 number of trees including Sukh Chain (08), Safaida (25), Sohanjna (07), Sheesham (28), Neem (15), Shahtoot (18) and Pine (49), may be impacted due to construction activities at all COE centers.

2. Fauna

168. The Punjab, Pakistan is blessed with diversified topographic conditions. These conditions have given rise to beautiful and wonderful wildlife. Punjab has various national parks and game reserves. The Map shows the distribution of national parks in all the districts of Punjab.

169. In Punjab except Murree, the common urban fauna in or around all COEs is as follows: Porcupine (*Hystrix indica*)⁶⁵, Squirrel with strips (*Funambulus pennant*)⁶⁶, Mouse (*Mus musculus*)⁶⁷, Rabbit (*Oryctolagus cuniculus*)⁶⁸, Black Buck (*Antelope cervicapra*), Common House Lizard (*Geko geko*)⁶⁹, Indian Krait (*Bungarus caeruleus*)⁷⁰, Common Toad (*Rana Tigrina*)⁷¹, Spider (*Stegodyphus sarasinorum*)⁷² etc. Domestic animals of significance include cows/ bulls⁷³, buffaloes, goats⁷⁴, donkeys and sheep. Stray cats and dogs were also found in or around the COEs.

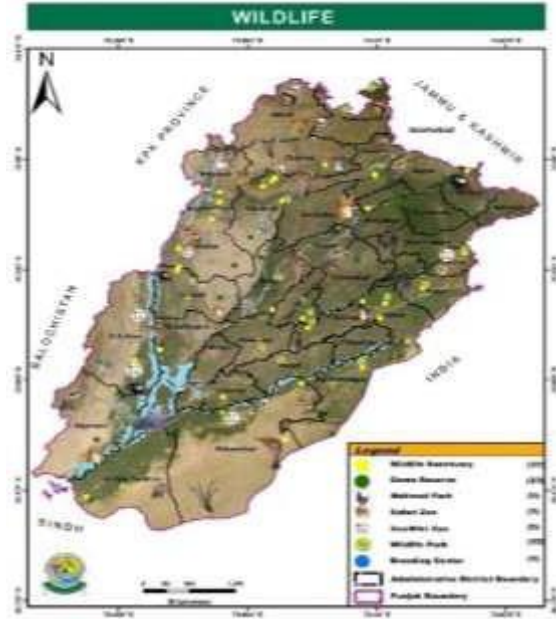


Figure 5.5.8: Wildlife Map of Pakistan



Photo 5.5-21: Common Lizard



Photo 5.5-22: Indian Krait⁵³



Photo 5.5-23: Spider⁵³

⁶⁵ Tribune. 2022. Man arrested for hunting porcupine in Swabi. <https://tribune.com.pk/story/2336761/man-arrested-for-hunting-porcupine-in-swabi>

⁶⁶ WWF Pakistan

⁶⁷ Pets Pakistan. <https://www.petspakistan.com/pets/detail/3010/laboratory-mice-cat-islamabad>

⁶⁸ Government of Punjab. District Bahawalpur. <https://bahawalpur.punjab.gov.pk/agriculture>

⁶⁹ Dawn. No Lizards, No Cry. <https://www.dawn.com/news/1218096>

⁷⁰ <http://www.wildlifeofpakistan.com/ReptilesOfPakistan/krait.htm>

⁷¹ <http://www.wildlifeofpakistan.com/AmphibiansofPakistan/indusvalleybullfrog.htm>

⁷² Dawn. Wildfire: Spider Feak Out. <https://www.dawn.com/news/1093115>

⁷³ <https://www.dawn.com/news/1633930>

⁷⁴ Dawn. Gujrati Beetal Goat, an Untapped Source of Poverty Alleviation. <https://www.dawn.com/news/1583657>



Photo 5.5-24: Toad



Photo 5.5-25: Monkey



Photo 5.5-26: Rabbit⁵³



Photo 5.5-27: Mouse



Photo 5.5-28: Squirrel with Stripes



Photo 5.5-29: Porcupine



Photo 5.5-30: Cow



Photo 5.5-31: Wolf



Photo 5.5-32: Fox

170. In Murree, apart from common urban fauna, the following fauna can also be found:

- (i) Wild Boar (*Sus scrofa*)⁷⁵
- (ii) Rhesus Monkey (*Macaca mulatta*)
- (iii) Jackals (*Canis aureus*)
- (iv) Foxes (SSP. *Vulpes*)⁷⁶

⁷⁵ Dawn. Due to Ban on Hunting, Wild Boars Rampant in Islamabad. <https://www.dawn.com/news/1050711>

⁷⁶ Government of Punjab, District Gujrat. <https://gujrat.punjab.gov.pk/agriculture>

171. The common urban avifauna in vicinity or surroundings of COEs is: Shikra (*Psittacula krameri*)⁷⁷, Crow (⁷⁸), Common kite (*Milvus migrans*)⁷⁷, Sparrow⁷⁹, Pigeons (*Columba livia*)⁸⁰, Dove (*Streptopelia*)⁸¹ SSP.)⁸¹, Parrot (*Psittacula krameri*)⁸², Mynah (*Acridotheres tristis*)⁸³ whereas Cheer Pheasant⁸⁴ and Kalij pheasant are common in Murree. There are no migratory birds reported in or around the COEs. There is no endangered species reported in the project area by the Wildlife Department of Punjab.

172. Since the COEs are located in urban areas therefore no critically endangered and/or endangered species are likely to be present.



Photo 5.5-33: Shikra



Photo 5.5-34: Parrot



Photo 5.5-35: Crow



Photo 5.5-36: Sparrow



Photo 5.5-37: Pheasant



Photo 5.5-38: Pigeon

⁷⁷ Bhatti et al. 2019. Vultures and Kites from Marala Wetlands *J Biores Manag.* 6 (4): 19-23.

⁷⁸ Tribune. How not to Kill a Crow. <https://tribune.com.pk/article/11177/how-not-to-kill-a-crow?amp=1>

⁷⁹ WWF Pakistan. Rise for the Sparrows.

https://www.wwfpak.org/knowledge_hub/natura/natura_june2/rise_for_the_sparrows/

⁸⁰ Dawn. Where Dreams Take Flight: Pakistan's Pigeon Racers. <https://www.dawn.com/news/1270546>

⁸¹ <https://birdspoint.pk/item/red-dove-n-pathe/>

⁸² Dawn. Talking Birds. <https://www.dawn.com/news/1278612>

⁸³ Dawn. Talking Birds. <https://www.dawn.com/news/1278612>

⁸⁴ Dawn. Pakistan's Dhodial Pheasantry: A Happy Tale of Conservation. <https://www.dawn.com/news/1557022>

3. Fisheries

173. Fishery sector is moderate on account of precious fertile land for agriculture production. Dependency of local people on fish as economic activity is limited, because of the non-existence of large fish farms in the area. The fish that is commonly found in Punjab is as follows: Wild Tilapia (*Oreochromis*



Photo 5.5-39: Rohu Fish



Photo 5.5-40: Thaila Fish⁵³

niloticus), Thaila (*Catla Catla*)⁸⁵, Mori (*Rhizoprionodon acutus*), Rahu (*Labeo rohita*)⁸⁶

4. Agriculture

174. Agriculture is the main source of income of the inhabitants of Punjab. Due to the most sophisticated canal irrigation system and supporting ecological and climate characteristics, this area has a good potential for producing almost all kinds of food commodities. The area has a diverse cropping pattern because of its heterogeneity in agro-climatic conditions.

175. Main Crops: Sugarcane, wheat, rice, maize and cotton are the main crops grown in the area. Besides guar seed, bajra, moong, mash, masoor, jawar, oil seeds are also grown in minor quantities in Sahiwal area. Average yield of important crops in study is given as under:

Table 5.5.1: Average Yield of Agricultural Crops⁸⁷

Sr. No.	Crop Name	Average Yield / Acre (kg)
1	Cotton	1000
2	Sugarcane	20600
3	Maize (Spring)	3400
4	Maize (Autumn)	2800
5	Rice	800
6	Wheat	1400
7	Potato	9600

⁸⁵ Department of Fisheries Punjab. <http://punjabfisheries.gov.pk/culturable/fishtypes.html>

⁸⁶ Department of Fisheries Punjab. <http://punjabfisheries.gov.pk/culturable/fishtypes.html>

⁸⁷ Saaf Consult B.V. Netherlnds Dev-Consult Pakistan; NEC Consultants Private Limited Pakistan; and M J Edge. 2017. *Environmental impact assessment. PAK: Punjab Intermediate Cities Improvement Investment Project Sahiwal City* (prepared for ADB).

176. Fruits: Citrus, guavas, dates and mangoes are the main fruits grown in the district. Besides, pomegranate, litchi, falsa and banana are also raised on minor scale.

177. Vegetables: Potatoes, onion, cauliflower, carrot, tomato and turnip are main vegetables grown in the area. Besides, peas, garlic, chilies and lady finger are grown on smaller scale.

5.6. Protected Areas/National Sanctuaries

178. In Punjab, there are several areas of land devoted to preservation of biodiversity through dedication of national parks and wildlife sanctuaries. Murree/Kahota/Kotli Satian has been declared as National Park notified by Forestry, Wildlife & Fisheries Department.⁸⁸ In this context, EIA has been conducted in compliance with IEE/EIA Regulation, 2022 Schedule II (I).

179. There is a protected forest at Lal Suhanra about 150 km north (to Multan) and that is nearest to the COE in Bahawalpur. There are also planted trees along canals and roads. The major trees grown in the forest are Shisham (*Dalberia sisso*), Kikar (*Acacia arbica*) and Eucalyptus. The national park provides excellent feeding, breeding and resting habitats to numerous migratory as well as

resident birds. The national park is located on one of the major bird migration routes of the world. It lies at a distance of 58 km from the COE in Bahawalpur, so no impact is envisaged.

1. Wetlands and Aquatic Biology

180. The nearest Wetland is Chenab River which is at a distance of 30 km from COE in Multan, so no impact on it is expected.

2. Game Reserves & Wildlife Sanctuaries

181. No game reserves and wildlife sanctuaries exist in the vicinity of project area even up to 5 km distance.

5.7. Socioeconomic Resources

182. Punjab has a rich culture and tradition and very strong history of political and administrative Settings. Major Settlements in Punjab are historical buildings, forts, shrines, mosques, monuments and irrigation canals network. Language is Punjabi, Saraiki, Urdu and Potohari. Religion is mainly Islam and ethnicity is brown. Some other socio-economic settings i.e. income and lifestyle are given below:



Figure 5.5.9: Forest Map of Punjab⁸⁸

⁸⁸ https://fwf.punjab.gov.pk/system/files/Forest_0.jpg#overlay-context=all_locality_maps

1. Agriculture and Livestock

183. Agriculture is by far the main economic activity in the project area. The main crops, during Rabi, are wheat, gram, rapeseed, mustard, barley and oil seeds. During Kharif, crops include cotton, jawar, sugarcane, bajra, maize, and rice. In addition, there are subsidiary crops known as Zaid Rabi, such as Kharbooza, tobacco and potatoes, and Zaid Kharif crops, such as potatoes and chilies. The main fruits grown are oranges, mangoes, watermelon, muskmelon, guava, citrus, falsa, jaman, and pomegranate. When cultivation began, the inhabitants are pilu and bair, the only wild fruits that grows, intermittently, in the region. With the introduction of canal irrigation, other fruits are now being grown on a commercial basis. However, wheat, cotton, sugarcane and rice remain the major crops.

184. The vegetables are grown in abundance, as the water and soil are suitable for cultivation. Crops include potatoes, carrots, ladyfingers, chilies, onions and cauliflower. Bitter gourd, turmeric and garlic are also grown to meet public demand. Other vegetables include radish, tinda (apple gourd), and bringal.

185. Livestock breeding is one of the main pursuits and means of livelihood among the rural and urban population in the project site. Common livestock are sheep, goats and cows, which serve as an important source of income.

2. Power Supplies

186. Interruptions are frequent, forcing industries, other businesses, and many of the residents who can afford it to rely on back-up diesel generators and Uninterrupted Power Supply systems. These are costly, environmentally degrading and generally a poor second option. Power generation and primary distribution are generally beyond a single urban center's capacity, so it is necessary to rely on provincial and national government support. Any city with reliable power enjoys an immediate competitive advantage. Solar options for institutional and residential use are increasing in popularity, but the technology has not reached the stage where it can provide the major energy source for heavier industry.

3. Industrial Activity

187. Punjab has a lot of industrial activity ranging from large scale to small and medium scale enterprises. Almost all major industries including textile, sugar, hydro and thermal power, food sector, plastic, tannery, sports, ceramics, construction, automobiles, cars, paints, steel, cement, industries are available in Punjab.

4. Water Supply Service

188. WASA supplies water in urban areas and ground water tube wells and domestic pumps are installed in abundance. Water supply is done through different types of materials, including PVC, MS, and duct Iron pipes.

5. Sewerage System Service

189. The sewerage and drainage system exists in most of the urban areas but is inefficient. In villages, septic tanks and ponds are available. Municipal wastewater is being used for irrigation purposes, according to farmers' demand, and the remaining wastewater is disposed of into rivers through drains and nullahs.

6. Solid Waste Management

190. The solid waste is done at Tehsil/District level by city administration. In metro cities, large infrastructure companies are involved in collection and transfer of solid waste.

7. Economic Settings

191. Most of the people are from farmers/agriculturists background, however, many humans are engaged in construction and other industrial sector. People are mostly daily wagers except few landlords, industry and business owners.

8. Employment and Unemployment

192. The labor force participation is the highest either in construction or agro-related, followed by industry. Service workers, in shops and market sales workers come at third, business personnel at fourth and then unskilled workers at fifth with 6th rank of high professionals. Main source of formal employment is factories, of varying size, and its capacities. The IWRPP would target the increase in number of skilled workforce and hence making them available for the local and foreign industry.

5.8. Project Sensitive Receptors

193. The project activities will be carried out within the premises of COEs which are educational institutes. Most of the COEs have residential areas in the nearby vicinity, whereas some of the COE's have other sensitive receptors like educations institutes, hospitals, etc. There would be some anticipated harmful impacts (e.g high level of noise, excessive dust emissions and other disturbances during working hours) on the nearby residential areas. These impacts have to be mitigated with implementation of effective mitigation measures proposed in EMP.

6. Climate Change Assessment

194. This section provides an overview of the climate change condition of the Punjab province and its impact on the project.

6.1. Climatic Regions of Pakistan

195. Pakistan has four climatic seasons comprising of the monsoon seasons which starts in the month of June and stays till September. In this season Pakistan receives 50-60% of the total rainfall in a year. The second season is winter which starts in December and ends in March. The total rainfall in the country during the winters is 30%. The third and fourth seasons are pre (April-may) and post (October- November) monsoon seasons which accounts for 12% and 4% of the total rain, respectively. According to the seasons and the physiography of the country, it is divided into eight (8) climatic zones/regions, given below and as shown in Fig.6.1

1. Zone I(a): Greater Himalayas (winter dominated)
2. Zone I(b): Sub montane region and monsoon dominated
3. Zone II: Western Highlands
4. Zone III: Southern and central Punjab
5. Zone IV: Lower Indus Plains
6. Zone V (a): Baluchistan Plateau (Northern) (Suleiman and Kirthar range)
7. Zone V(b): Baluchistan Plateau (Western)
8. Zone VI: Coastal belt



Figure 6.1: Climatic Zones of Pakistan⁸⁹

196. The Punjab province comprises of the Zone-III region

which is central and southern Punjab. However, Murree, Rawalpindi, Jhelum, Sialkot, and Lahore districts are present in zone 1(b) sub montane regions.⁸⁹

6.2. Climate Change in Pakistan

197. Pakistan is in the temperate zone and its climate varies with topography. Near the coast and the lowland plains of Indus River, the climate is usually dry and hot. Whereas in the Northern parts of the country, climates become cooler. Pakistan experiences four seasons 1) a cool, dry winter from December to February; 2) a hot, dry spring from March through May; 3) the summer rainy season, also known as the southwest monsoon period, occurring from June to September; and 4) the retreating monsoons from October to November. The country in general experiences

⁸⁹ M. Sheikh et al. 2009. *Climate Profile and Past Climate Changes in Pakistan, GCISC-RR01, Global Change Impact Studies Centre (GCISC)*. Islamabad

less rainfall except in the northern areas. The northern areas can experience more than 200-millimeter (mm) rain during the monsoon seasons.

198. Pakistan is one of the most prone countries to climate change. In the past century (1901-2000), Pakistan observed a warming trend in the average annual temperature of about 0.57°C. However, this trend was less than the average trend of 0.75°C increase in the south Asian region. The long-term trend of Pakistan from 1961-2007 is in accordance with the south Asian region, with a rise in the annual temperature by 0.47°C. 2004 was the warmest year until 2007. The highest increase is observed during the winter seasons which shows that the winter season is decreasing over Pakistan. The maximum and minimum annual temperatures from 1960-2007 have increased by 0.87°C and 0.48°C, respectively. Alongside, the increase in temperature, the solar radiations have also increased by 0.5%-0.7%. The northern areas of Pakistan have experienced an increase water imbalance due to the high spatial and temporal precipitation variations in the region.

199. Since 1960, according to the Asian Development Bank, the hot days in Pakistan have increased by 20 days and the hot nights have also increase by 23 days⁹⁰ On the contrary, the cold nights have decreased by 9.7 days.⁹¹ The past temperature trends show an increase in the mean average temperatures of Pakistan. According to the Pakistan meteorological department (1960-2007), the kpk region experience an increase of 0.12°C in the mean annual temperature. The graph below shows the Pakistan annual climate cycle (1991-2020) ⁹¹

1. Temperature

200. During the 20th century, 0.57°C warming was estimated in Pakistan. This figure, however, is below the average which was estimated for the South Asian region (0.75°C). Between 1961-2007, 0.47°C warming was measured in Pakistan, which shows an increasing trend in the temperatures. The warming is more during the winters and post monsoon months which are from November- February⁹¹

201. In Punjab alone, during 1960-2007, Punjab experienced an increase in the mean average temperatures during the winters and summers as well as the annual temperatures with an increase of 0.97, 0.22 and 0.54°C, respectively⁹⁰

202. The graph below shows the temperature variation from 2000-2018. From it is obvious that there is an increase in mean annual temperature in the Punjab regions during the time period. ⁹²

⁹⁰ ADB. 2017. *Climate Change of Pakistan*. Manila.

<https://www.adb.org/sites/default/files/publication/357876/climate-change-profile-pakistan.pdf>

⁹¹ ADB. 2017. *Climate Change of Pakistan*. Manila.

<https://www.adb.org/sites/default/files/publication/357876/climate-change-profile-pakistan.pdf>

⁹² J. Han et al. 2019. Dairy Production under Climatic Risks: Perception, Perceived Impacts and Adaptations in Punjab, Pakistan. *International Journal of Environmental Research and Public Health*. 16 (20).

https://www.researchgate.net/publication/336768896_Dairy_Production_under_Climatic_Risks_Perception_Perceived_Impacts_and_Adaptations_in_Punjab_Pakistan

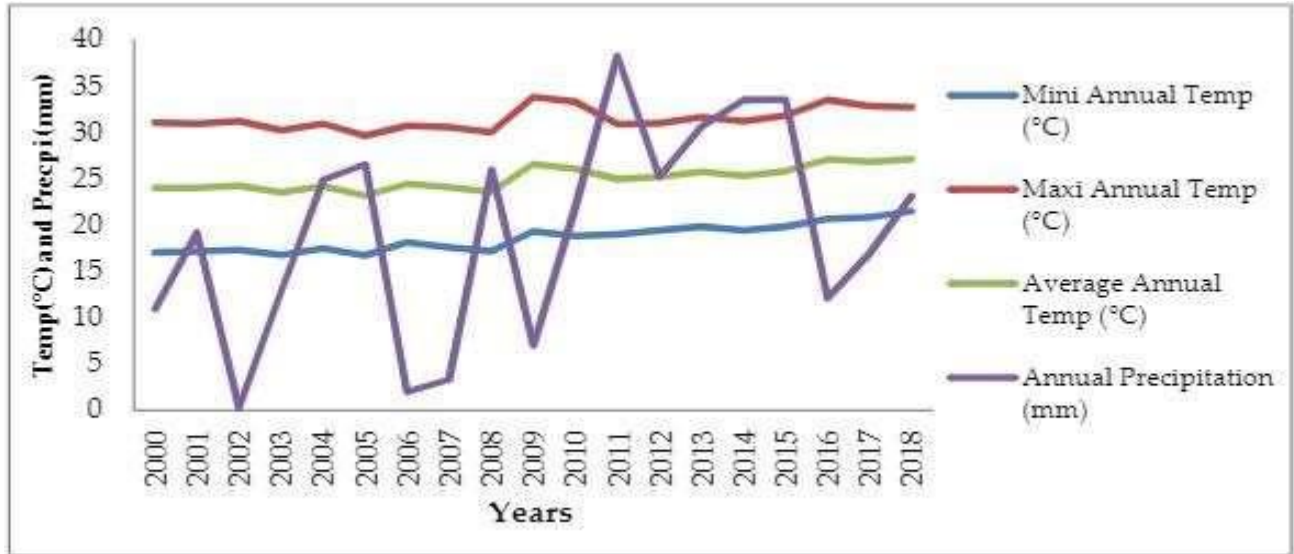


Figure 6.2-1 Temperature and precipitation trend in Punjab⁹²

2. Precipitation

203. Pakistan's precipitation history is not linear. During the 20th century a decline was seen in the annual rainfall in the country. However, an increasing trend is shown since 1960. In the arid plains and coastal belts, a mean decrease in the annual rainfall by 10-15% has been experienced. This has costed Pakistan degradation of important wetlands and mangrove ecosystems. All the other regions have experienced an increase in the precipitation patterns both during the monsoon and dry seasons. Since 1960s, the heavy rainfall events have increases and in 2010, nine of the heaviest rains occurred within the 24 hours.

204. During the early 1900s to 1940 the rainfall decreased from 600mm to 400mm was experienced. However, after 1940, 133mm increase was experienced in rainfall. 61mm precipitation was increased in the country from 1901 to 2007. The monsoon and winter precipitation also increased by 22.6 and 20.8 mm.

205. Regionally, the central and southern Punjab shows an overall increasing trend with an increase in annual precipitation by 0.63%, and the monsoon precipitation (June-September) increased by 0.57% and the winter precipitation (December- March) showed the most increase by 0.99%. The sun montane zone (I b) follows the same increasing trend with the increase in annual, monsoon and winter by 0.3%,0.38% and 0.53% respectively⁹³

206. The analysis of the total annual rainfall in each district of Punjab during the year 2009-2019, reflects that the total amount of rainfall showed an increasing trend till 2019 which was the wettest year. The year 2016 and 2017 were dry years. During these years, 25 out of the total 27 districts of Punjab received rain less than 125mm. On the other hand, during 2019, None of the districts in Punjab received rain less than 125 mm. The lowest rain received during 2019 was 180.9mm in Rajanpur district.⁹⁴

⁹³ ADB and World Bank. 2021. *Climate Risk Country Profile: Pakistan*. https://climateknowledgeportal.worldbank.org/sites/default/files/2021-05/15078-WB_Pakistan%20Country%20Profile-WEB.pdf

⁹⁴ Saqib and Gill.2019. *Pakistan Geographical Review*, Vol.74 (2), 74-89.

6.3. Future Projections of Climate:

1. Temperature:

207. The Representative Concentration pathways shows four possible scenarios based on the emissions of greenhouse gasses at global level. The RCP 2.6 represent the low emission pathway. To achieve this scenario rapid reduction strategies would be required to implemented. Whereas the RCP 8.5 scenario is the business-as-usual scenario where the emissions will increase throw-out the 21st century. ⁹¹

208. The projected increase in temperature in Pakistan is higher than the global projections. Under the highest emission scenario, globally an increase of 3.7°C is projected during 2080-2100. While for Pakistan the projected increase is 5.3°C. This is an alarming situation for Pakistan and rapid measures would be required to combat such high temperatures.

2. Precipitation:

209. The projections for precipitation in Pakistan are not certain. However, changes are expected to vary across Pakistan sub regions. Studies project that southern Punjab will experience a decrease in precipitation during the months January to April and increases over may to December. ⁹¹

6.4. Punjab Zonal Distribution:

210. According to Pakistan Agriculture Research Council, Punjab is divided into four Agro-ecological zones based on water availability to the land. ⁹⁵

Table 6.1: Agro-ecological Zones of Pakistan⁹⁵

Zone	Description of Land	Major districts
A	Irrigated Plains: Cotton zone, Central mixed zone, Rice Zone	Rajanpur, Rahimyar Khan, Bawalnagar, Lahore, Sheikhpura, Gujranwala, Kasur
B	Barani Region: High rainfall, low rainfall	Rawalpindi, Attock, Chakwal
C	Irrigated zone, arid zone	Layyah, Bhakkar, Mianwali, Khushab
D	Suleiman Mnts, Rud-I-Kohi, Cholistan	Dera Ghazi Khan, Bahawalpur, Rahimyar Khan

211. Climate change impacts vary with topography, usual weather patterns and land use. Each zone will have different intensity of impacts depending on these properties and unique land cover such as Zone A, irrigated plains; Zone B, barani region; Zone C, Thal region; and Zone D, marginal land.

⁹⁵ Punjab Climate Change Policy (Internal Draft).

https://epd.punjab.gov.pk/system/files/PCCP%20Draft%20%28internat%29_0.pdf

6.5. Climate Change Impacts:

1. Floods

212. Over the past few years, floods are a recurring phenomenon in the different parts of Punjab due to various reasons. The 2010 super floods are one of the deadliest floods in the country. It affected a wide area of the Punjab province. After two years of super flood, in 2012. The hill torrents which occur in southwestern mountain ranges of Punjab and heavy rainfall submerged parts of southern Punjab in flood water. A year later, monsoon rainfall caused a flash flood and affected the central Punjab. The weather extremes are not alone responsible for the disasters, many other key factors are responsible for it. The map below shows the most flood vulnerable districts of Punjab.⁹⁵

213. According to the map, many of Punjab's districts are prone to flooding. Many parts of zone D and C and few parts of zone A are vulnerable to flooding due to hill torrents and riverine floods. Due to poor drainage system, the eastern parts of zone A are prone to urban flooding.

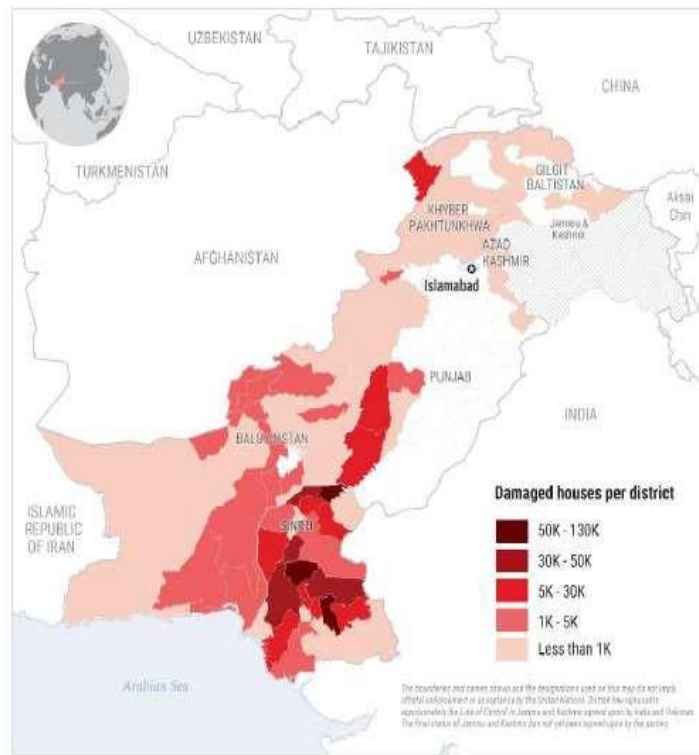


Figure 6.5-2: Flood Vulnerable districts of Punjab⁹⁵

2. Droughts:

214. According to the IPCC annual report of 2014, droughts in the Asian region will increase and the water and food shortage problems will also increase due to droughts. The arid to semi-arid areas of Punjab are most susceptible to droughts.

215. In Punjab province, the summers are long and hot which causes drought conditions. The southern parts of Punjab are most vulnerable to droughts. These parts include lower parts of zone A and marginal lands of zone D. For their livelihood, the people in these zones are dependent on cotton and wheat cultivation and the grazing of livestock. Droughts impacts their sources of livelihood negatively because of many reasons such as: death of livestock, decrease in crop yield, lower water tables thus limiting the access to clean ground water. Because of Climate change, Punjab is becoming more susceptible to droughts. During the years 1951-2010, Punjab province experiences 22 drought events. Out of which the droughts of 1969,1987-88, 2000-01 were the worst droughts in the history of province.⁹⁶

⁹⁶ Pakistan Meteorological Department. 2021. *Drought Bulletin of Pakistan*. July-September. <https://ndmc.pmd.gov.pk/new/assets/bulletins/1634554283.pdf>

6.6. Impacts of Climate Change on Project:

216. The increase in temperature will result in hotter and longer summers whereas the winters will become shorter and milder. This will have a significant impact on the cropping patterns. Agriculture is the livelihood of many residents of Punjab province. This will impact the living conditions of the people. The students will not be able to pay for the fees. This will disrupt the financial situations of the educational institutes. The change in the crop patterns will also cause malnutrition and the impacts of the people residing in Punjab. It will increase the medical costs of the families and thus negatively impact the project.

217. The temperature increase will also increase the events of heat waves in the lower parts of Punjab. Lahore is one of the most vulnerable cities of Pakistan due to heatwave. Currently, the probability of a heatwave occurring in any area of Pakistan is 3%. Heatwaves can cause health problems, and this was demonstrated in the 2015 heat wave in Pakistan as more than 65000 people were hospitalized because of heat strokes. A study estimated that Pakistan experienced 126 heat waves during the period of 1997-2015, around 7 per year. The study also suggests that the occurrence of heatwaves will increase significantly due to high temperatures paired with varying weather patterns.⁹⁷ The heat waves will impact the health of the students and the staff of the educational institutes.

218. The heat waves will increase the cost and demand of building cooling. The building's structures are also susceptible to higher temperatures as the materials can deteriorate during the high temperatures. It will also increase the demand for clean drinking water. It will increase the pressure on ground water table and more filtrations plants will be required to meet the demands for water. This will increase the cost of the project.

219. The high temperatures will also result in more severe monsoon rains as the evapotranspiration rate will be higher. This will cause flooding downstream in lower parts of Zone A and major parts of Zone C and D. Flooding will affect the building structures as well as the infrastructure of the areas. Thus, causing problems of commute for all the people.

220. Flooding also results in the outbreak of many waters and vector borne diseases such as gastroenteritis, diarrhea, and malaria. According to the World Health Organization, since November 2021, Punjab province have the highest reported cases of dengue fever in the country. 49.4% and 69.4% of cases reported and deaths respectively were from the Punjab province.⁹⁸ These such high rates of the diseases can significantly impact the staff and the students thus rendering the trainings efficiencies.

⁹⁷ W. Nasim, et al. 2018. Future risk assessment by estimating historical heat wave trends with projected heat accumulation using SimCLIM climate model in Pakistan. *Atmospheric Research*: 205: 118–133.
<https://ui.adsabs.harvard.edu/abs/2018AtmRe.205..118N/abstract>

⁹⁸ WHO. 2021. Dengue fever – Pakistan <https://www.who.int/emergencies/disease-outbreak-news/item/dengue-fever-pakistan>

7. POTENTIAL ENVIRONMENTAL IMPACTS & MITIGATION MEASURES

221. The potential impacts associated with the construction and rehabilitation works on 19 COEs are assessed in this Chapter and appropriate mitigation measures proposed. The impacts have been identified using ADB's Rapid Environmental Assessment (Appendix-6), expert's knowledge and experience. Rapid Environmental Assessment was carried out using predesigned questionnaire of ADB for REA. The questionnaire relies on the open-ended basic questions about physical, ecological and socioeconomic environment of the project and also concerns/suggestions by the concerned persons of CEO. Therefore, RAE appears to be reliable tool for quick environmental assessment of individual CEO. A team of environmental experts, graduates in environmental sciences were selected for data collection through questionnaire and consultation with CEO staff. Prior to data collection, the graduates were properly trained on the process of data collection and consultation. The impacts identified were assessed for their significance keeping in view their consequences, reversibility, likelihood, duration, location, timing etc. The evaluation of the environmental & social impacts has been summarized as below.

7.1. Impact Assessment Process

222. The project activities are comprised of construction (both renovation and new civil work) at 19 COEs and procurement, installation and operation of equipment. The location and scale of the works are very important in predicting the environmental impacts. This process of impact prediction is the core of the EIA process and it is critical that the recommendations and mitigation measures are carried out with reference to the conditions on the ground in the affected areas in the spirit of the environmental assessment process. In this section the potential environmental impacts are reviewed through ERA and secondary sources. Where impacts are significant enough to exceed acceptable environmental standards, mitigation is proposed in order to reduce residual impact to acceptable levels and achieve the expected outcomes of the project being implemented. Therefore, it is essential that a proper analysis is carried out during the project planning period. In this regard, the impact prediction plays a vital role as these predictions are used for developing mitigation measures and any alternative options, if appropriate. When the detailed designs are completed and if major design changes are found than the impacts and mitigation measures will need to be further reviewed.

7.2. Notion of Significance

223. The term "Environmental Impact" or simply "Impact" covers the negative, adverse or harmful as well as positive, desirable or beneficial impacts of the project on environmental settings. Prediction of impacts of the proposed activity is based on factual data; however, the significance of these impacts involves a value judgment technique. The nature of the impacts may be categorized in terms of:

- (i) Direction - Positive or Negative
- (ii) Duration - Long or Short Term
- (iii) Effect - Direct or Indirect
- (iv) Extent - Wide or Local

224. Impact significance depends on both the nature of the impact and on the sensitivity of the receptor. The more sensitive the receptor the greater will be the significance of impact from that proposed activity. For this EIA, activities and nature of impact are combined with the sensitivity of the receptor to evaluate the significance of the impact. The significance of impact is characterized as very low, low, moderate, high and very high. Environmental issues having "moderate", "high" and "very high" significance is provided with mitigation measures.

1. Methodology for Impact Evaluation

225. The methodology adopted for the evaluation of the impacts included the assessment tool of project impact evaluation matrix. This tool was used to identify the significance and magnitude of the impact as well as the nature, reversibility, extent etc.

2. Project Impact Evaluation Matrix

226. The Impact Evaluation Matrix was developed by placing project activities along one axis (i.e. Y-axis), and on the other axis (i.e. X-axis) the different environmental parameters likely to be affected by the proposed Project actions grouped into categories i.e. physical, ecological and socio-economic environment. For the impact assessment, project impact evaluation matrix was used by dividing the project action into different phases (design/pre-construction, construction and operational phases).

Table 7.1: Impact Assessment Matrix

	Air Quality	Noise	Soil Contamination	Visual and Aesthetic Value	Hazardous waste	Ground or Drinking Water	Increase in Wastewater Generation	Flora	Fauna	Livestock	Fishery	Disturbance to Locals	Cultural Issues	Gender Issues	Health and Safety of Workers	Archeological/Historical Religious Sites	Human Health	Safety Issues	Agriculture	Livelihood	Improvement in Overall Economy	Resettlement
Design/Pre-Construction Stage																						
Consumables of lab equipment	- 2	0	- 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
Design of COEs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
Preparation of Contractor Site Specific Plans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction Stage																						
Clearing of Land, Digging and Excavation	- 2	- 2	- 2	- 1	- 1	- 1	- 1	- 1	- 1	0	0	- 1	- 1	- 1	- 2	0	- 1	- 1	- 1	2	2	0
Construction material, equipment	- 2	- 2	- 2	- 2	- 1	- 1	- 1	- 1	- 1	0	0	- 1	0	0	- 1	0	- 1	0	0	2	2	0
Disposal of spoil material	- 1	0	- 2	- 2	- 1	- 1	- 1	- 1	- 1	0	0	0	0	0	- 1	0	- 1	0	0	2	2	0
Construction Camps	- 1	- 2	- 2	- 2	0	0	- 2	0	0	0	0	- 1	0	- 1	- 1	0	- 1	0	- 1	2	2	0
Construction Works	- 2	- 2	- 2	- 2	- 1	- 1	- 2	- 1	0	0	0	- 1	- 1	- 1	- 2	0	- 1	0	- 1	2	2	0
Use of Heavy Machinery	- 2	- 2	- 1	- 2	- 1	- 1	- 1	0	0	0	0	- 1	0	- 1	- 1	0	- 1	0	0	2	2	0

Wastewater Disposal	0	0	-	-	-	-	-	0	0	0	0	0	0	0	-	0	-	0	0	2	2	0
			1	1	1	1	1								1	1						
Solid Waste Disposal	-	0	-	-	-	-	-	0	0	0	0	-	0	0	-	0	-	0	-	2	2	0
	2		1	1	1	1	1					1			1	1			1			
Leakage & Spillage of Oils and Chemicals	0	0	0	0	-	-	-	0	0	0	0	0	0	0	-	0	-	0	0	2	2	0
					1	1	1								1	1						
Security Fencing and Lightning	0	0	0	-	0	0	0	0	0	0	0	-	0	0	0	0	0	0	0	2	2	0
				1								1										
Operation Stage																						
Landscaping	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Institute Operations	0	0	0	0	0	-	-	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0
						1	1												1			

Key: -3: High negative impact, -2: Moderate negative impact, -1: Low negative impact; 0: insignificant/negligible impact; +1: low positive impact; +2: high positive impact

NOTE: The above matrix shows the impact magnitude without any mitigation. With the application of mitigation, the magnitude of impacts will be either insignificant or low.

7.3. Positive Impacts

227. IWRPP is designed in a way that it will have positive impacts on environment and climate change. Apart from social and economic benefits of increasing skilled workforce that will bring livelihood for many families, project will also train a large human resource on environment, health and safety issues through curricula. The development of curricula would include the recommendations from environmental expert who will focus on knowledge transfer to the skilled work force. The conversion of COEs power reliance from conventional to solar energy would also have positive impact on environment and climate change, making COEs energy efficient. IWRPP also plans training of personnel and teachers who can be given training on environmental management measures.

7.4. Design Phase Negative Impacts

1. Drinking Water Supply Systems

228. During baseline environmental monitoring, water quality in some COEs (i.e. GCT Multan, VTI Multan, GTTI Bahawalpur, CAMI Khanewal, GTTI Faisalabad, GCT Faisalabad, GITT Sheikhpura) did not meet the essential water quality standards i.e. TDS, E.Coli, Fecal Coliforms, Chlorine, Lead and Hardness were found exceeding the water quality standard limits. At design stage, the designer may ignore the needs to install or enhance drinking water supply systems at these COEs specifically. This could pose serious health issues to the students and staff at those respective COEs. The impact is high and likelihood is low.

229. Mitigation measures are:

- (i) Designer will consider the installation and provision of high quality drinking water treatment options and disinfection units. For instance, chlorination or ozonation, or other suitable technologies can be used to disinfect water. Reverse Osmosis (RO) can be used to reduce TDS and chlorides. Carbon filters or Reverse Osmosis can be used to remove lead. Softening of water can be considered where hardness of water is high.
- (ii) If RO systems are already installed, the efficacy and performance of RO units can be upgraded.

2. Consumables for Lab Equipment

230. At design stage, the equipment and consumables to be finalized, may have some hazardous substances/chemicals. The impact is high and likelihood is very low.

231. **Mitigation measure:** Designer will consider the international conventions and local rules/regulations on hazardous substances.

3. Over design of COEs

232. The COEs are educational institutes and most of them are in urban environment. There is a possibility of over design elements or proposing new building blocks on existing open grounds. The impact is high, but likelihood is low.

233. Mitigation measures are:

- (i) The designer will consider the minimum tree cut while proposing the location for new building blocks.
- (ii) This could be achieved by adopting the same project footprints or changing project footprints only where unavoidable.
- (iii) The design will be completely on need assessment.
- (iv) The design and location will be finalized after close coordination and consultation with the stakeholders.
- (v) The design of the COE at GSTC, Murree will ensure not to disturb existing water boring facility (functional) located at site.
- (vi) Toilets facilities will be designed and recommended for males and females (as the case may be) at every floor of the COE.
- (vii) Sound proofing of the buildings will be ensured specially to avoid traffic noise (where required). It is also recommended to sound proof the rooms adjacent to mosque in COE of GCT, Wahdat Road, Lahore.
- (viii) The COEs will be designed in a way not to disturb the privacy of the nearby residential areas considered as sensitive receptors.
- (ix) Storm water drainage system of the COEs will be capable enough to deal with the urban flooding especially in GCT Sialkot where the whole GCT becomes flooded during monsoon season.
- (x) The building layout / orientation will be designed in a way not to stop sunshine for students / staff of COEs proposed in Murree. Furthermore, sloped roof tops will be designed for easy snow removal.

4. Building Load

234. The vertical construction on fragile structures of COEs may cause a risk of increased load of building which may ultimately exacerbate impact of natural disasters (e.g. earthquake). There are two COEs (GCTW Lahore and GCT Sialkot) that have very old infrastructure and any amendment may cause harm to historical value of buildings. The impact is high, and likelihood is low.

235. Mitigation measures are:

- (i) The designer will carry out building strength assessment before proposing the vertical blocks during detailed design.
- (ii) Efforts will be made to repair and renovate the Shadi Lal Block in GCT, Lahore with care as it is an old structure.

- (iii) The vertical construction will be done with light weight construction materials.

5. Wastewater and Solid Waste Hazards and Risks

236. During baseline environmental monitoring, it was found that the concentrations of some toxic pollutants were high in sewerage/wastewater of some COEs i.e. GCTW Lahore, GCTPP Lahore, GTTI Bahawalpur, GCT Bahawalpur, GCT Multan, CAMI Khanewal, GTTI Faisalabad and GCT Faisalabad. The higher concentrations of pollutants such as COD/BOD and heavy metals may pose serious risks to soil and water resources. Though, there is availability of septic tanks but at design stage, designer may ignore this threat to the environment, which would ultimately cause more threats during operation stage. The impact is high and likelihood is moderate.

237. **Mitigation measure:** With the upgradation of 19 COEs the quantity of wastewater and solid waste will increase. Therefore, designer will consider the options for wastewater treatment at each site in order to reduce the pollutants' concentration load particularly TSS, Sulphide and Ammonia which were high in Lahore and Faisalabad. The best option could be the construction of septic tank or retention pond where wastewater could be given enough retention time for settlement of contaminants and then released into main sewers or environment. Owing to increase in solid waste, the designer will consider proper waste collection and segregation method such as use of different color buckets to segregate waste before handing over to municipal agencies for disposal. For COEs of Textile & Garments the designer will give due consideration to the treatment of waste water released from the laboratories in addition to routinewaste water from toilets etc., by carefully assessment of all potential scenarios of accidental and/or routine laboratory chemicals available in different training laboratories.

6. Vehicular Traffic Issues

238. The design provisions may skip the necessary requirements for construction camp and vehicle movement. The impact is moderate on environment, but likelihood is high.

239. **Mitigation measures** are:

- (i) The designer will consider the traffic congestion and situation that may arise during project activities.
- (ii) A traffic management framework will be prepared at the stage of detailed design.

7. Lack of Integration of EIA and EMP into Bidding Documents

240. The bidding documents may not be responsive to environmental and social considerations. The impact is high, and likelihood is moderate.

241. **Mitigation measures** are:

- (i) The proponent will consider the environmental and social considerations during detailed design.
- (ii) The EIA & EMP will be made compulsory part of bidding documents.
- (iii) The estimates on environmental monitoring and enhancement will be incorporated in BOQs.

8. Disturbance to students

242. Unavoidable major disturbance in routine teaching / training activities in existing class rooms, labs, buildings and allied facilities. Unavoidable interference between contractor crew and students/teachers of the COE, that will adversely impact the safe learning environment.

243. Mitigation measure: The proponent will assess and analyze the disturbance and impact of renovation / construction activity with the individual COE management and based on the scale, duration, timing, and intensity of the proposed activity consider following appropriate measures to avoid, minimize or mitigate the impact:

- (i) Re-scheduling of daily teaching hours to accommodate construction/renovation activity
- (ii) Re-scheduling / break in classes to restart after completion of proposed construction activities
- (iii) Re-scheduling of daily working hours for construction workers to accommodate teaching activities
- (iv) Accommodating / shifting classrooms to other existing / available rooms within COE to avoid any loss of teaching/training
- (v) Provisions of Temporary facilities to serve as classrooms for the construction duration
- (vi) Shifting the impacted classrooms, hostels, etc., to a temporary rented facility

7.5. Construction Phase Impacts

1. Construction camps, material and equipment yards

244. Exploitation of local facilities/utilities such as electricity and temporary construction activities like material placement and storage may temporarily affect the routine matters of COEs administration. The impact and likelihood are moderate.

245. **Mitigation measures** are:

- (i) Contractor will prepare SSEMPs using the information and suggestions proposed in EMPs.
- (ii) The location and development of the contractor's facilities (this applies to all types of facilities, storage areas, workshops, and labor camps) will be approved by the PIU.
- (iii) Locations will be selected so that it does not interfere with the environment and social well-being of the surrounding communities in respect to noise, dust, vibration, and other physical impacts.
- (iv) The size of contractor's facilities is limited to absolute minimum to reduce unnecessary clearing of vegetation.
- (v) Labor Influx Management and Construction Camp Management Plan will be prepared by the Contractor on the basis of the site-specific E&S management plans. The Plan will include the camp layout, details of various facilities including supplies, storage, and disposal. The Plan will be submitted to the PIU for review and approval before camp establishment
- (vi) Contractor will follow the best management practices for safe handling and disposal of the material if found during refurbishment.
- (vii) Contractor will ensure that the baseline conditions are recorded before establishing camps and other site facilities.

- (viii) Contractor will establish the camp (where necessary) at least 500 m away from the nearest habitation.
- (ix) Contractor will maintain photographic record of area adjacent to the camp site and other features are taken prior to commencement of any work activity which will be used as a reference during site restoration.
- (x) Contractor will ensure that latrines, septic tanks, and soaking pits or sumps are built at a safe distance from water body (tube wells or hand pumps), stream, or dry streambed and the bottom of the sump or soaking pits are above the ground water level.
- (xi) Contractor will ensure that effective drainage system is in place at site in order to avoid rain or wastewater ponding in the area.

2. Wastewater Generation at Construction Camps

246. Wastewater will be generated at the construction camps. If the generated wastewater is not properly treated or disposed of, this may contaminate the nearby surface water resources (if any) apart from soil contamination. The wastewater generation is estimated to be 800 liters/day for 25 construction workers for each COE which means that total wastewater generation for 20 COEs will be 16,000 liters/day. The impact and likelihood are moderate.

247. **Mitigation measures** are:

- (i) Domestic effluents from the construction camp will be disposed by the development of on-site sanitation systems i.e. septic tanks.
- (ii) Contractor will ensure that latrines, septic tanks, and soaking pits or sumps are built at a safe distance from water body (tube wells or hand pumps), stream, or dry streambed and the bottom of the sump or soaking pits are above the ground water level.
- (iii) Proper monitoring to check the compliance of PEQS will be carried out (as advised by EHS Specialists).

3. Liquid and Solid Waste Generation at Construction Camps

248. Considering the construction workforce (about 25 in numbers / COE), an average solid waste generation rate of 0.5 kg/capita/day¹⁰⁰ is adopted for the estimation of solid waste generation. Based on this assumption, about 12.5 kg solid waste will be generated from construction camps on daily basis at each COE which means that total solid waste generation for 20 COEs will be 250 kg/day. The major components of the labor camp waste will be garbage, putrescible waste, rubbish and small portion of ashes and residues, etc. Other type of wastes may include inorganic construction wastes including hazardous waste. These wastes will be generated due to the construction activities and the materials used for construction. This waste would require proper disposal to minimize land and water contamination. The impact is moderate, but likelihood is high.

249. **Mitigation measures** are:

- (i) All the solid waste from the camps will be properly collected at source by placing containers and disposed of through proper solid waste management system. The

¹⁰⁰ T D. Hoornweg and P. Bhada-Tata. 2012. What a Waste : A Global Review of Solid Waste Management. *Urban Development Series; Knowledge Papers*. No. 15. World Bank, Washington, DC. Based on UNEP estimates for waste generation in the Asia Pacific: average is 0.45 kg/capita/day.

- Contractor will coordinate with local representatives and administration concerned department for the disposal of solid waste.
- (ii) The concerned department must develop a plan of action for transporting the waste to the disposal site for final disposal. It is the responsibility of the concerned department to ensure that the disposal site is properly lined to prevent the leachate from contaminating the groundwater.
 - (iii) Secondly, the disposal site must be located away as far as practical from populated areas.
 - (iv) The waste will be properly sealed in containers with proper labels indicating the nature of the waste.
 - (v) Solid waste will be segregated at source so that it can be re-used or recycled.
 - (vi) Toxic waste will be handled, stored, transported and disposed-off separately. Safe handling precautions and product specific information is found in Material Safety Data Sheet (MSDS) which must be located on site and accessible to all workers.
 - (vii) All persons interacting with hazardous wastes will be required to wear the appropriate PPE.
 - (viii) The waste will be properly sealed in containers with proper labels indicating the nature of the waste.

4. Solid Waste Generation at Construction Sites

250. The construction waste will include damaged or spoiled materials, demolished materials, temporary and expendable construction materials etc. The construction waste types also include timber, metals, rubber, concrete, electric cables, old machinery/equipment, etc. The handling and storage of oil and other hazardous waste will be a source of environmental pollution during the excavation, foundation, levelling, carpeting and pavement activities. Due to old construction, there may be a possibility of presence of Asbestos during repair and refurbishment work.

251. Improper disposal of construction waste can lead to nuisance and hazards towards environment. The unspent materials and debris produced from consumed up materials, if left as such and allowed to mix with soil underneath, can degrade the quality of receiving soils and render them unfit for plantation. Leakages of oils, lubricants, chemicals, and other similar substances from their storage sites can spoil the receiving soils and may undermine ability of the spoiled soils to support growth of vegetation and plants. The impact and likelihood are high.

252. **Mitigation measures** are:

- (i) Site-specific waste management plan for each COE will be developed to implement an efficient and responsive solid waste management system during construction phase. Recyclable wastes e.g. steel bars will be sold to waste vendors. Site-specific plan should also contain exact location of excavation and quantum of soil to be excavated and disposed.
- (ii) Contractor must follow Best Management Practices for Asbestos safe handling, packaging and disposal. For this purpose, site-specific Asbestos management plan needs to be prepared by the contractor for each COE and seek prior approval from Supervision Consultant's EHS Specialist. The site-specific Asbestos management plan should cover ways to handle, store, precautions, transport, safe handover to trained professionals for its disposal.
- (iii) Reusable material will be used as a filling material during ground levelling.

- (iv) Solid waste generated during construction will be safely disposed in demarcated waste disposal sites and the contractor will provide a proper waste management plan.
- (v) The site will be restored back to its original conditions after construction completion.
- (vi) The Contractor must develop a plan of action with the help of concerned solid waste management department for transporting the construction waste to the disposal site.
- (vii) Toxic waste will be handled, stored, transported and disposed-off separately. Safe handling precautions and product specific information is found in MSDS which must be located on site and accessible to all workers.
- (viii) All persons interacting with hazardous wastes will be required to wear the appropriate PPE.
- (ix) Contractor will ensure that all trucks used for the transportation of construction waste must be covered and water resist. It is the contractor's contractual obligation to complete and follow the guidelines in case any private land is damaged / contaminated due to disposal of waste generated from the construction activities.

5. Loss of trees

253. It is anticipated that construction of new building blocks may cause tree cutting at three COEs (GCTW Faisalabad, GTTIW Murree, GSTC Murree) and damage to green landscapes in almost all COEs. The impact and likelihood are high.

254. **Mitigation measures** are:

- (i) Clearing of green surface cover for construction, cutting trees and other important vegetation during construction will be minimized.
- (ii) The exact amount of tree count can be verified during design and designer may made best possible use of skills to avoid tree cut.
- (iii) During the design stage of the project sites and finalizing the site orientation, it would be the priority to avoid those areas where there are chances of cutting of significant trees and clearing of vegetation.
- (iv) In case if it is not possible to avoid, then the project site would be restored to its original as much as possible by planting trees, and vegetation at the cleared land.
- (v) It is pertinent to mention that trees will be relocated/transplanted/replanted (where possible) instead of cutting and may be replanted within the 500 meters radius of its original location;
- (vi) Compensatory plantation will be planned to be undertaken at prescribed rates (at least 5 times of the number of trees cut).
- (vii) The contractor's staff and labor will be strictly directed not to damage any vegetation such as trees or bushes.
- (viii) All works will be carried out in a fashion that ensures minimum damage or disruption to the flora.
- (ix) The contractor will be responsible for the restoration of the site and PIU will ensure restoration as per the requirements.
- (x) Landscaping and road verges to be re-installed on completion.
- (xi) At completion, all debris and waste will be removed and disposed of at approved disposal locations and reclaimed the disposal areas.
- (xii) All temporary structures, including office buildings, shelters and toilets will be removed, and restored all such sites to avoid any nuisance to the public.

6. Load on Sanitation and Sewage System

255. Population influx during project construction activities may cause severe impact on existing utilities such as sewerage and sanitation infrastructure of COEs as in most of the COEs have poor sewerage system. The impact and likelihood are moderate.

256. **Mitigation measures** are:

- (i) Access to nearby lavatories will be allowed or provision of temporary toilets will be made.
- (ii) Construction worker camps will be necessary, based on the scale of the works needed.
- (iii) The construction camp will be provided with toilets, soakage pits or portable lavatories or at least pit latrines.
- (iv) Disposal of surplus materials will be negotiated through local authority approvals prior to the commencement of construction.
- (v) If surplus materials arise from the excavation activities, it will be used elsewhere on the subproject before additional soil, rock, gravel or sand is brought in.

7. Water Usage

257. Project activities at all COEs would increase the groundwater/drinking water consumption rate, due to sudden increase in several consumers during construction. The impact and likelihood are moderate.

258. **Mitigation measures** are:

- (i) Contractors will make temporary arrangements for construction / drinking water in a manner so that existing water users are not affected. For this purpose, contractors will meet their requirements through water bowser / tanks with drinking water requirement met through bottled water. No groundwater and water supply of COEs will be utilized during construction period to avoid any conflict.
- (ii) Contractor will train the staff and labor on less water consumption and to minimize the wastage of drinking water.

8. Disturbance of Power Sources

259. Project activities at all COEs may trigger unnecessary exploitation of electric power and natural gas supplies. As the COEs have to bear all the expenses/dues of consuming electric or gas resources. Any exploitation or usage by contractor may cause impact on consumption of resources. The impact is medium and likelihood is medium.

260. **Mitigation measures** are:

- (i) Contractor will bring or use their own power sources i.e. generators or gas cylinders for all kind of activities.
- (ii) The contract will include the bindings on contractor and in case any exploitation to COEs resources occurs, contractor will be bound to bear the utility bills.

9. Traffic Congestion

261. Traffic congestion is expected in the vicinity of COEs due to increased number of vehicles and movement of construction machinery. The impact is high, and likelihood is moderate.

262. **Mitigation measures** are:

- (i) Preparation of traffic management and construction machinery movement plan in each SSEMP will be made sure.
- (ii) Submit temporary haul and access routes plan one month prior to start of works.
- (iii) Formulate and implementation of a plan of alternate routes for heavy vehicles. Installation of traffic warning signs and enforcing traffic regulations during transportation of materials and equipment and machinery.

10. Air Quality

263. It is expected that air quality in the vicinity of COEs may decline due to increased traffic volume, movement of construction machinery and generation of dust in from construction activities. This may affect the construction camps, COEs themselves and more specifically the sensitive receptors nearby GCT Multan, GCT Bahawalpur, GCT Gujranwala, GCT Lahore and GCT Sialkot. The impact and likelihood both are high.

264. **Mitigation measures** are:

- (i) The construction work at COEs where sensitive receptors are nearby, will be scheduled during vacations only, to avoid any impact or disturbance to sensitive receptors.
- (ii) Client/Supervisory Consultant will make sure that no construction activity is done when the sensitive receptors/institutions are operational.
- (iii) The construction machinery and vehicles will be kept away from sensitive receptors as much as possible.
- (iv) Undertake regular spraying of water on traffic routes and places prone to cause dust pollution.
- (v) Trucks carrying spoil materials will have tarpaulin cover to prevent spills during haulage.
- (vi) Suspended particulate matter (SPM) will be monitored at dust creating sites such as crushers, and dust mask will be issued to workers.
- (vii) Need of large stockpiles will be minimized by careful planning of the supply of materials from controlled sources.
- (viii) Stockpiles will be covered with tarpaulins when not in use and at the end of the working day to enclose dust.
- (ix) Aggregate material will be delivered to the batching and/or asphalt plant in a damp condition, and water sprays will be applied if needed, to reduce dust emissions.
- (x) Fuel-efficient and well-maintained haulage trucks will be employed to minimize exhaust emissions.
- (xi) Ambient air monitoring will be conducted after periodic intervals as mentioned in the EMP.

11. Noise

265. Noise can be generated due to use of drillers, machines inside buildings/facility. This can be a source of nuisance to neighboring properties and other class rooms / dormitories and common facilities. Noise levels may reach to as much as 85 decibels (dBA) at a distance of about 15 m from the source or operation of construction equipment (for less than 50% time of work). Other sensitive receptors nearby GCT Multan, GCT Bahawalpur, GCT Gujranwala, GCT Lahore

¹⁰⁰ Several equipment has different noise thresholds – drills, excavators, trucks, compressors etc. which are specified by national governments. The monitoring of these equipment will rely on nationally approved threshold limits.

and GCT Sialkot are also likely to be affected by high levels of noise. However, this will be temporary in nature. The impact significance is rated as moderate.

266. Mitigation measures are:

- (i) Construction camps and workshops are recommended to be located outside the premises of COEs. In this way, noisy operations of workshops would stay away from the COEs.
- (ii) Contractor will be responsible to provide the construction workers with suitable hearing protection like ear cap, or earmuffs at noisy workplaces.
- (iii) All construction equipment and machinery will be fitted in full compliance with the national and local regulations and with effective silencing apparatus to minimize noise.
- (iv) As a rule, the construction activities should be confined to daylight hours only. No such activity should be conducted during night hours.
- (v) Construction equipment like generators, which generates excessive noise, will be enclosed or fitted with effective silencing apparatus to minimize noise.
- (vi) Contractor will take adequate measures to minimize noise nuisance in the vicinity of construction sites by way of adopting available acoustic methods such that at the edge of the work sites noise will be less than 55 dB(A) Laeq during the day hours.
- (vii) Qualitative measurement of noise¹⁰¹ from working area (source e.g. Drilling, excavation etc.) to be done by contractor strictly adhering to National or IFC EHS guidelines, whichever is stringent. Noise monitoring should be carried out using a Type 1 or 2 sound level meter meeting all appropriate IEC¹⁰² standards at all of the identified sensitive receptors (including residential areas).

12. Ground Vibrations

267. No heavy machinery or any blasting activity is anticipated to be used which could generate severe vibrations and cause damage to nearby structures. Furthermore, no deep excavations or pilings are expected during construction period and no damaged or structurally unsafe buildings are situated near new civil constructions works within the COEs which could be impacted. Most of the buildings around the project sites are not likely to be affected by the vibration induced impacts. The impact and likelihood is therefore rated as low.

268. Mitigation measures are:

- (i) Client/Supervisory Consultant must make sure that no construction activity is done when the sensitive receptors/institutions are operational.
- (ii) Designer should assess the existing infrastructures stability and strength.
- (iii) Review requirements for piling and use of powered mechanical equipment. Non-percussive piling methods to be used wherever practicable.
- (iv) Percussive piling will be conducted in daylight hours.
- (v) A pre-construction vibration survey will be carried out by the contractor to identify buildings which can be severely impacted by the vibration induced impacts.

¹⁰¹ For every 3 dB(A) increase in noise levels above the standard, the allowed exposure period or duration should be reduced by 50% (The American Conference of Governmental Industrial Hygienists (ACGIH), 2006). Limits for vibration and action values (i.e. the level of exposure at which remediation should be initiated) are provided by the ACGIH.

¹⁰² Noise Monitors should be located approximately 1.5 m above the ground and no closer than 3m to any reflecting surface (e.g., wall).

- (vi) Contractor should use shock absorbers where impulsive actions are proposed near the old buildings (if any).

13. Soil Contamination

269. Land/soil contamination is expected due to spill of lubricants, fuel, chemicals and other construction waste material. The impact and likelihood both are high.

270. **Mitigation measures** are:

- (i) Avoid the chemical and oil spills such materials will be properly stored and maintain good housekeeping by the Contractor.
- (ii) Contractor will ensure that the maintenance of vehicle (LTV and HTV) and other plant takes place only in designated areas underlined with concrete slabs and a system to catch surface runoff.
- (iii) The contractor will construct lined wash area for vehicle washing. Contractor will ensure effluents from plant washing and other potentially contaminated effluents are released into soaking pit.
- (iv) Contractor will store and handle fuels, oils, and other hazardous substances according to standard safety practices such as secondary containment banded area. Fuel tanks will be labeled accordingly by the Contractor.
- (v) Contractor will ensure that fuels, oils, and chemical are stored in areas lined by an impermeable base and containing dykes.
- (vi) The Material Safety Data Sheets (MSDS) or Control of Substances Hazardous to Health (COSHH) sheets will be available at material storage area. Contractor will carry out vehicles fuel, oil, or battery fluid leakage check regularly.

14. Impact on Fauna

271. No major impact on the protected areas is expected. However, care will be taken during construction at COE in Bahawalpur as Lal Suhanra Protected Area is 58 km away from GCT Bahawalpur. There is no impact on protected area.

272. **Mitigation measures** are:

- (i) Contractor will sign a binding that no intrusion or damage to protected area will take place during the whole construction period.
- (ii) Contractor will train the staff and labors to be careful about demarcated area and any involvement outside the construction camp will be monitored.
- (iii) Poaching, hunting, camping near the protected area will be banned.

15. Social Issues

273. Local conflicts between workers and students/staff of COEs may arise. Further, privacy of women in COEs can also be at risk. This impact is high, and likelihood is moderate. The impact of likelihood are moderate.

274. **Mitigation measures** are:

- (i) Contractor will ensure that workers follow the work ethics and will ensure that project staff interaction with students/staff and COE staff is minimum.
- (ii) Contractor will not allow any offence by their workers.
- (iii) Contractor and workers will respect the local conditions.

- (iv) Claims/complaints of the students/staff on construction nuisance/damages will be considered and responded promptly by the contractor.
- (v) Active construction sites will be cordoned off to maintain the privacy of the female students and staff. To maintain the privacy and minimum interaction of workers with students and staff members, other nearby gates of the COEs could be utilized instead of main gates.

16. Public Health and Safety

275. Risks to community health and safety from construction activities, traffic/machinery movement, or failure of the building's safety features can be higher if construction sites are not fenced off properly. In addition, the prevailing Covid-19 situation may add risks of transfer either way i.e. from workers to community and community to workers. The impact is high, but likelihood is moderate.

276. **Mitigation measures** are:

- (i) The contractor will follow Government of Pakistan Covid-19 guidelines for construction (Appendix-8) and ADB guidance on Covid-19, which includes provision of masks, hand sanitizers etc.
- (ii) Training on health safety and environment will be conducted by specialist every 3 months.
- (iii) The Contractor will also prepare emergency response plan for such an outbreak in the construction camp and at construction sites.
- (iv) The construction activities can be planned during vacations to avoid any impact on students or staff.
- (v) The construction activities will be performed in separated areas or at the remotest possible point to avoid any direct impact on public.
- (vi) Health, Safety and Environment (HSE) plan with an additional component of community Health and Safety will be developed and implemented by the contractor.
- (vii) The contractor will ensure that medical staff headed by qualified medical doctor, first aid equipment and stores, sick bay and suitable ambulance service are available at the camps all time.
- (viii) The Contractor will depute guards at all entry points into construction sites 24 hours a day.
- (ix) Appropriate arrangements and sufficient number of active emergency exits will be established at each construction site
- (x) Contractor will ensure no machinery is left unattended in the project area.
- (xi) Claims from people in nearby vicinity of COEs will be well-addressed.

17. Visual Impact Solar Panel Installation

277. The potential impacts could be visual and reflection. The PV modules are expected to be visible within the immediate vicinity and up to some kilometers around the COEs and thus is likely to create visual impacts. These visual and reflection may create nuisance to nearby inhabitants (if any). The impact and likelihood both are moderate.

278. Mitigation measures are: It is suggested to use PV modules whose surface would absorb sunlight and minimize sunlight reflections. The modules will be efficient enough to absorb heat with low chances of reflection.

18. Cleaning Mechanism of Solar PV Panels

279. The blessing of any available resource might be wiped out by poor governance. With the passage of time, dust and soot deposit on the surface of PV modules which requires regular cleaning of PV panels on routine basis. About 15,000 liters of water is required for 1 MW PV modules at one time¹⁰³. If not cleaned regularly, efficiency of the solar system will be lower down day by day. The impact is moderate, but likelihood is high.

280. Mitigation measures are:

- The water supply system will be installed along the solar panel array for cleanliness purpose.
- There will be minimal discharge of wastewater from cleaning of solar PV modules. The wastewater emanating from cleaning operations will be recycled for plantation around the COEs.
- Periodic cleaning of the PV modules will be ensured at least bimonthly.

19. Health and Safety Issues of Solar Power System

281. There are occupational health and safety risks to workers who will be involved in the operation and maintenance activities of solar system. Risks generally associated to solar system's O&M are: exposure to a variety of hazards such electric shock, burn hazards; and exposure to chemicals, hazardous or flammable materials (if any). The impact is high, but likelihood is moderate.

282. Mitigation measures are:

- O&M of machinery and equipment of solar panels will be controlled and handled by efficient management, staff training, and related preventive measures.
- Provision of PPE's to the workers dealing with O&M of solar system.
- Proper training should be given to workers on health and safety measures.

20. Solid Waste Generation by Solar Power System

283. Different types of waste including municipal and hazardous wastes are likely to be generated during the operation phase of the COEs. The maintenance of solar system may generate small quantities of wastes, such as pieces of metal pipes, pipe fittings, copper, aluminum, rubber, silicon, glass as well as left over materials, etc. Solid wastes can also be generated from the operations of workshops within each COE whose composition depends on the activities being performed in the workshops. For example, food technology lab may produce organic waste whereas automobile technology lab may produce waste lubricants, pieces of metals, etc. These waste can potentially cause soil and water contamination, if not properly managed. The impact and likelihood both are moderate.

284. Mitigation measures are:

- A waste inventory of various waste generated will be prepared and periodically updated.
- Food waste and recyclables viz. paper, plastic, glass etc. will be stored in designated waste bins/containers. The recyclables will be periodically sold to local recyclers while food waste will be disposed through waste handling agency.
- Hazardous waste viz. waste oil etc. will be collected and stored in paved and bounded area and subsequently sold to authorized recyclers.

¹⁰³ Renewable Resources (Private) Limited. 2017. *Environmental impact assessment: Zorlu Solar Power Project* (prepared for ADB).

- Ensure immediate collection of solid waste after the completion of maintenance works.
- Solid waste generated will be safely disposed in demarcated waste disposal sites.
- Regular trainings will be provided to staff involved in solid waste management.
- All persons interacting with hazardous wastes will be required to wear the appropriate PPE.

21. Occupational health and safety issues

285. Risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological hazards during project construction would be higher. The prevailing pandemic covid-19 may also cause severe health issues. The students and staff of COEs would also be prone to such risks. The impact and likelihood are higher.

286. **Mitigation measures** are:

- (i) The contractor will follow Government of Pakistan Covid-19 guidelines for construction (Appendix-8) and ADB guidance on Covid-19, which includes provision of masks, hand sanitizers etc.
- (ii) Training on health safety and environment will be conducted by specialist every 3 months.
- (iii) The Contractor will also prepare emergency response plan for such an outbreak in the construction camp.
- (iv) A comprehensive SSEMP and HSE plan will be developed and implemented by the contractor.
- (v) The contractor will ensure that medical staff headed by qualified medical doctor, first aid equipment and stores, sick bay and suitable ambulance service are available at the camps all time.
- (vi) A proper screening of laborer will be done at the time of recruitment. Ensure that periodic awareness campaigns for COVID-19 / HIV/AIDS are undertaken for the project staff.
- (vii) Contractor will provide potable water and shadow area to the workers at workplace area for short breaks.
- (viii) The Contractor will depute guards at all entry points into construction sites 24 hours a day.
- (ix) Appropriate arrangements and sufficient number of active emergency exits will be established at each construction site
- (x) Contractor will ensure no machinery is left unattended in the project area.
- (xi) Providing adequate personal protective equipment (PPE) to the workers, warning signs.
- (xii) Potential for spread of vector borne and communicable diseases from labor camps will be avoided (worker awareness orientation and appropriate sanitation will be maintained).

22. Orientation for Contractors, and Workers

287. Contractor and workers may have negligence to ensure compliance with administrative rules of COEs. The impact and likelihood are moderate to low.

288. **Mitigation measures** are:

- (i) Conduct special briefings and trainings for managers and / or on-site training for the contractors and workers on the local rules and regulations.

- (ii) SSEMP will consider all social and environmental issues.

23. Handling, Transportation and Placement of Lab Equipment

289. The transportation and installation of project equipment may have an interaction with the ongoing construction activities. The transportation in parallel with construction may cause nuisance.

290. **Mitigation measures** are:

- (i) Civil contractor will cooperate and understand the importance of machinery transfer and installation in the COEs.
- (ii) The installation contractor will follow HSE guidelines and SSEMPs requirements.
- (iii) Equipment transfer plan will not coincide with major construction activities.

24. Impact on Sensitive Receptors

291. Five COEs i.e., GCT Multan, GCT Sialkot, GCT Gujranwala, GCT Bahawalpur and GCT Lahore have other educational institutes nearby to their buildings. Any construction activity may cause nuisance to them. The impact and likelihood both are high. This is in addition to the residential areas surrounding the COE's.

292. **Mitigation measures** are:

- (i) Civil contractor will consider the sensitive receptors part of the project area.
- (ii) SSEMPs of these five COEs will consider a comprehensive plan for controlling environmental, health and safety risks to the students of these receptors.
- (iii) Risk assessment will be done to avoid any impact to the institutes. Measures will be taken to control dust, noise and wastewater emissions.
- (iv) Contractor will share a copy of SSEMP with the administration of receptors institutes.

25. Restoration/ Rehabilitation of Sites

293. The execution of construction work would have an impact on the existing land use, utilities and aesthetic values. The closure of construction activities may leave a certain impact on COEs. This impact and its likelihood are moderate.

294. **Mitigation measures** are:

- (i) Contractor will be asked to submit rehabilitation and restoration plan along with SSEMPs.
- (ii) Camp site is restored as per agreed contract and approved SSEMP.
- (iii) All extra products / materials, solid and liquid will be disposed of in accordance with the requirement of the EIA, SSEMP and contract document by the contractor.
- (iv) Contractor will make sure that none of the COEs' utilities are disturbed or exploited.
- (v) Contractor will make sure that site restoration is near to the baseline settings and the damage to land, property, and trees is compensated.

7.6. Operation Phase Negative Impacts

1. Noise & Vibration

295. Increase in noise levels in the area due to influx of more students is expected in operation phase of the project. The noise levels are already high during night times as per baseline environmental monitoring results. According to IFC Guidelines, if the background noise levels already exceed the standard, a maximum increase in background levels of 3 dBA is allowed. The noise levels are likely to increase but would remain within the 3dBA criteria and therefore does not require any specific mitigation measures (like noise barriers). This impact significance is moderate. Vibration induced impacts are not anticipated during the operation phase.

296. **Mitigation measures** are:

- (i) The installation of double-glazed windows and fixed glass windows with air conditioners are recommended to reduce noise in hostels and new buildings.
- (ii) Safety signs such as “No Horns Please” will be placed at parking lots.
- (iii) Consideration of noise reducing measures i.e. operating the equipment in daytime and closing the windows during classes. For machinery / equipment, installation of shock absorbers and proper lubrication is recommended.

2. Health and Safety Issues to Students in Dormitories

297. The planned blocks in GCT Multan are across the road to other building blocks and there is a possibility of free movement between both blocks. The students/staff can be at risk of road accidents. Further, COEs and hostels may have ventilation and fire risks due to natural gas or cylinders uses. The impact is high, and likelihood is moderate.

298. **Mitigation measures** are:

- (i) If building blocks are proposed on both sides of road then there will be a provision of pedestrian bridges in detailed design of COEs to avoid any accidents.
- (ii) In all buildings, firefighting equipment will be installed.
- (iii) Students/staff will be given training on HSE and fire risks.
- (iv) Proper installation of HVAC in COEs is recommended.
- (v) First aid box will also be readily available in the buildings.

3. Ground Water Usage

299. The drinking water consumption would also increase due to increase in number of students/staffs in COEs. The impact and its likelihood are moderate.

300. **Mitigation measures** are:

- (i) There will be a general thumb rule of preserving the natural resource and not wasting it.
- (ii) Training sessions will be conducted on groundwater preservation.

4. Damage to Compensatory Tree Planting

301. The new saplings of trees which construction contractor may grow as compensation to the expected damage to green lawns and trees during construction, can be impacted by trespassers. The impact is moderate, but likelihood is low.

302. **Mitigation measure** for this impact: Engagement of landscape inspector to observe the growth of trees and well-being of grassy lawns.

7.7. CUMULATIVE AND INDUCED IMPACT ASSESSMENT

303. The US Council on Environmental Quality defines cumulative impacts as “*the impacts on the environment that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions*”¹⁰⁴.

304. The purpose of Cumulative and Induced Impact Assessment (CIIA) is to assess the impacts of all COEs as cumulatively. CIIA is totally based on qualitative and expert judgment on the information of 19 COEs.

7.7.1. Valued Environmental Components (VECs)

305. Following VECs identified while keeping in view the COE’s construction and operational phase activities:

- Physical Environment
 - Land use Change and Aesthetics
 - Ambient Air Quality
 - Water Quality
- Biological Environment
 - Fauna
 - Flora
- Social Environment
 - Social & Cultural Conflicts
 - Agriculture & Livelihood
 - Transportation

7.7.2. Potential Cumulative Impacts

7.7.2.1. Physical Environment

306. **Land use Change and Aesthetics:** Some of the existing buildings are being demolished for COEs construction whereas some are being renovated / upgraded. Deterioration of aesthetics and visual amenity of nearby receptors due to construction activities, including vehicular movement on roads, may cause disturbance in aesthetics for students. Construction and operational phases of 19 COEs will result in enhancement of educational/learning activities in the area.

307. **Ambient Air Quality:** The construction of 19 COEs will cause dust and gaseous emissions during the construction stage due to various construction activities and vehicular movement. This impact is cumulatively increased due to these projects interventions.

¹⁰⁴ ADB. 2003. *Environmental Assessment Guidelines*. Manila.

308. **Water Quality:** No cumulative impacts are anticipated on nearby water bodies (if any) due to construction of 19 COEs. Similarly, no pressure on ground water resources are expected during construction phase. However, operation of all COEs may have pressure on ground water resources up to some extent.

7.7.2.2. Ecological Environment

309. **Flora:** The construction of 19 COEs will have different level of impacts on vegetation which will cause direct negative impacts on flora and cutting of trees. Construction activities result in cutting of trees and clearing of ground vegetation having significant adverse impacts to environment. About 150 number of different tree species has to be cut. Cutting of trees may disturb the ecological environment of the area for which the 750 number of trees will be planted as a compensation.

310. **Fauna:** All COEs are located within urban areas and are away from any ecological sensitive area. Therefore, no impacts on fauna has been anticipated cumulatively.

7.7.2.3. Social Environment

311. **Social & Cultural Conflicts:** Development of other 19 COEs may have a significant impact on the community's ability to accommodate new residents and adapt changes in the social environment for existing residents. Therefore; it may arise the social conflicts and disturb the harmony of the project area.

312. **Transportation:** Due to the construction activities of COEs in restive cities, proper traffic management has to be done avoid any traffic jam and inconvenience to the citizens.

313. Keeping in view the above impact assessment, it can be concluded that there will be no adverse significant impacts on physical, ecological and socioeconomic environment due to proposed project.

7.8. Residual Impacts of Project

314. Residual impacts refer to those environmental effects predicted to remain after the application of mitigation outlined in this EIA. Through careful design and planning, combined with prudent application of proven mitigation measures, all potential adverse environmental effects have been identified and addressed, and reduced the predicted adverse impacts to a low level of significance.

Table 7.2 Residual Impacts of Project Activities

Sr. No.	Project Components/ Activity	Impacts	Impacts Significance without Mitigation Measures	Mitigation Measures	Residual Impact Significance
Design Phase					
1	Water supply system in COEs	Water quality in some COEs does not meet the essential water quality standards during	High	Designer will consider the installation and provision of high-quality drinking water treatment options and disinfection units. For instance,	negligible

Sr. No.	Project Components/ Activity	Impacts	Impacts Significance without Mitigation Measures	Mitigation Measures	Residual Impact Significance
		baseline environmental monitoring i.e. TDS, E.Coli, Fecal Coliforms, Chlorine, Lead and Hardness was found in the drinking water sources. This could pose serious health issues to the students and staff.		chlorination or ozonation, or other suitable technologies can be used to disinfect water. RO can be used to reduce TDS and chlorides, lead etc. Softening of water can be considered where hardness of water is high. If RO systems are already installed, the efficacy and performance of RO units can be upgraded. In all such situation it is required that the suggested/selected treatment system is appropriate to address all the site-specific water quality issues (biological/chemical/physical). The COE management / staff will be given appropriate training to operate the RO system. An un-interrupted power supply system (needed for functional working of water supply and treatment system) or any alternate arrangement is in place, and they have enough supplies / funds for consumable components / filters / supplies essentially required for the proper operation of the recommended water treatment systems. It is also required to repair/functionalize the out of order RO plants situated in respective COE e.g. VTI, Green Town, Lahore	
2	Consumables for Lab Equipment	At design stage, the equipment and consumables may have some hazardous substances. The impact is high likelihood is very low.	High	Designer will consider the international conventions and local regulations on hazardous substances.	Low
3	Overdesign of COEs	The COEs are educational institutes and most of them are in urban environment. There	High	The designer will consider the minimum tree cut while proposing the location for new building blocks. This could be achieved by adopting the same	Low

Sr. No.	Project Components/ Activity	Impacts	Impacts Significance without Mitigation Measures	Mitigation Measures	Residual Impact Significance
		is a possibility of over/unnecessary design elements or proposing new building blocks on existing open grounds. The impact is high but likelihood is low.		<p>project footprints or changing project footprints only where unavoidable.</p> <p>The design of the COE at GSTC, Murree will ensure not to disturb existing water boring facility (functional) located at site.</p> <p>Toilets facilities will be designed and required for males and females (as the case may be) at every floor of the COE.</p> <p>Sound proofing of the buildings could be ensured especially to avoid traffic noise (where required). It is also required to sound proof the rooms adjacent to mosque in COE of GCT, Wahdat Road, Lahore.</p> <p>Storm water drainage system of the COEs will be capable enough to deal with the urban flooding especially in GCT Sialkot where the whole GCT becomes flooded during monsoon season.</p> <p>The building layout / orientation will be designed in a way not to stop sunshine for students / staff of COEs proposed in Murree. Furthermore, sloped roof tops will be designed for easy snow removal.</p>	
4	Building Load	The vertical construction on fragile structures of COEs may cause a risk of increased load of building which may ultimately exacerbate impact of natural disasters (e.g. earthquake). There are two COEs (GCTW Lahore and GCT Sialkot) that have very old infrastructure and any amendment may cause harm to	High	<p>The designer will carry out building strength assessment before proposing the vertical blocks during detailed design.</p> <p>Efforts will be made to renovate the Shadi Lal Block in GCT, Lahore with care as it is an old structure.</p>	Negligible

Sr. No.	Project Components/ Activity	Impacts	Impacts Significance without Mitigation Measures	Mitigation Measures	Residual Impact Significance
		historical value of buildings.			
5	Wastewater Risks and Hazards	During baseline environmental monitoring, it was found that the concentrations of some toxic pollutants were high in sewerage/wastewater of some COEs. The higher concentrations of pollutants such as COD/BOD and heavy metals may pose serious risks to soil and water resources. Though, there is availability of septic tanks but at design stage, designer may ignore this threat to the environment, which would ultimately cause more threats during operation stage.	High	Designer will consider the options for wastewater treatment or reducing the pollutants' concentration load either through development of efficient septic tanks before the open release of wastewater into main sewers or environment. For CoEs of Textile & Garments the designer will give due consideration to the treatment of waste water released from the laboratories in addition to routine waste water from toilets etc., by carefully assessment of all potential scenarios of accidental and/or routine laboratory chemicals available in different training laboratories.	Low
6	Vehicular Traffic Issues	The design provisions may skip the necessary requirements for construction camp and vehicle movement	Moderate	The designer will consider the traffic congestion and situation that may arise during project activities. A traffic management framework will be prepared at the stage of detailed design.	Low
7	Lack of Integration of EIA and EMP into Bidding Documents	The bidding documents may not be responsive to environmental and social considerations	High	The proponent will consider the environmental and social considerations during detailed design. The EIA & EMP will be made compulsory part of Bidding documents. The estimates on environmental monitoring and enhancement will be incorporated in BOQs.	Low
8	Disturbance to Student	Unavoidable major disturbance in routine teaching /	High	Re-scheduling of daily teaching hours to accommodate construction/renovation activity	Low

Sr. No.	Project Components/ Activity	Impacts	Impacts Significance without Mitigation Measures	Mitigation Measures	Residual Impact Significance
	s / Local Community	training activities in existing class rooms, labs, buildings and allied facilities. Unavoidable interference between contractor crew and students/teachers of the COE, that will adversely impact the safe learning environment.		Re-scheduling / break in classes to restart after completion of proposed construction activities Re-scheduling of daily working hours for construction workers to accommodate teaching activities Accommodating / shifting classrooms to other existing / available rooms within COE to avoid any loss of teaching/training Provisions of Temporary facilities to serve as classrooms for the construction duration Shifting the impacted classrooms, hostels etc., to a temporary rented facility	
Construction Phase					
1	Construction camps, material and equipment yards	Exploitation of local facilities/utilities such as electricity and temporary construction activities like material placement and storage may temporarily affect the routine matters of COEs administration.	Moderate	Contractor will prepare SSEMPs using the information and suggestions proposed in EMPs. Contractor will follow the best management practices for handling and disposal of the material if found during refurbishment. Contractor will ensure that the baseline conditions are recorded before establishing camps and other site facilities. Contractor will establish the camp where necessary and land is available. Contractor will maintain photographic record of area adjacent to the camp site and other features are taken prior to commencement of any work activity which will be used as a reference during site restoration.	Low
2	Wastewater Generation at Construction Camps	Wastewater will be generated at the construction camps. If the generated wastewater is not properly treated or disposed of, this may	Moderate	Domestic effluents from the construction camp will be disposed by the development of on-site sanitation systems i.e. septic tanks. Contractor will ensure that latrines, septic tanks, and	Low

Sr. No.	Project Components/ Activity	Impacts	Impacts Significance without Mitigation Measures	Mitigation Measures	Residual Impact Significance
		contaminate the nearby surface water resources (if any) apart from soil contamination. The wastewater generation is estimated to be 800 liters/day for 25 construction workers for each COE		soaking pits or sumps are built at a safe distance from water body (tube wells or hand pumps), stream, or dry streambed and the bottom of the sump or soaking pits are above the ground water level. Proper monitoring to check the compliance of PEQS will be carried out (as advised by EHS Specialists).	
3	Solid Waste Generation at Construction Camps	Considering the construction workforce (about 25 in numbers / COE), an average solid waste generation rate of 0.5 kg/capita/day ¹⁰⁵ is adopted for the estimation of solid waste generation. Based on this assumption, about 12.5 kg solid waste will be generated from construction camps on daily basis at each COE which means that total solid waste generation for 20 COEs will be 250 kg/day.	Moderate	All the solid waste from the camps will be properly collected at source by placing containers and disposed of through proper solid waste management system. The Contractor will coordinate with local representatives and administration concerned department for the disposal of solid waste. The concerned department will develop a plan of action for transporting the waste to the disposal site for final disposal. It is the responsibility of the concerned department to ensure that the disposal site is properly lined to prevent the leachate from contaminating the groundwater. Secondly, the disposal site will be located away as far as practical from populated areas.	Low
4	Solid Waste Generation at Construction Sites	The construction waste will include damaged or spoiled materials, demolished materials, temporary and expendable	High	Site-specific waste management plan for each COE will be developed to implement an efficient and responsive solid waste management system during construction phase.	Low

¹⁰³ D. Hoornweg and P. Bhada-Tata. 2012. What a Waste : A Global Review of Solid Waste Management. *Urban Development Series; Knowledge Papers*. No. 15. World Bank, Washington, DC. Based on UNEP estimates for waste generation in the Asia Pacific. Average is 0.45 kg/capita/day.

Sr. No.	Project Components/ Activity	Impacts	Impacts Significance without Mitigation Measures	Mitigation Measures	Residual Impact Significance
		<p>construction materials etc. The construction waste types also include timber, metals, rubber, concrete, electric cables, old machinery/equipment, etc. The handling and storage of oil and other hazardous waste will be a source of environmental pollution during the excavation, foundation, levelling, carpeting and pavement activities. Due to old construction, there may be a possibility of presence of Asbestos during repair and refurbishment work.</p>		<p>Recyclable wastes e.g. steel bars will be sold to waste vendors. Site-specific plan will also contain exact location of excavation and quantum of soil to be excavated and disposed. Contractor will follow Best Management Practices for Asbestos safe handling, packaging and disposal. For this purpose, site-specific Asbestos management plan needs to be prepared by the contractor for each COE and seek prior approval from Supervision Consultant's EHS Specialist. The site-specific Asbestos management plan will cover ways to handle, store, precautions, transport, safe handover to trained professionals for its disposal.</p>	
5	Loss of Vegetation	<p>Construction of new building blocks may cause tree cutting at three COEs (GCTW Faisalabad, GTTI Murree, GST Murree) and damage to green landscapes in almost all COEs.</p>	High	<p>Clearing of green surface cover for construction, cutting trees and other important vegetation during construction will be minimized. The exact amount of tree count can be verified during design and designer will make best possible use of skills to avoid tree cut.</p>	Low
6	Load on Sanitation and Sewage System	<p>Population influx during project construction activities may cause severe impact on existing utilities such as sewerage and sanitation infrastructure of COEs as in most of the COEs have poor sewerage system.</p>	Moderate	<p>Access to nearby lavatories will be allowed or provision of temporary toilets will be made. Construction worker camps will be necessary, based on the scale of the works needed. The construction camp will be provided with toilets, soakage pits or portable lavatories or at least pit latrines. Disposal of surplus materials will also be negotiated through local authority approvals prior</p>	Low

Sr. No.	Project Components/ Activity	Impacts	Impacts Significance without Mitigation Measures	Mitigation Measures	Residual Impact Significance
				to the commencement of construction. If surplus materials arise from the excavation activities, it will be used elsewhere on the subproject before additional soil, rock, gravel or sand is brought in.	
7	Water Usage	Project activities at all COEs would increase the groundwater/drinking water consumption rate, due to sudden increase in number of consumers during construction.	Moderate	Contractors will make temporary arrangements for construction / drinking water in a manner that existing water users will not be affected. For this purpose, contractors will meet their water requirements through water bowsers tanks with drinking water requirements met through bottled water. No groundwater and water supply of COE will be utilized during construction period to avoid any conflict. Contractors will train the staff and labor on less water consumption and to minimize the wastage of drinking water.	Low
8	Exploitation / Disturbance of Utilities	Project activities at all COEs may trigger unnecessary exploitation of electric power and natural gas supplies. As the COEs have to bear all the expenses/dues of consuming electric or gas resources. Any exploitation or usage by contractor may cause impact on consumption of resources.	Moderate	Contractor will bring or use their own power sources i.e. generators or gas cylinders for all kind of activities. The contract will include the bindings on contractor and in case any exploitation to COEs resources occurs, contractor will be bound to bear the utility bills.	Low
9	Traffic Congestion	Traffic congestion is expected in the vicinity of COEs due to increased number of vehicles and movement of construction machinery.	High	Preparation of traffic management and construction machinery movement plan in each SSEMP. Submit temporary haul and access routes plan one month prior to start of works. Formulate and implementation of a plan of alternate routes for	Low

Sr. No.	Project Components/ Activity	Impacts	Impacts Significance without Mitigation Measures	Mitigation Measures	Residual Impact Significance
				heavy vehicles. Installation of traffic warning signs, and enforcing traffic regulations during transportation of materials and equipment and machinery.	
10	Air Quality	It is expected that air quality in the vicinity of COEs may decline due to increased traffic volume, movement of construction machinery and generation of dust in from construction activities. This may affect the construction camps, COEs themselves and more specifically the sensitive receptors nearby GCT Multan, GCT Bahawalpur, GCT Gujranwala, GCT Lahore and GCT Sialkot.	Moderate	<p>The construction work at COEs where sensitive receptors are nearby, will be scheduled during vacations only, to avoid any impact or disturbance to sensitive receptors.</p> <p>Client/Supervisory Consultant will make sure that no construction activity is done when the sensitive receptors/institutions are operational.</p> <p>The construction machinery and vehicles will be kept away from sensitive receptors as much as possible. Undertake regular spraying of water on traffic routes and places prone to cause dust pollution.</p> <p>Trucks carrying spoil materials will have tarpaulin cover to prevent spills during haulage.</p> <p>Suspended particulate matter (SPM) will be monitored at dust creating sites such as crushers, and dust mask will be issued to workers.</p> <p>Need of large stockpiles will be minimized by careful planning of the supply of materials from controlled sources.</p> <p>Stockpiles will be covered with tarpaulins when not in use and at the end of the working day to enclose dust.</p> <p>Aggregate material will be delivered to the batching and/or asphalt plant in a damp condition, and water sprays will be applied if needed, to reduce dust emissions.</p> <p>Fuel-efficient and well-maintained haulage trucks will be employed to minimize exhaust emissions.</p>	Low

Sr. No.	Project Components/ Activity	Impacts	Impacts Significance without Mitigation Measures	Mitigation Measures	Residual Impact Significance
				Ambient air monitoring will be conducted after periodic intervals as mentioned in the EMP.	
11	Noise	Normally, noise at construction sites is produced due to the operation of heavy construction machinery/equipment, operational works of workshops at construction camps, etc. However, no such heavy machinery is anticipated to be used during construction of COEs and construction camps are proposed to be located outside the COEs. That's why it is anticipated that noise will not be very much high that could impact the daily routine operations of the COEs.	Moderate	<p>Construction camps and workshops are required to be located outside the premises of COEs. In this way, noisy operations of workshops would stay away from the COEs. Contractor will be responsible to provide the construction workers with suitable hearing protection like ear muffs or earmuffs at noisy workplaces. No sensitive receptors were reported to be present adjacent or nearby the proposed interventions except a mosque present adjacent to COE of GCT, Wahdat Road, Lahore. In this scenario, it is required to reschedule construction activities in a way that prayers hours would not be disturbed</p> <p>All construction equipment and machinery will be fitted in full compliance with the national and local regulations and with effective silencing apparatus to minimize noise.</p> <p>As a rule, the construction activities will be confined to daylight hours only. No such activity will be conducted during night hours.</p> <p>Construction equipment like generators, which generates excessive noise, will be enclosed or fitted with effective silencing apparatus to minimize noise.</p> <p>Contractor will take adequate measures to minimize noise nuisance in the vicinity of construction sites by way of adopting available acoustic methods such that at the edge of the work sites noise will be</p>	Low

Sr. No.	Project Components/ Activity	Impacts	Impacts Significance without Mitigation Measures	Mitigation Measures	Residual Impact Significance
				less than 55 dB(A) Leq during the day hours. Noise monitoring will be conducted after periodic intervals as mentioned in the EMP.	
12	Ground Vibration	<p>No heavy machinery or any blasting activity is anticipated to be used which could generate severe vibrations and cause damage to nearby structures. Furthermore, no deep excavations or pilings are expected during construction period and no damaged</p> <p>or structurally unsafe buildings are situated near new civil constructions works within the COEs which could be impacted. Most of the buildings around the project sites are not likely to be affected by the vibration induced impacts. The impact and likelihood is therefore rated as medium.</p>	Low	<p>Client/Supervisory Consultant must make sure that no construction activity is done when the sensitive receptors/institutions are operational.</p> <p>Designer should assess the existing infrastructures stability and strength.</p> <p>Contractor should use shock absorbers where impulsive actions are proposed near the old buildings (if any).</p> <p>Review requirements for piling and use of powered mechanical equipment. Non-percussive piling methods to be used wherever practicable.</p> <p>Percussive piling will be conducted in daylight hours.</p> <p>A pre-construction vibration survey will be carried out by the contractor to identify buildings which can be severely impacted by the vibration induced impacts.</p>	Low
13	Soil Contamination	Soil contamination is expected due to spill of lubricants, fuel, chemicals and other construction waste material.	Moderate	<p>To avoid the chemical and oil spills such materials will be properly stored and maintain good housekeeping by the Contractor.</p> <p>Contractor will ensure that the maintenance of vehicle (LTV and HTV) and other plant takes place only in designated areas underlined with concrete slabs and a system to catch surface runoff.</p> <p>The contractor will construct lined wash area for vehicle washing. Contractor will ensure effluents from plant</p>	Low

Sr. No.	Project Components/ Activity	Impacts	Impacts Significance without Mitigation Measures	Mitigation Measures	Residual Impact Significance
				washing and other potentially contaminated effluents are released into soaking pit.	
14	Impact on Fauna	No major impact on the protected areas is expected. However, care must be taken during construction at COE in Bahawalpur as Lal Suhanra Protected Area is 58 km away from GCT Bahawalpur.	Low	Contractor will sign a binding that no intrusion or damage to protected area will take place during the whole construction period. Contractor will train the staff and labors to be careful about demarcated area and any involvement outside the construction camp will be monitored. Poaching, hunting, camping near the protected area will be banned.	Low
15	Social Issues	Local conflicts between workers and students/staff of COEs may occur, privacy of women in COEs may be at risk.	Moderate	Contractor will ensure that workers follow the work ethics and will ensure that project staff interaction with students/staff and COE staff is minimum. Contractor will not allow any offence by their workers. Contractor and workers will respect the local conditions. Claims/complaints of the students/staff on construction nuisance/damages will be considered and responded promptly by the Contractor. Active construction sites will be cordoned off to maintain the privacy of the female students and staff. To maintain the privacy and minimum interaction of workers with students and staff members, other nearby gates of the COEs could be utilized instead of main gates.	Low
16	Public Health and Safety	Risks to community health and safety from construction activities, traffic/machinery movement, or failure of the building's safety features can be higher if	High	The construction activities can be planned during vacations to avoid any impact on students or staff. The construction activities will be performed in separated areas or at the remotest	Low

Sr. No.	Project Components/ Activity	Impacts	Impacts Significance without Mitigation Measures	Mitigation Measures	Residual Impact Significance
		<p>construction sites are not fenced off properly. In addition, the prevailing Covid-19 situation may add risks of transfer either way i.e. from workers to community and community to workers.</p>		<p>possible point to avoid any direct impact on public. Health, Safety and Environment (HSE) plan with an additional component of community Health and Safety will be developed and implemented by the contractor. The contractor will ensure that medical staff headed by qualified medical doctor, first aid equipment and stores, sick bay and suitable ambulance service are available at the camps all time.</p>	
17	Occupational health and safety issues	<p>Risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological hazards during project construction would be higher. The prevailing pandemic may also cause severe health issues. The students and staff of COEs would also be prone to such risks.</p>	High	<p>The contractor will follow Government of Pakistan Covid-19 guidelines for construction (Appendix-8) and ADB guidance on Covid-19, which includes provision of masks, hand sanitizers etc. Training on health safety and environment will be conducted by specialist every 3 months. The Contractor will also prepare emergency response plan for such an outbreak in the construction camp. A comprehensive SSEMP and HSE plan will be developed and implemented by the contractor. Contractor will provide potable water and also shadow area to the workers at work place area for short breaks. The Contractor will depute guards at all entry points into construction sites 24 hours a day. Contractor will ensure no machinery is left unattended in the project area. Providing adequate PPEs to the workers, warning signs. Potential for spread of vector borne and communicable diseases from labor camps will be avoided (worker awareness orientation and appropriate sanitation will be maintained)</p>	Low

Sr. No.	Project Components/ Activity	Impacts	Impacts Significance without Mitigation Measures	Mitigation Measures	Residual Impact Significance
				A monthly safety championship program at each site will be organized to encourage workers to adhere with health and safety requirements.	
18	Handling, Transportation and Storage of Lab Equipment	The transportation and installation of project equipment may have an interaction with the ongoing construction activities.	Moderate	Civil contractor will cooperate and understand the importance of machinery transfer and installation in the COEs. The installation contractor will follow HSE guidelines and SSEMPs requirements. Equipment transfer plan will not coincide with major construction activities.	Low
19	Impact on Sensitive Receptors	Impact on Sensitive Receptors (other educational institutes nearby to GCTs in Multan, Lahore, Sialkot, Gujranwala and Bahawalpur.	Moderate	Civil contractor will consider the sensitive receptors part of project area. SSEMPs of these five COEs will consider a comprehensive plan for controlling environmental, health and safety risks to the nearby community. Risk assessment will be done to avoid any impact to the sensitive receptors. Measures will be taken to control dust, noise and wastewater emissions. Contractor will share a copy of SSEMP with the administration of receptors institutes.	Low
20	Restoration/ Rehabilitation of Sites	The execution of construction work would have an impact on the existing land use, utilities and aesthetic values. The closure of construction activities may leave a certain impact on COEs.	Moderate	Contractor will be asked to submit rehabilitation and restoration plan along with SSEMPs. Camp site is restored as per contract. Contractor will make sure that none of the COEs' utilities are disturbed or exploited. All extra products / materials, solid and liquid will be disposed off in accordance with the requirement of the EIA and contract document by the contractor.	Low

Sr. No.	Project Components/ Activity	Impacts	Impacts Significance without Mitigation Measures	Mitigation Measures	Residual Impact Significance
				Contractor will make sure that site restoration is near to the baseline settings and the damage to land, property, and trees is compensated.	
OperationPhase					
1	Noise and Vibration	Increase in noise levels in the area due to influx of more students is expected in operation phase. The noise levels are already high during night times as per baseline environmental monitoring results. According to IFC Guidelines, if the background noise levels already exceed the standard, a maximum increase in background levels of 3 dBA is allowed. The noise levels are likely to increase but would remain within the 3dBA criteria and therefore does not require any specific mitigation measures (like noise barriers). This impact significance is moderate. Vibration induced impacts are not anticipated during the operation phase	Moderate	The installation of double-glazed windows and fixed glass windows with air conditioners are required to reduce noise in hostels and new buildings. (Safety signs such as "No Horns Please" will be placed at parking lots. Consideration of noise reducing measures i.e. operating the equipment in day time and closing the windows during classes.	Low
2	Health and Safety Issues to Students in Dormitories	The planned blocks in GCT Multan are across the road to other building blocks and there is a possibility of free movement between both blocks. The students/staff can be	Moderate	If building blocks are proposed on both sides of road then there will be a provision of pedestrian bridges in detailed design of COEs to avoid any accidents. In all buildings, firefighting equipment will be installed. Students/staff will be given training on HSE and fire risks.	Low

Sr. No.	Project Components/ Activity	Impacts	Impacts Significance without Mitigation Measures	Mitigation Measures	Residual Impact Significance
		at risk of road accidents. Further, COEs and hostels may have ventilation and fire risks due to natural gas or cylinders uses		Proper installation of HVAC in COEs is required. First aid box will also be readily available in the buildings.	
3	Water Usage	The drinking water consumption would also increase due to increase in number of students/staffs in COEs.	High	There will be a general thumb rule of preserving the natural resource and not wasting it. Training sessions will be conducted on groundwater preservation	Low
4	Damage to Compensatory Tree Planting	The new saplings of trees which construction contractor may grow as compensation to the expected damage to green lawns and trees during construction, can be impacted by trespassers.	Moderate	Engagement of landscape inspector to observe the growth of trees and well-being of grassy lawns.	Low

8. STAKEHOLDERS CONSULTATION AND INFORMATION DISCLOSURE

8.1. Introduction

315. Stakeholders' consultation was done as an integral part of environmental assessment process of the proposed project. During field visits to all 19 COEs for due diligence, consultation was used as a tool to acquire basic information from Heads/Principals of COEs. Initially, it was planned to conduct detailed consultation in April/May 2020 with all relevant stakeholders to educate them about the proposed actions of the project and to get their concerns or recommendations. However, due to prevailing global pandemic (Covid-19), the government of Pakistan had imposed lockdown across the country, and it was not possible to conduct consultations following normal procedures. To adapt with new normal life settings, it was decided to carry out stakeholders' consultations through phone calls as per the instructions of ADB Stakeholder Analysis and Consultation Tool. For this, the IWRPP coordination team provided the list of focal persons from relevant department. The consultations with PVTC, TEVTA, PSDF, private stakeholders and other government officials was performed through phone calls keeping the discussion around following points:

- (i) What is IWRPP and how it will be beneficial for the concerned department and public in general?
- (ii) What are the major concerns or recommendations for IWRPP?
- (iii) How IWRPP will affect the social, economic and environmental settings of Punjab?

316. However, after lockdown when life begins to normal 2021-2022, the field visits to all CEOs' were conducted for Rapid Environmental Assessment and consultations with CEOs' staff in June, 2022. Follow up consultations with the stakeholders from each COEs, immediate local neighborhood of COEs, tehsil or district offices, FGDs communities including vulnerable groups will be carried out prior to preparing the site-specific EMPs and during implementation phase.

317. This participatory process helps in reducing the stakeholder's resistance to change and enables the participation of the relevant departments in the decision-making process. Stakeholders' consultation is the major keys to any success in infrastructure development. The sustainability of any infrastructure development depends on the participatory planning in which consultation plays a major role.

318. The environmental assessment process under the Pakistan Environmental Protection Act 1997 (Punjab Environmental Protection Act Amended 2012), requires the disclosure to the public after the statutory EIA / EIA has been accepted by the Punjab EPA, to be in strict adherence to the rules.

319. In this EIA, the consultation process was also performed to satisfy the ADB requirements (Safeguard Policy Statement 2009) and disclosure will be followed as well as ADB's guidelines on Access to Information (AIP 2018). The policy, led by a new overarching principle of clear, timely, and appropriate disclosure, contains principles and exceptions to information sharing with external stakeholders.

8.2. Objectives of Consultations

320. The basic objective of the consultations is as follows:

- (i) Understand views of the key stakeholders and generate ideas regarding the expected demands of the parties;

- (ii) Disseminate information to the stakeholders about the project in terms of its activities and scope of work; and understand the views and perceptions of the counterparts.
- (iii) Identify, assess major economic and social information and characteristics of the project area to enable effective project planning and its implementation.
- (iv) Resolve issues related to impacts on stakeholders.
- (v) Examine COEs' opinions on project interventions.
- (vi) Identify levels and extent of stakeholders' participation in project implementation and monitoring.
- (vii) Establish an understanding for identification of overall developmental goals and benefits of the project.
- (viii) Disseminate information to and develop a thorough coordination with different government, non-government and public private sector stakeholder line agencies ensuring their participation and mobilization of support in the process for the successful planning and implementation of the project.
- (ix) Assess the concerned people's willingness to get involved with the project; and enumerate the measures to be taken during the implementation of the project.

8.3. Identification and Selection Criteria for Proposed Project Stakeholders

321. The criteria for selection of stakeholders is based upon the proposed project interventions and the level of engagement to execute or to implement the activities. The IWRPP team interacted with TVET sector and major industry groups to understand the breadth and depth of the need for this project. The same public level and private level stakeholders were the primary stakeholders which are identified as:

- (i) PSDA
- (ii) PVTC
- (iii) TEVTA
- (iv) Planning & Development Department, Government of Punjab
- (v) Heads/Principals of COEs
- (vi) Hunar Foundation & Other Private TVET Sector Organizations
- (vii) Association for Builders and Developers of Pakistan
- (viii) All Pakistan Textile Mills Association etc.

322. All these stakeholders have different types of stakes according to their roles, interests and scope. It is important to emphasize that the public consultation is a continual process that will be conducted throughout the project development phase with different public and private stakeholders through dialogue and discussion. These consultations will continue during the project detailed design phase whenever required. Follow up consultations with the stakeholders from each COEs, immediate local neighborhood of COEs, tehsil or district offices, FGDs communities including vulnerable groups will be carried out prior to preparing the site-specific EMPs and during implementation phase.

8.4. Consultations – Concerns & Responses (Primary Stakeholders)

323. As mentioned earlier, the approach to conduct stakeholders' consultation was initially as per new normal i.e. no direct meetings were conducted, and stakeholders were approached

through phone calls. During the consultations, stakeholders were requested to express their concerns with the proposed project and to provide suggestions that can address unforeseen challenges and concerns.

324. During the consultations, stakeholders were informed about the scope of the project and its various components. They were also informed about the stakeholder's involvement and their roles and responsibilities in this project. Following sections summarize the consultations which have been performed so far.

1. Consultations with Government Departments & Public/Private TVET Sector

325. The consultations were conducted with government officials and TVET sector (public/private). The consultations were conducted through phone calls amid Covid-19 situation. The project brief introduction, activities and quantum were expressed to the stakeholders. The stakeholders' feedback (concerns/recommendations) on project and its social/economic/environmental impact was recorded and summarized below:

Table 8.1: Consultation with Government Departments and TVET Sector

Sr. No.	Details	Name of Focal Person / Designation	Contact No.	Date & Time of Call	Concerns / Suggestion Recommendations
1	Planning & Development, Punjab	Mr. Kashif, Chief Production Sector	+92 335 4708282	19 th May, 1400 HRS	Covid-19 situation has made us realized the importance of skilled workforce that can work abroad. Idea of upgrading 19 COEs and development of curricula meeting international standards must be given priority.
2	Environment Protection Department, Punjab	Ms. Pakeezah Bukhari, Assistant Director	+92 321 9044492	20 th May, 1300 HRS	It must be checked that consumables/chemicals to be procured under this project are non-hazardous. If hazardous nature chemicals are included then EIA can be recommended.
3	Public Sector Development Program (PSDP)	Mr. Haroon Naseer, Additional Project Director	+92 333 4491980	19 th May, 1100 H R S	The project sounds great as in skills requirements are reflected. It has soft interventions and could be operated through public private partnerships. I have heard that skill labor will be involved on ADB projects, that's also a great step. The recommendations are such programs should be aligned with master planning strategy. Secondly, concessional loan category for this important social sector must be approved. Regarding environment, designer must prepare detailed design in consultation with environmental expert.
4	Punjab Skills Development Foundation	Mr. Ali Bosan, Chief Operating Officer	+92 300 8412394	21 st May, 1200 HRS	We have been working on this idea since last two years. We prefer two components i.e. trainings (Build4Skills) and challenge fund to upgrade the skilled workforce who can work locally and in abroad.

Sr. No.	Details	Name of Focal Person / Designation	Contact No.	Date & Time of Call	Concerns / Suggestion Recommendations
5	Technical Education and Vocational Training Authority (TEVTA)	Mr. Shujaat Ali Khan, Deputy General Manager	+92 334 4195964	20 th May, 2000 HRS	COEs would be an asset in future, we encourage the investment in building the infrastructure. Upgraded COEs would help in building the capacity of skilled workforce and its readiness. However, we have to think about that what will be governance arrangement for such a huge investment.
6	Punjab Vocational Training Council (PVTC)	Mr. Shafqat u Rehman, Manager Research & Development	+92 42 3520925 2	19 th May, 1200	Solar panels must be installed at all COEs. The green energy and green building concept must also be introduced. Social and economic benefits are huge, and we have full confidence in this project.
7	Lahore Chamber of Commerce (LCCI)	Mr. Furqan Muneer, Deputy Secretary	+92 321 4919479	19 th May, 1230 HRS	Good initiative that may address a gap between supply and demand, but forums must be used to assess the needs of the market for adaptation.
8	Multan Chamber of Commerce and Industry (MCCI)	Mr. Mian Rashid Iqbal, Senior Vice President	+92 300 8635156	19 th May, 1500 HRS	Project plan must be aligned with existing situation, curricula should be developed as per need assessment. We recommend involvement of foreign consultants and inclusion of subjects such as dairy farming, data analysis, elderly caring in the curricula.
9	Rawalpindi Chamber of Commerce and Industry (RCCI)	Mr. Waqas, Officer R&D	+92 309 6666564	19 th May, 1530 HRS	Good project and should be appreciated at all forums.
10	All Pakistan Textile Mills Association (APTMA)	Mr. Shahid Sattar, Executive Director	+92 333 5237680	19 th May, 1600 HRS	This is good initiative and may provide the required skilled workforce as per requirements.
11	Hunar Foundation	Ms. Ayesha Akram	+92 300 4326684	19 th May, 1030 HRS	Female skilled workers are need of the hour; a gender balanced approach should be followed to implement this program. COEs should have quality instructors, preference should be given to teachers training.
12	Association for Builders and Developers (ABAD)	Mr. Mohsin Sheikhani, Chairman	+92 323 3307308	20 th May, 1230 HRS	It's a good project and should be in line with the private sector demand.
13	Rubitrans Lab	Sabrina, head of strategic	+92 321 9044492	20 th May,	Students are theoretically strong, but training component is weak, an integrated approach and need based trainings is

Sr. No.	Details	Name of Focal Person / Designation	Contact No.	Date & Time of Call	Concerns / Suggestion Recommendations
		alliances & collab.		1330 HRS	important. The project will have positive impact.
14	COTHM	Mr. Nadeem Anwar	+92 300 9444896	19 th May, 1130 HRS	Private sector should be given preference in such initiatives, a model on PPP mode may also work.
15	Infinity	Mr. Noman Ilyas	+92 311 5091325, +92 42 3797001 1	19 th May, 1330 HRS	The focus should be more towards ownership and handing over this project to multiple private sector groups who have close liaison with industry.
16	Atlas Honda	Mr. Khalid Aziz	+92 300 4326652	19 th May, 1430 HRS	Private sector must be strengthened. Government sector institutes may need a lot of effort for upgradation. Supervision and execution must be under some quality governance mechanism.

2. Consultations with COEs

326. A Rapid Environmental Assessment (REA) was carried out by using pre-designed questionnaire which comprised of open-ended basic questions about physical, ecological and socioeconomic environment of the project sites. Questionnaire was also designed in a way to record concerns / apprehensions and suggestions / recommendations of the staff and students of the concerned Centre of Excellence (COEs). A team of Environmental Experts visited each COE and collected baseline environmental conditions through field observations and stakeholder consultations in the months of May-June, 2022. Follow up consultations with the stakeholders from each COEs, immediate local neighborhood of COEs, tehsil or district offices, FGDs communities including vulnerable groups will be carried out prior to preparing the site-specific EMPs and during implementation phase. **Table 7.2** presents the summary of consultations conducted at each COE whereas details are available in questionnaires attached as **Annex-XIV**. A brief description of the REA findings is provided below:

327. **Physical Environment:** Punjab is Pakistan's second largest province by area after Balochistan with an area of 205,344 square kilometers (79,284 square miles). It occupies 25.8 percent of the total landmass of Pakistan. Topographically, Punjab can be divided as: Upper hilly region; Potohar (or Potwar) plateau; Central plain lands (Doab); Desert like plains; and Cholistan and Thal deserts. The concerned districts are scattered in above mentioned landforms of Punjab.

328. Groundwater is the main source of water supply in the institutions which is either extracted through water turbines installed within their premises or distributed public water supply network by the respective municipalities. In most of the cases, water is stored in the overhead water reservoirs and distributed through pipeline network laid down in the institutions. As per data collected from field, groundwater table varies from 80 to 850 feet. Normally groundwater quality is reported as good except few of the districts namely Faisalabad, Bahawalpur, some areas of Lahore, etc. having poor water quality. Filtration plants have been installed to provide safe drinking water to the students and staff members. Some of the institutions also lack filtration plants and intents to install them for safe drinking water for their students.

329. Almost all the institutions have separate wastewater collection system comprising of septic tanks, disposal stations, drainage lines, etc. Some of the institutions situated in Sahiwal, Faisalabad, etc. also drain out their effluents in agricultural lands directly. No natural surface water bodies having impact due to project interventions are identified near the COEs.

330. Solid waste bins are placed in each institution for solid waste collection which is normally picked-up by respective municipal committee, and waste management companies in big cities e.g. Lahore Waste Management Company (LWMC), etc. for disposal purpose. Solid waste burning was also witnessed within the premises of various institutions. Major sources of air and noise pollution near institutions are vehicular traffic and industries especially present near GCT, Gujranwala.

331. The province of Punjab is vulnerable to most kinds of disasters, with floods in rivers. Punjab faces floods in varying intensity almost every year. There have also been examples of tornadoes and earthquakes in the province, but their frequency has been quite low, with most of the Punjab being relatively safe with regards to vulnerability to earthquakes. Some areas such as Murree and parts of the Rawalpindi Division are located on a fault line hence vulnerable to earthquakes. Tornadoes too are a rare happening in Punjab. Punjab's geographic location and climatic conditions make it more vulnerable to monsoon floods and droughts in the southern areas. The effects of climate change and associated variability in the monsoons means that the occurrence and intensity of floods have significantly been increased in the last few years. The worrisome facts are that different rivers have caused flooding in different areas of the province including riverine, urban and flash floods (hill torrents) during last few years. The COEs proposed in hilly areas like Murree may experience earthquake hazards and snow storms. However, no historical flood evidences are reported from relative institutions. Heat wave is the common phenomenon of the Punjab.

332. **Ecological Environment:** The details of flora and fauna species of each location are given in REAs which are attached as Annex-XIV. However, number of trees being cut /affected are also provided in Table 7.2. Most of the buildings (except GCT, Printing & Design, Lahore, etc.) are being renovated/restored by using existing project footprints. That's why no major impacts on flora and fauna species are anticipated due to proposed project interventions. Furthermore, COEs do not fall within any game reserve, wildlife sanctuary and reserved/ protected forests. No endangered or threatened species will be impacted due to proposed project interventions.

333. Site proposed for GSTC located in Murree is not suitable for construction as about 50 numbers of trees may need to be cut. For this purpose, some alternate sites need to be identified.

334. **Socioeconomic Environment:** Since the institutions are located in densely populated areas, therefore, majority of social services such as education, health facilities, commercial areas, mosques, etc. are available within few kilometers from project sites. People have an opportunity to use public/private transport to reach these facilities. Most of the institutes have their own dispensary, located within their premises. Punjabi, Urdu and English are being spoken and well understood in whole Punjab. However, Saraiki and Pothohari languages specifically belong to Southern Punjab (Multan, Bahawalpur, etc.) and Northern Punjab (Murree, Rawalpindi, etc.) respectively. There are no cultural / religious sensitive sites present near the COEs which could be impacted due to the project interventions.

335. The summary of consultations (held during due diligence in May-June 2022) with COEs as described above is given below:

Table 8.2: Consultations with Centers of Excellence

Sr. No.	Name of the Institution	Ground Water Depth (feet)	No. of Tree to be Cut	Name of Focal Person & Designation	Contact No.	Meeting Date	Concerns / Apprehensions	Suggestions / Recommendations
1.	Govt. Staff Training College, Murree	400	50	Mr. Ahmad	+92 333 4174611	24 th	• Protection of Ecosystems.	Mitigations should be adopted during the construction of COEs.
2.	Govt. Technical Training Institute (Women), Murree	300	10	Ms. Rehana Abbasi	+92 51 3413071	24 th June 2022	<ul style="list-style-type: none"> • Privacy issues • Building layout and design 	<ul style="list-style-type: none"> • Wall raising to make the residential area separate • Roof slope must be provided for easy snow removal

3. Gender Responses/Issues

336. The consultations at COEs were enhanced through interaction with COEs staff. The main feedback in general related to gender is as follows:

- (i) Females staff said that females must be given trainings separately.
- (ii) There was a suggestion that there should be a female in GRC specifically to listen and register the complaints of females regarding the irregularity in the supply of water or any kind of issue in the quality of water or any sewerage related issue. In this way they can easily go to GRC to get the water services in a better way.
- (iii) They said that many infectious diseases are spreading due to the ponding of sewer water.
- (iv) They also agreed upon that people should not throw their garbage in sewer lines which ultimately resulted in blockage of sewer lines.
- (v) Some females were concerned about restricting their movement due to movement of labor force during construction.

4. Random Feedback from COEs

337. The consultations at COEs were done randomly with staff and the outcome is summarized below:

- (i) Public safety should be on top priority during construction.
- (ii) The sewerage system can become problem during construction
- (iii) Ponding problems in low lying areas during rainy season are evident.
- (iv) Decades old piped network is more prone to leaks and rusts as many of the pipelines are reported to be old and in poor condition.
- (v) Deteriorating water quality is due to mixing of sewage, which is caused by damaging of water supply pipes during laying of new sewers.
- (vi) The traffic should be managed properly during the execution of the Project.
- (vii) The mechanism should be developed in such a way that the non-availability of electricity should not affect the training and learning process.
- (viii) Contractor's activities should be confined to construction area only.
- (ix) Dust produced due to construction activities may create different health problems, therefore water sprinkling should be carried out regularly to suppress the dust emissions.
- (x) During construction, labor force movement should be controlled so that activities of the student are not disturbed

8.5. Disclosure Requirement and Procedures (Awareness, dissemination etc.)

338. The project executing agency ICI & SDD will disclose this EIA and EMP to all the stakeholders before the commencement of the proposed project. The EIA report will be made available to the stakeholders at the sites designated by the Punjab EPD, in accordance with the PEPA, 2012 legislation. In addition, the executive summary of the EIA will be translated into Urdu language (if necessary) and made available to the affected people (and kept at the project sites). This will ensure that the local communities are aware of the project, its key impacts, the mitigation measures and the implementation mechanism. In addition, the Executive Summary will be disclosed through the ICI & SDD official website. The EIA Report will also be disclosed on the ADB Website.

9. ENVIRONMENTAL MANAGEMENT PLAN

9.1. Introduction

339. The EMP presented here provides the mechanism to implement the mitigation measures and assistance in infrastructure development identified during the environmental assessment, based on primary (ERA) and secondary data. The EMP proposes an effective plan of action that will indicate responsibilities and required measures to minimize the negative environmental & social impacts at various stages of the project. It is the responsibility of the Contractor to develop Site Specific Environmental Management Plan (SSEMP) using this EMP and get approval from PIU with endorsement of ADB, before the commencement of physical works on site.

9.2. Objectives of EMP

340. Environmental Management Plan (EMP) provides a mechanism to address the adverse environmental impact of a project during its construction, to accelerate project benefits, and to introduce standards of good practice to be adopted for all project works. The objectives of the EMP are to:

- (i) Define the responsibilities of the project proponents, contractors and construction supervision consultants;
- (ii) Facilitate the implementation of the mitigation measures identified in the EIA;
- (iii) Define a monitoring and reporting mechanism and identify monitoring parameters;
- (iv) Provide a procedure for reporting and timely action in the face of unanticipated environmental situation; and
- (v) Identify training, requirements at various levels.

9.3. EMP Reporting Requirements

341. The reporting and feedback mechanism will comply with the EIA and EMP for all aspects of the environment. The monitoring and reporting requirements for design, construction and operation phase are provided in Table 8.1. The roles and responsibilities of relevant institutions and their staff for implementation, monitoring and reporting of EMP is further clarified in this section.

342. During the design phase, the DD Environment - PIU, will prepare monthly compliance report on the EMP implementation. During construction, the construction contractor, through the environmental specialist on the contractor team, will prepare monthly status reports on the EMP implementation (including measures for mitigations of impacts). Such reports will carry information on the main types of activities carried out within the reporting period, status of any clearances/permits/licenses which are required for carrying out such activities, mitigation measures applied, and any environmental issues emerging. These will also include monitoring reports as specified in Table 8.2. The construction contractors will prepare a SSEMP demonstrating the manner in which they will comply with the requirements of mitigation measures proposed in the EIA, EMP, and SSEMP. The SSEMP's will be approved by DD Environment-PIU, 10 days prior to start of any construction works. After completion of the construction Contractor's contract, PIU will be in charge of the operation and maintenance of the Project and will be responsible for compliance with the mitigation and monitoring plan during operations. During the operation phase. The independent external monitor will do periodic reviews to ensure that monitoring requirements are being met.

343. Regular Reporting to PIU and ADB: All documentation mentioned as part of the reporting requirements, including monitoring related reports from Table 8.1 and 8.2, will be compiled and shared in the form of a "Compliance Report" with the PIU on a monthly basis.

PIU will share this information with other relevant stakeholders, such as ADB, on a regular basis (at least semi-annually). Consolidated comments and feedback on the compliance reports from ADB and PIU will be incorporated into suggestions for modifying or refining the EMP if required.

9.4. Institutional Arrangement for Implementation, Monitoring, and Reporting of EMP during Construction Phase

344. The EA (Secretary ICI & SDD) will establish a PIU to discharge day to day project implementation functions. The PIU, headed by the project director, will be supported by a full-time Deputy Director (Environment) along with other specialists including Lead EHS specialist, two deputy EHS Specialist, financial management, monitoring & evaluation, procurement and contract management, senior engineer, social safeguard team, etc.

345. The key players involved during construction stage of the proposed Project are the Project Director and Deputy Director (Environment) of PIU, ICI & SDD, ADB, Environmental Protection Department (EPD) - Punjab, Lead and Deputy Environment, Health and Safety (EHS) Specialists of Supervision Consultant, and Environment Specialist(s) of the Construction Contractor. The roles, remits and responsibilities of these key players are outlined below.

346. The following staff will be involved in the implementation, monitoring and reporting of EMP:

- (i) Project Director, PIU;
- (ii) Deputy Director (Environment), PIU;
- (iii) Lead EHS Specialist and two (02) Deputy EHS Specialists of Supervision Consultant; and
- (iv) Construction Contractor's Environment Specialist(s).

348. The Construction Contractor will make a bond through contract documents to implement the EIA along with EMP. The whole EIA along with EMP will be included as a clause of the contract documents. Construction camps will be established after necessary approvals from environment representatives from PIU and Supervision Consultant, a submission and approval of contractor's SSEMPs by PIU/Supervision Consultant with endorsement of ADB, ten days before commencement of new works. The organizational setup for implementation, monitoring and reporting of EMP is given below.

1. Roles and Responsibilities

a. EPD-Punjab

349. EPD-Punjab is the national regulatory authority for issuance of NOC for this proposed Project. As part of its mandate, protection of environment (water, air and noise) is its responsibility. Therefore, this agency may inspect the site at any time to check the compliance of EMP.

b. ADB

350. ADB team would make sure the compliance with ADB Safeguards Policy Statement and this EIA's recommendations and approvals.

c. PIU: Project Director

351. Project Manager will have responsibility for assuring implementation of EMP. This includes the following:

- (i) Coordinate activities of consultants or contractors or specialists who may be hired or assigned specialized functions such as implementation, monitoring, and reporting on the actions taken on environmental impact assessment, and other similar activities required under the project
- (ii) Ensuring that the required environmental training is provided to the concerned staff;
- (iii) Carrying out random site visits to the construction sites to review the environmental performance of the Construction Contractors;
- (iv) Review monitoring reports (monthly, semiannual and/or issue specific) or for the progress of environment related activities;
- (v) Make sure that the Construction Contractor is implementing the additional measures suggested by the Lead EHS Specialist in environmental monitoring reports;
- (vi) To assist Contractor for obtaining necessary approvals from the concerned departments.
- (vii) Maintaining interface with the other lined departments/stakeholders; and
- (viii) Semi Annual reporting to ADB, IWRPP Steering Committee and EPD-Punjab on status of EMP implementation.

d. PIU: Deputy Director (Environment)

352. The Deputy Director (Environment) will assist PIU on environmental compliance including:

- (i) In consultation with ADB staff, review and approve the contractor's drafted SSEMPs before the start of actual construction work;
- (ii) Conduct monitoring at each subproject site where works are being conducted document the monitoring findings and submit to the PIU/ADB for review;
- (iii) (IAs) and supervision consultant with respect to implementation of EIA/EIA (NOCs).
- (iv) bidding documents to ensure that EIA/EIA/EMP requirements are incorporated. implementation;
- (v) Identify any gaps in compliance relating to EMP implementation and provide inputs to prepare a Corrective Action Plan (CAP) and monitor its implementation;
- (vi) environmental monitoring reports for submission to ADB and disclosure at EA's website;
- (vii) respective EMPs of the subprojects and implemented by project contractors as and approval;
- (viii) entirety and is fully functional and any grievances are efficiently and effectively addressed and resolved;
- (ix) bi-annual environmental monitoring reports for submission to ADB;
- (x) Review and verify the environmental compliance reports prepared by supervision consultant and/or implementation agencies;

- (xi) Support IAs towards developing EMP implementation mechanism and ensure that IAs are executing the activities in compliance to EIA/EIA/EMP requirements;
- (xii) Inform ADB project team and PIU on environmental non-compliance issues;
- (xiii) Conduct consultations with stakeholders including project affected persons to obtain their views on implementation of environmental safeguards and mitigation measures;
- (xiv) Attend to comments/ suggestions made by ADB project team, PIU and EPD-Punjab; and
- (xv) Provide any other additional support as requested by the PIU to ensure compliance with national safeguard regulatory requirements and ADB SPS 2009.

e. Supervision Consultant: Lead EHS Specialist

353. Supervision Consultant's Lead EHS Specialist will perform following responsibilities:
- (i) Review and update the EIA report due to any major design changes or unanticipated impacts;
 - (ii) Ensure that bidding documents and civil works contracts include provisions on environmental safeguards management;
 - (iii) Review and approve SSEMPs prepared by the contractors before start of construction of sub-projects and where needed and submit SSEMPs for PIU acceptance;
 - (iv) Regularly visit all the COE sites for environmental monitoring and consultation with all relevant stakeholders including but not limited to the COE's management, staff, students, official residents, relevant neighborhood and all other officials concerned;
 - (v) Support the PIU to extend the GRM at field/district level, and organize training for the contractors and PIU's engineering team;
 - (vi) Supervise and review the day-to-day implementation progress of the EMPs, undertake site visits as required, identify environment-related implementation issues, and propose necessary corrective actions;
 - (vii) Liaise with Head/Deputy Director (Environment) of PIU and Deputy Health & Safety Specialist(s) of the Contractors the safety and wellbeing of workers and communities in regards with COVID 19;
 - (viii) Consolidate the day-to-day implementation progress in monthly progress reports for the review of the Head/Deputy Director (Environment) of PIU, and assist the PIU team in preparation of semi-annual environmental monitoring reports for the PIU and ADB;
 - (ix) Coordinate with the PIU to organize training for contractors on environmental management of the project in terms of the government's legal and ADB's Safeguards Policy requirements; and
 - (x) Perform such other functions in the area of environmental management and safeguards as may be requested by the PIU environmental specialist or the team leader.

f. Supervision Consultant: Deputy EHS Specialists

354. Supervision Consultant's Deputy EHS Specialists will perform following responsibilities:
- (i) Assist Lead EHS-Specialist in review and update of the EIA report due to any major design changes or unanticipated impacts;
 - (ii) Assist Lead EHS-Specialist in review and approval of SSEMPs prepared by the contractors before start of construction of sub-projects;

- (iii) Regularly visit all the assigned COE sites for environmental monitoring and consultation with all relevant stakeholders including but not limited to the COE's management, staff, students, official residents, relevant neighborhood and all other officials concerned;
- (iv) Support the Lead EHS-Specialist to extend the grievance redress mechanism at field/district level, and organize training for the contractors and PIU's engineering team;
- (v) Under the guidance of Lead EHS-Specialist, supervise and review the day-to-day implementation progress of the EMPs, undertake site visits as required, identify environment-related implementation issues, and propose necessary corrective actions;
- (vi) Liaise with the Lead EHS-Specialist in the safety and wellbeing of workers and communities in regards with COVID 19;
- (vii) Consolidate the day-to-day implementation progress in monthly progress reports for the review of the Lead EHS-Specialist, and assist the Lead EHS-Specialist in preparation of semi-annual environmental monitoring reports for the PIU and ADB; and
- (viii) Perform such other functions in the area of environmental management and safeguards as may be requested by the Lead EHS-Specialist.

g. Construction Contractor: Environment Specialist(s)

355. Contractors will be bond to appoint Environment Specialist(s) with relevant educational background and experience for each construction camp. Contractor's Environmental Specialist(s) will carry out following activities:

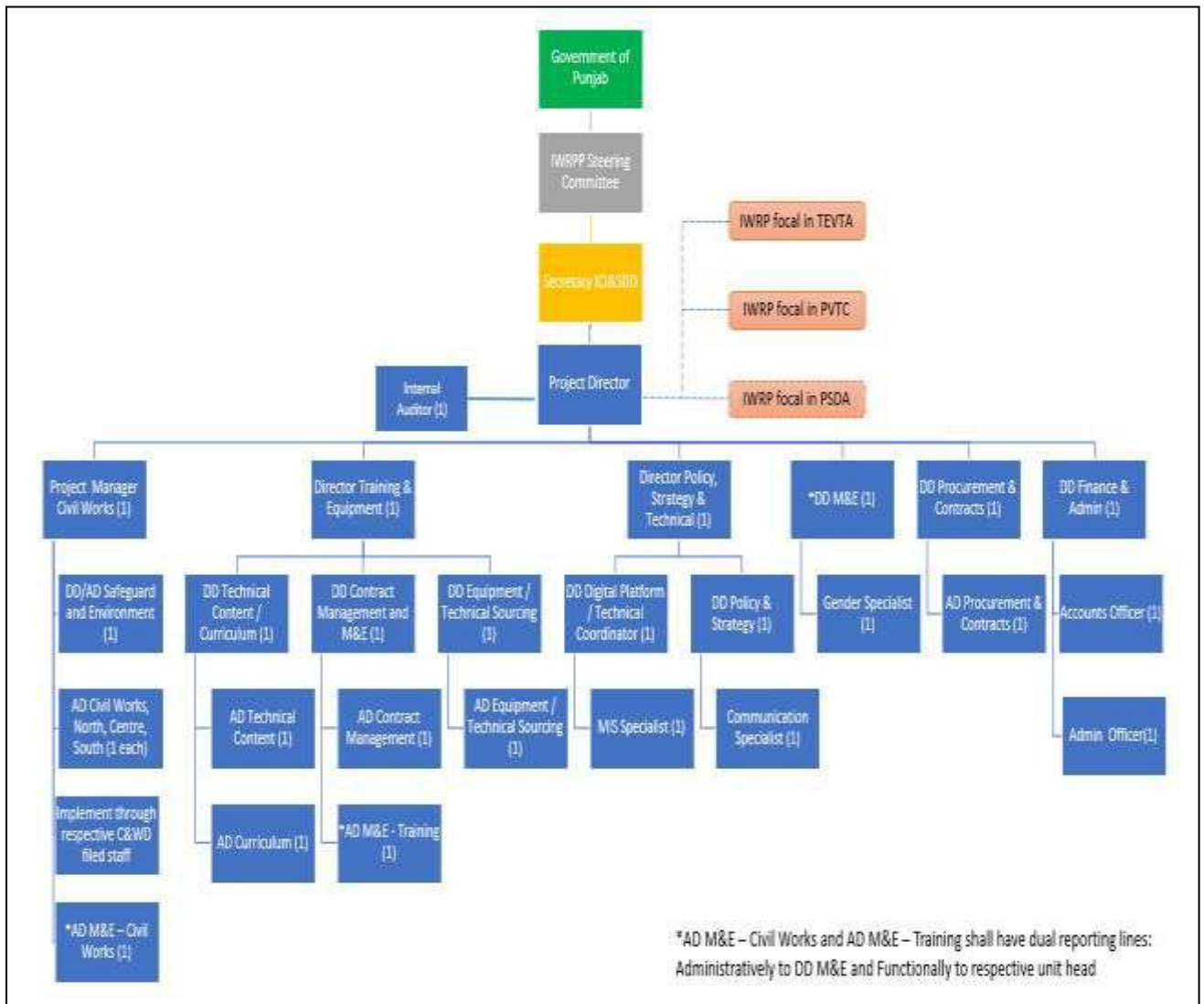
- (i) Preparation, at the pre-construction stage, of the SSEMPs based on the EIA and generic EMP, and submit them for approval to the PIU;
- (ii) Implementation of the SSEMP under supervision of the PIU;
- (iii) Submission of monthly environmental monitoring reports to the PIU;
- (iv) In case of unpredicted environmental impacts occurring during project implementation immediately inform the PIU;
- (v) The safety and well-being of workers and communities in regards with COVID 19, in liaison with the Supervision Consultant's EHS Specialist(s);
- (vi) In case of any major accident at the construction site immediately inform the PIU, adequately record the condition of roads, and other relevant infrastructure prior to starting to transportation of materials and civil works; and
- (vii) Reinstate pathways, other local infrastructure to at least their pre-project condition upon the completion of construction.

2. Non-Compliance of the EMP

356. The implementation of the proposed EMP involves inputs from various functionaries. Construction Contractor will be primarily responsible for ensuring implementation of the mitigation measures proposed in the EMP, which will be part of the contract documents. The provision of the environmental mitigation cost will be made in the total cost of Project, for which Construction Contractor will be paid based on monthly compliance reports. A clause can be added in the contract of contractor about the payment modality and the penalties. If the Construction Contractor fails to comply with the implementation of EMP and submission of the monthly compliance reports, the penalties (as decided by proponent, PIU, DD Environment - PIU and agreed by contractor) would be triggered.

357. The PIU organogram is shown in figure 9.1.

Figure 9.1: PIU Organogram



9.5. Environmental Management Plan

358. The EMP is summarized in below Table 8.1:

Table 8.1: Environmental Management Plan

Sr. No.	Project Components / Activity	Impacts	COEs	Mitigation Measures	Responsibility		Location to Implement	Parameters for Monitoring	Monitoring & Reporting Frequency
					Implementation / Reporting	Monitoring/supervision			
Design Phase									
1	Water supply system in COEs	Water quality in some COEs does not meet the essential water quality standards during baseline environmental monitoring i.e. TDS, E.Coli, Fecal Coliforms, Chlorine, Lead and Hardness was found in the drinking water sources. This could pose serious health issues to the students and staff.	All COEs	<p>Designer will consider the installation and provision of high-quality drinking water treatment options and disinfection units. For instance, chlorination or ozonation, or other suitable technologies can be used to disinfect water.</p> <p>Although arsenic was not detected in any site but studies have clearly shown the presence of high arsenic in Ravi river flood plain and Lahore is situated in Ravi River Flood plain. Therefore, presence of high arsenic in Lahore cannot be ignored and for the selection of appropriate drinking water treatment unit removal of arsenic in addition to other site-specific contaminants will be given a due consideration. As such a "Reverse Osmosis (RO)" treatment plant of</p>	DD Environment - PIU	PIU, ICISDD,		Drinking Water sources and Drinking Water Treatment Systems	Monthly during design stage

Sr. No.	Project Components / Activity	Impacts	COEs	Mitigation Measures	Responsibility		Location to Implement	Parameters for Monitoring	Monitoring & Reporting Frequency
					Implementation / Reporting	Monitoring/supervision			
				<p>sufficient capacity could be a best fit as an all-in-one solution.</p> <p>RO can be used to reduce TDS and chlorides, lead etc. Softening of water can be considered where hardness of water is high. If RO systems are already installed, the efficacy and performance of RO units can be upgraded.</p> <p>In all such situation it is required that the suggested/selected treatment system is appropriate to address all the site-specific water quality issues (biological/chemical/physical). The COE management / staff will be given appropriate training to operate the RO system. An uninterrupted power supply system (needed for functional working of water supply and treatment system) or any alternate arrangement is in place, and they have</p>					

Sr. No.	Project Components / Activity	Impacts	COEs	Mitigation Measures	Responsibility		Location to Implement	Parameters for Monitoring	Monitoring & Reporting Frequency
					Implementation / Reporting	Monitoring/supervision			
				<p>enough supplies / funds for consumable components / filters / supplies essentially required for the proper operation of the recommended water treatment systems.</p> <p>It is also recommended to repair/functionalize the out of order RO plants situated in respective COE e.g. VTI, Green Town, Lahore</p>					
2	Consumables for Lab Equipment	At design stage, the equipment and consumables may have some hazardous substances. The impact is high likelihood is very low.	All COEs	Designer will consider the international conventions and local regulations on hazardous substances.	DD Environment - PIU	PIU, ICISDD,		Design	Monthly during design stage
3	Overdesign of COEs	The COEs are educational institutes and most of them are in urban environment. There is a possibility of over/unnecessary design elements or proposing new	All COEs	The designer will consider the minimum tree cut while proposing the location for new building blocks. This could be achieved by adopting the same project footprints or changing project footprints only where unavoidable.	DD Environment - PIU	PIU, ICISDD,		Design	Monthly during design stage

Sr. No.	Project Components / Activity	Impacts	COEs	Mitigation Measures	Responsibility		Location to Implement	Parameters for Monitoring	Monitoring & Reporting Frequency
					Implementation / Reporting	Monitoring/supervision			
		building blocks on existing open grounds. The impact is high but likelihood is low.		<p>The design will be completely on need assessment.</p> <p>The design and location will be finalized after close coordination and consultation with the stakeholders.</p> <p>The design of the COE at GSTC, Murree will ensure not to disturb existing water boring facility (functional) located at site.</p> <p>Toilets facilities will be designed and recommended for males and females (as the case may be) at every floor of the COE.</p> <p>Sound proofing of the buildings could be ensured especially to avoid traffic noise (where required). It is also recommended to sound proof the rooms adjacent to mosque in COE of GCT, Wahdat Road, Lahore.</p> <p>Storm water drainage system of the COEs must be capable enough to deal with the urban</p>					

Sr. No.	Project Components / Activity	Impacts	COEs	Mitigation Measures	Responsibility		Location to Implement	Parameters for Monitoring	Monitoring & Reporting Frequency
					Implementation / Reporting	Monitoring/supervision			
				<p>flooding especially in GCT Sialkot where the whole GCT becomes flooded during monsoon season.</p> <p>The building layout / orientation will be designed in a way not to stop sunshine for students / staff of COEs proposed in Murree. Furthermore, sloped roof tops will be designed for easy snow removal.</p>					
4	Building Load	<p>The vertical construction on fragile structures of COEs may cause a risk of increased load of building which may ultimately exacerbate impact of natural disasters (e.g. earthquake). There are two COEs (GCTW Lahore and GCT Sialkot) that have very old infrastructure and any amendment may cause harm to</p>	All COEs,	<p>The designer must carry out building strength assessment before proposing the vertical blocks during detailed design.</p> <p>Efforts will be made to repair and renovate the Shadi Lal Block in GCT, Lahore with care as it is an old structure</p> <p>The vertical construction will be done with light weight construction materials.</p>	DD Environment - PIU	PIU, ICISDD,	All COEs	Design	Monthly during design stage

Sr. No.	Project Components / Activity	Impacts	COEs	Mitigation Measures	Responsibility		Location to Implement	Parameters for Monitoring	Monitoring & Reporting Frequency
					Implementation / Reporting	Monitoring/supervision			
		historical value of buildings.							
5	Wastewater Risks and Hazards	<p>During baseline environmental monitoring, it was found that the concentrations of some toxic pollutants were high in sewerage/wastewater of some COEs. The higher concentrations of pollutants such as COD/BOD and heavy metals may pose serious risks to soil and water resources. Though, there is availability of septic tanks but at design stage, designer may ignore this threat to the environment, which would ultimately cause more threats during operation stage.</p>	All COEs	<p>Designer will consider the options for wastewater treatment or reducing the pollutants' concentration load either through development of efficient septic tanks before the open release of wastewater into main sewers or environment.</p> <p>For COEs of Textile & Garments the designer will give due consideration to the treatment of waste water released from the laboratories in addition to routine waste water from toilets etc., by carefully assessment of all potential scenarios of accidental and/or routine laboratory chemicals available in different training laboratories.</p>	DD Environment - PIU	PIU, ICISDD,	All COEs	Sewers and Septic Tanks	Monthly

Sr. No.	Project Components / Activity	Impacts	COEs	Mitigation Measures	Responsibility		Location to Implement	Parameters for Monitoring	Monitoring & Reporting Frequency
					Implementation / Reporting	Monitoring/ supervision			
6	Construction Vehicles Traffic Issues	The design provisions may skip the necessary requirements for construction camp and vehicle movement	All COEs	The designer will consider the traffic congestion and situation that may arise during project activities. A traffic management framework will be prepared at the stage of detailed design.	DD Environment - PIU	PIU, ICISDD,	All COEs	Design, Traffic Management Plan	Monthly during design stage
7	Lack of Integration of EIA and EMP into Bidding Documents	The bidding documents may not be responsive to environmental and social considerations	All COEs	The proponent will consider the environmental and social considerations during detailed design. The EIA & EMP will be made compulsory part of Bidding documents. The estimates on environmental monitoring and enhancement will be incorporated in BOQs.	DD Environment - PIU	PIU, ICISDD,	All COEs	Bidding Documents	Monthly during design stage
8	Site Specific Environmental Management Plan	There is a possibility of hiring multiple contractors and their capacity to prepare and develop site specific EMPs can be low	All COEs	The contractor(s) would prepare SSEMP taking help from EIA and EMP, that will cover the following aspects: <ul style="list-style-type: none"> Define boundaries Identify sensitive receptors & environmental values Specify construction activities 	Contractor, DD Environment - PIU	PIU, ICISDD	All COEs	Site Specific documents	Prior to construction

Sr. No.	Project Components / Activity	Impacts	COEs	Mitigation Measures	Responsibility		Location to Implement	Parameters for Monitoring	Monitoring & Reporting Frequency
					Implementation / Reporting	Monitoring/supervision			
				<ul style="list-style-type: none"> • Conduct risk assessment • Assign environmental management measures • Prepare monitoring plan • Prepare site plans • Prepare environmental work plan 					
9	Renovation / construction activities in COEs, during active teaching / training sessions / semesters.	Unavoidable major disturbance in routine teaching / training activities in existing class rooms, labs, buildings and allied facilities. Unavoidable interference between contractor crew and students/teachers of the COE, that will adversely impact the safe learning environment.	All COEs	<p>The proponent will assess and analyze the disturbance and impact of renovation / construction activity with the individual COE management and based on the scale, duration, timing, and intensity of the proposed activity consider following appropriate measures to avoid, minimize or mitigate the impact:</p> <ul style="list-style-type: none"> • Re-scheduling of daily teaching hours to accommodate construction/renovation activity • Re-scheduling / break in classes to restart after completion of 	DD Environment - PIU, COE Management	PIU, ICISDD,	All COEs	Satisfaction note from COE management on the arrangements for the continuation of COEs routine functions during construction activities	Monthly before the start of construction phase

Sr. No.	Project Components / Activity	Impacts	COEs	Mitigation Measures	Responsibility		Location to Implement	Parameters for Monitoring	Monitoring & Reporting Frequency
					Implementation / Reporting	Monitoring/supervision			
				<p>proposed construction activities</p> <ul style="list-style-type: none"> • Re-scheduling of daily working hours for construction workers to accommodate teaching activities • Accommodating / shifting classrooms to other existing / available rooms within COE to avoid any loss of teaching/training • Provisions of Temporary facilities to serve as classrooms for the construction duration • Shifting the impacted classrooms, hostels etc., to a temporary rented facility 					
10	Visual Impacts of Solar Panels	The potential impacts could be visual and reflection. The PV modules are expected to be visible within the immediate vicinity and up to some	All COEs	It is suggested to use PV modules whose surface would absorb sunlight and minimize sunlight reflections. The modules will be efficient enough to absorb heat with low chances of reflection.	C&W Deptt / Supervision Consultant	DD Environment - PIU, PIU, ICISDD	All COEs	Inspection	Once

Sr. No.	Project Components / Activity	Impacts	COEs	Mitigation Measures	Responsibility		Location to Implement	Parameters for Monitoring	Monitoring & Reporting Frequency
					Implementation / Reporting	Monitoring/supervision			
		kilometers around the COEs and thus is likely to create visual impacts. These visual and reflection may create nuisance to nearby inhabitants (if any).							
Construction Phase									
1	Construction camps, material and equipment yards	Exploitation of local facilities/utilities such as electricity and temporary construction activities like material placement and storage may temporarily affect the routine matters of COEs administration.	All COEs	Contractor will prepare SSEMPs using the information and suggestions proposed in EMPs. Contractor will follow the best management practices for handling and disposal of the material if found during refurbishment. Contractor will ensure that the baseline conditions are recorded before establishing camps and other site facilities. Contractor will establish the camp where necessary and land is available. Contractor will maintain photographic record of area adjacent to the	Contractor	DD Environment - PIU, ICISDD,	All COEs	Consumption Record, Photograph Record	Daily

Sr. No.	Project Components / Activity	Impacts	COEs	Mitigation Measures	Responsibility		Location to Implement	Parameters for Monitoring	Monitoring & Reporting Frequency
					Implementation / Reporting	Monitoring/supervision			
				camp site and other features are taken prior to commencement of any work activity which will be used as a reference during site restoration.					
2	Wastewater Generation at Construction Camps	Wastewater will be generated at the construction camps. If the generated wastewater is not properly treated or disposed of, this may contaminate the nearby surface water resources (if any) apart from soil contamination. The wastewater generation is estimated to be 800 liters/day for 25 construction workers for each COE which means that total wastewater generation for 19 COEs will be 16,000 liters/day.	All COEs	Domestic effluents from the construction camp will be disposed by the development of on-site sanitation systems i.e. septic tanks. Contractor will ensure that latrines, septic tanks, and soaking pits or sumps are built at a safe distance from water body (tube wells or hand pumps), stream, or dry streambed and the bottom of the sump or soaking pits are above the ground water level. Proper monitoring to check the compliance of PEQS will be carried out (as advised by EHS Specialists).	Contractor	DD Environment PIU Supervision Consultant, PIU, ICISDD,	All COEs	Visible Signs, Inspection of Construction camp	Daily
3	Solid Waste Generation at	Considering the construction	All COEs	All the solid waste from the camps will be	Contractor	DD Environment	All COEs	Visible Signs, Inspection of	Daily

Sr. No.	Project Components / Activity	Impacts	COEs	Mitigation Measures	Responsibility		Location to Implement	Parameters for Monitoring	Monitoring & Reporting Frequency
					Implementation / Reporting	Monitoring/supervision			
	Construction Camps	workforce (about 25 in numbers / COE), an average solid waste generation rate of 0.5 kg/capita/day ¹⁰⁷ is adopted for the estimation of solid waste generation. Based on this assumption, about 12.5 kg solid waste will be generated from construction camps on daily basis at each COE which means that total solid waste generation for 20 COEs will be 250 kg/day. The major components of the labour camp waste will be garbage, putrescible waste, rubbish and small portion of ashes and residues, etc. This waste would require proper disposal to		properly collected at source by placing containers and disposed of through proper solid waste management system. The Contractor will coordinate with local representatives and administration concerned department for the disposal of solid waste. The concerned department must develop a plan of action for transporting the waste to the disposal site for final disposal. It is the responsibility of the concerned department to ensure that the disposal site is properly lined to prevent the leachate from contaminating the groundwater. Secondly, the disposal site must be located away as far as practical from populated areas. The waste will be properly sealed in containers with proper		PIU Supervision Consultant, PIU, ICISDD,		Construction camp	

¹⁰⁷ D. Hoornweg and P. Bhada-Tata. 2012. What a Waste : A Global Review of Solid Waste Management. *Urban Development Series; Knowledge Papers*. No. 15. World Bank, Washington, DC.

Sr. No.	Project Components / Activity	Impacts	COEs	Mitigation Measures	Responsibility		Location to Implement	Parameters for Monitoring	Monitoring & Reporting Frequency
					Implementation / Reporting	Monitoring/supervision			
		minimize land and water contamination.		labels indicating the nature of the waste. Toxic waste will be handled, stored, transported and disposed-off separately. Safe handling precautions and product specific information is found in Material Safety Data Sheet (MSDS) which must be located on site and accessible to all workers.					
4	Solid Waste Generation at Construction Sites	e construction waste will include damaged or spoiled materials, demolished materials, temporary and expendable construction materials etc. The construction waste types also include timber, metals, rubber, concrete, electric cables, old machinery/equipment, etc. The handling and storage of oil and other hazardous	All COEs	Site-specific waste management plan for each COE will be developed to implement an efficient and responsive solid waste management system during construction phase. Recyclable wastes e.g. steel bars will be sold to waste vendors. Site-specific plan will also contain exact location of excavation and quantum of soil to be excavated and disposed. Contractor must follow Best Management Practices for Asbestos safe handling, packaging	Contractor	DD Environment PIU Supervision Consultant, PIU, ICISDD,	All COEs	Visible Signs, Inspection of active construction sites	Daily

Sr. No.	Project Components / Activity	Impacts	COEs	Mitigation Measures	Responsibility		Location to Implement	Parameters for Monitoring	Monitoring & Reporting Frequency
					Implementation / Reporting	Monitoring/supervision			
		waste will be a source of environmental pollution during the excavation, foundation, levelling, carpeting and pavement activities. Due to old construction, there may be a possibility of presence of Asbestos during repair and refurbishment work.		and disposal. For this purpose, site-specific Asbestos management plan needs to be prepared by the contractor for each COE and seek prior approval from Supervision Consultant's EHS Specialist. The site-specific Asbestos management plan will cover ways to handle, store, precautions, transport, safe handover to trained professionals for its disposal. Reusable material will be used as a filling material during ground levelling. Solid waste generated during construction will be safely disposed in demarcated waste disposal sites and the contractor will provide a proper waste management plan.					
5	Excavation at Construction Site	Construction of new building blocks within premises of all COEs would involve	All COEs	The actual amount of excavation material can be estimated during detailed design. Preferably no extra land will be excavated.	Contractor	DD Environment - PIU, PIU, ICISDD,	All COEs	Boundary Marks, Visible Signs, Inspection of site	Once before construction, daily during excavation, Weekly

Sr. No.	Project Components / Activity	Impacts	COEs	Mitigation Measures	Responsibility		Location to Implement	Parameters for Monitoring	Monitoring & Reporting Frequency
					Implementation / Reporting	Monitoring/supervision			
		excavation. The excavation may cause health, safety, stability and aesthetic issues		Contractor will prepare SSEMP with exact location of excavation and quantum of soil to be excavated. Contractor will ensure that the movement of earth moving machinery is limited to the work area and that the erosion protection measures are taken, such as retaining wall (if required), avoidance of steep cut.					during construction
6	Disposal of Spoil Material	Requirements for disposal of fill, excavation, and/or spoil materials is expected.	All COEs	Excavation materials produced from digging activities will be disposed off on daily basis. Use of spoil material during construction of buildings will be done, where possible, to minimize waste production. Contractor will submit a detailed for collection and transfer of spoil material to the approved sites prior any dumping of materials.	Contractor	DD Environment - PIU, PIU, ICISDD,	-do-	Spoil material quantum	Weekly

Sr. No.	Project Components / Activity	Impacts	COEs	Mitigation Measures	Responsibility		Location to Implement	Parameters for Monitoring	Monitoring & Reporting Frequency
					Implementation / Reporting	Monitoring/supervision			
7	Loss of trees and vegetation	Construction of new building blocks may cause tree cutting at 14 COEs	All COEs	<p>Clearing of green surface cover for construction, cutting trees and other important vegetation during construction will be minimized.</p> <p>The exact amount of tree count can be verified during design and designer will make best possible use of skills to avoid tree cut.</p> <p>During the design stage of the project sites and finalizing the site orientation, it will be the priority to avoid those areas where there are chances of cutting of significant trees and clearing of vegetation.</p> <p>In case if it is not possible to avoid, then the project site will be restored to its original as much as possible by planting trees, and vegetation at the cleared land.</p> <p>It is pertinent to mention that trees will be relocated/transplanted/replanted (where possible)</p>	Contractor	DD Environment - PIU, PIU, ICISDD	All COEs	Tree count	During Excavation and Machinery movement

Sr. No.	Project Components / Activity	Impacts	COEs	Mitigation Measures	Responsibility		Location to Implement	Parameters for Monitoring	Monitoring & Reporting Frequency
					Implementation / Reporting	Monitoring/supervision			
				<p>instead of cutting and may be replanted within the 500 meters radius of its original location;</p> <p>Compensatory plantation will be planned to be undertaken at prescribed rates (at least 5 times of the number of trees cut). The contractor's staff and labor will be strictly directed not to damage any vegetation such as trees or bushes. All works will be carried out in a fashion that ensures minimum damage or disruption to the flora. The contractor will be responsible for the restoration of the site and PIU will ensure restoration as per the requirements. Landscaping and road verges to be re-installed on completion.</p>					
8	Load on Sanitation and Sewage System	Population influx during project construction activities may	All COEs	Access to nearby lavatories will be allowed or provision of temporary toilets will be made.	Contractor	DD Environment - PIU, PIU, ICISDD	All COEs	Sewerage system inspection	Daily

Sr. No.	Project Components / Activity	Impacts	COEs	Mitigation Measures	Responsibility		Location to Implement	Parameters for Monitoring	Monitoring & Reporting Frequency
					Implementation / Reporting	Monitoring/supervision			
		cause severe impact on existing utilities such as sewerage and sanitation infrastructure of COEs as in most of the COEs have poor sewerage system.		Construction worker camps will be necessary, based on the scale of the works needed. The construction camp will be provided with toilets, soakage pits or portable lavatories or at least pit latrines. Disposal of surplus materials will also be negotiated through local authority approvals prior to the commencement of construction. If surplus materials arise from the excavation activities, it will be used elsewhere on the subproject before additional soil, rock, gravel or sand is brought in.					
9	Water Usage	Project activities at all COEs would increase the groundwater/drinking water consumption rate, due to sudden increase in number of consumers during construction.	All COEs	Contractors will make temporary arrangements for construction / drinking water in a manner that existing water users may not be affected. For this purpose, contractors will meet their water requirements through water bowsers tanks. No groundwater and water	Contractor	DD Environment - PIU, PIU, ICISDD	All COEs	Less running hours of water pumping	Monthly

Sr. No.	Project Components / Activity	Impacts	COEs	Mitigation Measures	Responsibility		Location to Implement	Parameters for Monitoring	Monitoring & Reporting Frequency
					Implementation / Reporting	Monitoring/supervision			
				supply of COE will be utilized during construction period to avoid any conflict. Contractors will train the staff and labor on less water consumption and to minimize the wastage of drinking water.					
10	Exploitation / Disturbance of Utilities	Project activities at all COEs may trigger unnecessary exploitation of electric power and natural gas supplies. As the COEs have to bear all the expenses/dues of consuming electric or gas resources. Any exploitation or usage by contractor may cause impact on consumption of resources.	All COEs	Contractor will bring or use their own power sources i.e. generators or gas cylinders for all kind of activities. The contract will include the bindings on contractor and in case any exploitation to COEs resources occurs, contractor will be bound to bear the utility bills.	Contractor	DD Environment - PIU, PIU, ICISDD	All COEs	Utility Bills	Monthly
11	Traffic Congestion	Traffic congestion is expected in the vicinity of COEs due to increased number of vehicles and	All COEs	Preparation of traffic management and construction machinery movement plan in each SSEMP will be made sure.	Contractor	DD Environment - PIU, PIU, ICISDD	All COEs		Prior to and throughout the construction.

Sr. No.	Project Components / Activity	Impacts	COEs	Mitigation Measures	Responsibility		Location to Implement	Parameters for Monitoring	Monitoring & Reporting Frequency
					Implementation / Reporting	Monitoring/supervision			
		movement of construction machinery.		Submit temporary haul and access routes plan one month prior to start of works. Formulate and implementation of a plan of alternate routes for heavy vehicles. Installation of traffic warning signs, and enforcing traffic regulations during transportation of materials and equipment and machinery.					
12	Air Quality	It is expected that air quality in the vicinity of COEs may decline due to increased traffic volume, movement of construction machinery and generation of dust in from construction activities. This may affect the construction camps, COEs themselves and more specifically the sensitive	All COEs	The construction work at COEs where sensitive receptors are nearby, will be scheduled during vacations only, to avoid any impact or disturbance to sensitive receptors. Client/Supervisory Consultant will make sure that no construction activity is done when the sensitive receptors/institutions are operational. The construction machinery and vehicles will be kept away from sensitive receptors as	Contractor	DD Environment - PIU, PIU, ICISDD	All COEs	Air Quality Parameters as per PEQS and WHO	Instrumental monitoring on a quarterly basis

Sr. No.	Project Components / Activity	Impacts	COEs	Mitigation Measures	Responsibility		Location to Implement	Parameters for Monitoring	Monitoring & Reporting Frequency
					Implementation / Reporting	Monitoring/supervision			
		receptors nearby GCT Multan, GCT Bahawalpur, GCT Gujranwala, GCT Lahore and GCT Sialkot.		<p>much as possible. Undertake regular spraying of water on traffic routes and places prone to cause dust pollution.</p> <p>Trucks carrying spoil materials will have tarpaulin cover to prevent spills during haulage.</p> <p>Suspended particulate matter (SPM) will be monitored at dust creating sites such as crushers, and dust mask will be issued to workers.</p> <p>Need of large stockpiles will be minimized by careful planning of the supply of materials from controlled sources.</p> <p>Stockpiles will be covered with tarpaulins when not in use and at the end of the working day to enclose dust.</p> <p>Aggregate material will be delivered to the batching and/or asphalt plant in a damp condition, and water sprays will be applied if</p>					

Sr. No.	Project Components / Activity	Impacts	COEs	Mitigation Measures	Responsibility		Location to Implement	Parameters for Monitoring	Monitoring & Reporting Frequency
					Implementation / Reporting	Monitoring/supervision			
				needed, to reduce dust emissions. Fuel-efficient and well-maintained haulage trucks will be employed to minimize exhaust emissions. Ambient air monitoring will be conducted after periodic intervals as mentioned in the EMP.					
13	Noise	Noise will be generated due to use of drillers, machines inside buildings/facility. This can be a source of nuisance to neighboring properties and other class rooms / dormitories and common facilities. Noise levels may reach to as much as 85 decibels (dBA) at a distance of about 15 m from the source or operation of construction equipment (for less than 50% time	All COEs	Construction camps and workshops will be located outside the premises of COEs. In this way, noisy operations of workshops will stay away from the COEs. Contractor will be responsible to provide the construction workers with suitable hearing protection like ear cap, or earmuffs at noisy workplaces. All construction equipment and machinery will be fitted in full compliance with the national and local regulations and with effective silencing	Contractor	DD Environment - PIU, PIU, ICISDD	All COEs	Noise levels	Instrumental monitoring on a quarterly basis

Sr. No.	Project Components / Activity	Impacts	COEs	Mitigation Measures	Responsibility		Location to Implement	Parameters for Monitoring	Monitoring & Reporting Frequency
					Implementation / Reporting	Monitoring/supervision			
		of work) ¹⁰⁸ . The sensitive receptors nearby GCT Multan, GCT Bahawalpur, GCT Gujranwala, GCT Lahore and GCT Sialkot are likely to be affected by high levels of noise. However, this will be temporary in nature		<p>apparatus to minimize noise.</p> <p>As a rule, the construction activities will be confined to daylight hours only. No construction activity will be conducted during night hours.</p> <p>Construction equipment like generators, that generate noise, will be enclosed or fitted with effective silencing apparatus to minimize noise.</p> <p>Contractor will take adequate measures to minimize noise nuisance in the vicinity of construction sites by way of adopting available acoustic methods such that at the edge of the work sites noise will be less than 55 dB(A) Leq during the day hours.</p> <p>Noise monitoring will be conducted after periodic intervals as mentioned in the EMP.</p>					

¹⁰⁸ Several equipment has different noise thresholds – drills, excavators, trucks, compressors etc. which are specified by national governments. The monitoring of these equipment will rely on nationally approved threshold limits.

Sr. No.	Project Components / Activity	Impacts	COEs	Mitigation Measures	Responsibility		Location to Implement	Parameters for Monitoring	Monitoring & Reporting Frequency
					Implementation / Reporting	Monitoring/supervision			
14	Ground Vibration	No heavy machinery or any blasting activity is anticipated to be used which could generate severe vibrations and cause damage to nearby structures. Furthermore, no deep excavations or pilings are expected during construction period and no damaged or structurally unsafe buildings are situated near new civil constructions works within the COEs which could be impacted. Most of the buildings around the project sites are not likely to be affected by the vibration induced impacts.	All COEs	<p>The building design, construction methods, construction machinery, construction equipment, construction materials, installation techniques will be selected to avoid and minimize chances of ground vibration.</p> <p>In case it is unavoidable the activity will be carried out with maximum safety of workers, COE staff and students and surrounding structures.</p> <p>All such activities will be properly planned and will be initiated after the approval of EHS specialist.</p> <p>All such activities will be implemented under strict supervision of technical supervisors and construction supervision consultant staff.</p> <p>Designer will assess the existing infrastructures stability and strength.</p>	Contractor	DD Environment - PIU, PIU, ICISDD	All COEs, Specifically GCT Multan, GCT Bahawalpur, GCT Sialkot, GCT Lahore, GCT Gujranwala, GCTW Lahore.	Pre-Construction vibration survey of buildings likely to be affected by vibration induced impacts.	Prior to start of construction phase

Sr. No.	Project Components / Activity	Impacts	COEs	Mitigation Measures	Responsibility		Location to Implement	Parameters for Monitoring	Monitoring & Reporting Frequency
					Implementation / Reporting	Monitoring/supervision			
				<p>A pre-construction vibration survey will be carried out by the contractor to identify buildings which can be severely impacted by the vibration induced impacts</p> <p>Contractor will apply shock absorbers where impulsive actions are proposed near the old buildings.</p>					
15	Waste Issues	Solid waste and wastewater generation is anticipated during construction activities.	All COEs	<p>For solid wastes disposal, the waste disposal plan will be followed by the Contractor. No waste will be left in the open.</p> <p>Contractor will maintain the Photographic record of the area of the nominated waste disposal site in order to restore the site at the completion of the construction phase.</p> <p>Contractor will ensure that all the waste generated from different locations will be disposed off according</p>	Contractor	DD Environment - PIU, PIU, ICISDD	All COEs	Site Inspections	Daily

Sr. No.	Project Components / Activity	Impacts	COEs	Mitigation Measures	Responsibility		Location to Implement	Parameters for Monitoring	Monitoring & Reporting Frequency
					Implementation / Reporting	Monitoring/supervision			
				<p>to the Waste Disposal Plan.</p> <p>Contractor will ensure that all trucks used for the transportation of waste construction material will be covered and water resist. It is the contractor's contractual obligation to complete and follow the guidelines in case any private land is damaged / contaminated due to disposal of waste generated from the construction activities. Contractor will ensure that the movement of lifting machinery and vehicles is limited to the work area. Contractual clauses will require the contractor to produce a materials management plan (one month before construction commences) to identify all sources of cement and aggregates and to balance cut and fill. The plan will clearly state the methods to be employed prior to and</p>					

Sr. No.	Project Components / Activity	Impacts	COEs	Mitigation Measures	Responsibility		Location to Implement	Parameters for Monitoring	Monitoring & Reporting Frequency
					Implementation / Reporting	Monitoring/supervision			
				during the extraction of materials and all the mitigation measures to be employed to mitigate nuisances to local residents. Contractual clauses will require the contractor to produce a solid waste management plan so that proper disposal of waste can be ensured					
16	Soil Contamination	Soil contamination is expected due to spill of lubricants, fuel, chemicals and other construction waste material.	All COEs	To avoid the chemical and oil spills such materials will be properly stored and maintain good housekeeping by the Contractor. Contractor will ensure that the maintenance of vehicle (LTV and HTV) and other plant takes place only in designated areas underlined with concrete slabs and a system to catch surface runoff. The contractor will construct lined wash area for vehicle washing. Contractor will ensure effluents from plant washing and other potentially contaminated	Contractor	DD Environment - PIU, PIU, ICISDD	All COEs	Photograph, Inspection	Daily

Sr. No.	Project Components / Activity	Impacts	COEs	Mitigation Measures	Responsibility		Location to Implement	Parameters for Monitoring	Monitoring & Reporting Frequency
					Implementation / Reporting	Monitoring/supervision			
				<p>effluents are released into soaking pit. Contractor will store and handle fuels, oils, and other hazardous substances according to standard safety practices such as secondary containment bunded area. Fuel tanks will be labeled accordingly by the Contractor.</p> <p>Contractor will ensure that fuels, oils, and chemical are stored in areas lined by an impermeable base and containing dykes. The Material Safety Data Sheets (MSDS) or Control of Substances Hazardous to Health (COSHH) sheets will be available at material storage area. Contractor will carry out vehicles fuel, oil, or battery fluid leakage check regularly</p>					
17	Impact on Fauna	No major impact on the protected areas is expected. However, care will be taken during	All COEs	Contractor will sign a binding that no intrusion or damage to protected area will take place	Contractor	DD Environment - PIU, PIU, ICISDD	All COEs	SOPs / Guidelines for Workers	Daily

Sr. No.	Project Components / Activity	Impacts	COEs	Mitigation Measures	Responsibility		Location to Implement	Parameters for Monitoring	Monitoring & Reporting Frequency
					Implementation / Reporting	Monitoring/supervision			
		construction at COE in Bahawalpur as Lal Suhanra Protected Area is 58 km away from GCT Bahawalpur.		during the whole construction period. Contractor will train the staff and labors to be careful about demarcated area and any involvement outside the construction camp will be monitored. Poaching, hunting, camping near the protected area will be banned.					
18	Social Issues	Local conflicts between workers and students/staff of COEs may occur, privacy of women in COEs may be at risk.	All COEs	Contractor will ensure that workers follow the work ethics and will ensure that project staff interaction with students/staff and COE staff is minimum. Contractor will not allow any offence by their workers. Contractor and workers will respect the local conditions. Claims/complaints of the students/staff on construction nuisance/damages will be considered and responded promptly by the Contractor.	Contractor	DD Environment - PIU, PIU, ICISDD	All COEs	Concerns and complaints	Daily

Sr. No.	Project Components / Activity	Impacts	COEs	Mitigation Measures	Responsibility		Location to Implement	Parameters for Monitoring	Monitoring & Reporting Frequency
					Implementation / Reporting	Monitoring/supervision			
				Active construction sites will be cordoned off to maintain the privacy of the female students and staff. To maintain the privacy and minimum interaction of workers with students and staff members, other nearby gates of the COEs could be utilized instead of main gates.					
19	Public Health and Safety	Risks to community health and safety from construction activities, traffic/machinery movement, or failure of the building's safety features can be higher if construction sites are not fenced off properly. In addition, the prevailing Covid-19 situation may add risks of transfer either way i.e. from workers to community and	All COEs	The contractor will follow Government of Pakistan Covid-19 guidelines for construction (Appendix-8) and guidance on Covid-19, which includes provision of masks, hand sanitizers etc. Training on health safety and environment will be conducted by specialist every 3 months. The Contractor will also prepare emergency response plan for such an outbreak in the construction camp. The construction activities will be performed in separated areas or at the remotest	Contractor	DD Environment - PIU, PIU, ICISDD	All COEs	HSE / Risk Logs	Daily

Sr. No.	Project Components / Activity	Impacts	COEs	Mitigation Measures	Responsibility		Location to Implement	Parameters for Monitoring	Monitoring & Reporting Frequency
					Implementation / Reporting	Monitoring/supervision			
		community workers. to		<p>possible point to avoid any direct impact on public.</p> <p>Health, Safety and Environment (HSE) plan with an additional component of community Health and Safety will be developed and implemented by the contractor.</p> <p>The contractor will ensure that medical staff headed by qualified medical doctor, first aid equipment and stores, sick bay and suitable ambulance service are available at the camps all time.</p> <p>A proper screening of laborer will be done at the time of recruitment.</p> <p>Ensure that periodic awareness campaigns for COVID-19 / HIV/AIDS are undertaken for the project staff.</p> <p>Contractor will provide potable water and also shadow area to the workers at work place area for short breaks.</p>					

Sr. No.	Project Components / Activity	Impacts	COEs	Mitigation Measures	Responsibility		Location to Implement	Parameters for Monitoring	Monitoring & Reporting Frequency
					Implementation / Reporting	Monitoring/supervision			
				<p>The Contractor will depute guards at all entry points into construction sites 24 hours a day.</p> <p>Contractor will ensure appropriate arrangements and sufficient number of active emergency exits at each construction site.</p> <p>Contractor will ensure no machinery is left unattended in the project area.</p> <p>Claims from people in nearby vicinity of COEs will be well-addressed.</p>					
20	Occupational health and safety issues	Risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological hazards during project construction would be higher. The prevailing pandemic may also cause severe health issues. The students and staff	All COEs	<p>The contractor will follow Government of Pakistan Covid-19 guidelines for construction (Appendix-8) and ADB guidance on Covid-19, which includes provision of masks, hand sanitizers etc.</p> <p>Training on health safety and environment will be conducted by specialist every 3 months.</p> <p>The Contractor will also prepare emergency response plan for such an outbreak in the</p>	Contractor	DD Environment - PIU, PIU, ICISDD	All COEs	HSE/ Risk Assessment	Daily

Sr. No.	Project Components / Activity	Impacts	COEs	Mitigation Measures	Responsibility		Location to Implement	Parameters for Monitoring	Monitoring & Reporting Frequency
					Implementation / Reporting	Monitoring/supervision			
		of COEs would also be prone to such risks.		<p>construction camp. A comprehensive SSEMP and HSE plan will be developed and implemented by the contractor.</p> <p>The contractor will ensure that medical staff headed by qualified medical doctor, first aid equipment and stores, sick bay and suitable ambulance service are available at the camps all time.</p> <p>A proper screening of laborer will be done at the time of recruitment. Ensure that periodic awareness campaigns for COVID-19 / HIV/AIDS are undertaken for the project staff.</p> <p>Contractor will provide potable water and also shadow area to the workers at work place area for short breaks.</p> <p>The Contractor will depute guards at all entry points into construction sites 24 hours a day.</p>					

Sr. No.	Project Components / Activity	Impacts	COEs	Mitigation Measures	Responsibility		Location to Implement	Parameters for Monitoring	Monitoring & Reporting Frequency
					Implementation / Reporting	Monitoring/supervision			
				Contractor will ensure appropriate arrangements and sufficient number of active emergency exits at each construction site. Contractor will ensure no machinery is left unattended in the project area. Providing adequate PPEs to the workers, warning signs. Potential for spread of vector borne and communicable diseases from labor camps will be avoided (worker awareness orientation and appropriate sanitation will be maintained) A monthly safety championship program at each site will be organized to encourage workers to adhere with health and safety requirements					
21	Orientation for Contractors, and Workers	Contractor and workers may have negligence to ensure compliance with	All COEs	Special briefings and trainings for managers and / or on-site training for the contractors and workers on the local	Contractor, DD Environment - PIU	DD Environment - PIU, ICISDD	All COEs	Training Plan	Weekly

Sr. No.	Project Components / Activity	Impacts	COEs	Mitigation Measures	Responsibility		Location to Implement	Parameters for Monitoring	Monitoring & Reporting Frequency
					Implementation / Reporting	Monitoring/supervision			
		administrative rules of COEs.		rules and regulations will be conducted. SSEMP will consider all social and environmental issues. Sufficient number of Engineers/Sub-Engineers and other relevant staff will be deputed at sites, to assure all aspects of QA/QC at each site including the implementation of ESM.					
19	Handling, Transportation and Storage of Construction Materials	The transportation and installation of project equipment may have an interaction with the ongoing construction activities.	All COEs	Civil contractor will cooperate and understand the importance of machinery transfer and installation in the COEs. The installation contractor will follow HSE guidelines and SSEMPs requirements. Equipment transfer plan will not coincide with major construction activities.	Contractor	DD Environment - PIU, PIU, ICISDD	All COEs Sites within the project area	HSE and Waste Management	Daily
22	Impact on Sensitive Receptors	Impact on Sensitive Receptors (other educational institutes adjacent)	All COEs	<ul style="list-style-type: none"> Civil contractor will consider the sensitive receptors part of project area. 	Contractor	DD Environment - PIU, PIU, ICISDD	All COEs	SSEMP	Daily

Sr. No.	Project Components / Activity	Impacts	COEs	Mitigation Measures	Responsibility		Location to Implement	Parameters for Monitoring	Monitoring & Reporting Frequency
					Implementation / Reporting	Monitoring/supervision			
				<ul style="list-style-type: none"> SSEMPs of COEs will consider a comprehensive plan for controlling environmental, health and safety risks to the students of these receptors. Risk assessment will be done to avoid any impact to the institutes. Measures will be taken to control dust, noise and wastewater emissions. Contractor will share a copy of SSEMP with the administration of receptors institutes. 					
23	Restoration/ Rehabilitation	The execution of construction work would have an impact on the existing land use, utilities and aesthetic values. The closure of construction activities may leave a certain impact on COEs.	All COEs	Contractor will be asked to submit rehabilitation and restoration plan along with SSEMPs. Camp site is restored as per contract. Contractor will make sure that none of the COEs' utilities are disturbed or exploited. All extra products / materials, solid and liquid will be disposed off	Contractor	DD Environment - PIU, PIU, ICISDD	All COEs	Photograph	Before, Monthly

Sr. No.	Project Components / Activity	Impacts	COEs	Mitigation Measures	Responsibility		Location to Implement	Parameters for Monitoring	Monitoring & Reporting Frequency
					Implementation / Reporting	Monitoring/supervision			
				in accordance with the requirement of the EIA and contract document by the contractor. Contractor will make sure that site restoration is near to the baseline settings and the damage to land, property, and trees is compensated.					
24	Construction Workers / labor Safety	The execution of construction / renovation works and installation of equipment pose safety issues for the construction workers.	All COEs	Best practices on Health and Safety will be adopted like: <ul style="list-style-type: none"> • Provision of Personal Protective Equipment to workers. • Safety trainings to the workers. • Contractor will engage drivers having all relevant licenses for operating construction vehicles and machinery. • Safe driving trainings to drivers • Adequate safety barricades for working at or near any elevated level and excavated level. 	Contractor	DD Environment - PIU, PIU, ICISDD	All COEs	Visual inspection / observation <ul style="list-style-type: none"> • Use of PPE • Check record of safety inductions/ trainings • Compliance with best practices on health and safety. 	Monthly

Sr. No.	Project Components / Activity	Impacts	COEs	Mitigation Measures	Responsibility		Location to Implement	Parameters for Monitoring	Monitoring & Reporting Frequency
					Implementation / Reporting	Monitoring/supervision			
				<ul style="list-style-type: none"> • Provision of electrical safety training procedures during electrical installations etc. • Provision of firefighting equipment and training before and during the construction. • Provision of shoring to the excavated areas on priority basis • Compliance with best practices on Health and Safety. • The contractor will have the obligation to protect the health and ensure safety of the workers involved in construction / renovation activities through preparation and implementation of OHS Plan. <p>The contractor will supply PPE and ensure their use at the site such as safety gloves, masks, face shields, goggles, safety shoes, and safety helmet.</p>					

Sr. No.	Project Components / Activity	Impacts	COEs	Mitigation Measures	Responsibility		Location to Implement	Parameters for Monitoring	Monitoring & Reporting Frequency
					Implementation / Reporting	Monitoring/supervision			
				First aid boxes will be available at each site. The workers will also follow the COVID-19 SOPs during work.					
Operation Phase									
1	Noise	Increase in noise levels in the area due to influx of more students is expected in operation phase. The noise levels are already high during night times as per baseline environmental monitoring results. According to IFC Guidelines, if the background noise levels already exceed the standard, a maximum increase in background levels of 3 dBa is allowed. The increased noise level may have less impact on COE buildings but the hostels may	All COEs	The installation of double-glazed windows and fixed glass windows with air conditioners are recommended to reduce noise in hostels and new buildings. (Safety signs such as "No Horns Please" will be placed at parking lots. Consideration of noise reducing measures i.e. operating the equipment in day time and closing the windows during classes. For machinery / equipment, installation of shock absorbers and proper lubrication is recommended.	PIU	Consultant, ICISDD	All COEs	Inspection	Start and Bi-annually

Sr. No.	Project Components / Activity	Impacts	COEs	Mitigation Measures	Responsibility		Location to Implement	Parameters for Monitoring	Monitoring & Reporting Frequency
					Implementation / Reporting	Monitoring/supervision			
		have more impacts.							
2	Health and Safety Issues to Students in Dormitories	The planned blocks in GCT Multan are across the road to other building blocks and there is a possibility of free movement between both blocks. The students/staff can be at risk of road accidents. Further, COEs and hostels may have ventilation and fire risks due to natural gas or cylinders uses	All COEs	If building blocks are proposed on both sides of road then there will be a provision of pedestrian bridges in detailed design of COEs to avoid any accidents. In all buildings, firefighting equipment will be installed. Students/staff will be given training on HSE and fire risks. Proper installation of HVAC in COEs is recommended. First aid box will also be readily available in the buildings.	PIU	Consultant, ICISDD	All COEs	Pedestrian bridge, Risk Assessment at GCT Multan	Start and Bi-annually
3	Power Requirements	The addition of new building blocks and installation of new machinery/equipment would cause an impact on power requirements.	All COEs	Designer will calculate the power requirements and will propose the installation of solar panels as an energy resource. The conversion of conventional lights to LED bulbs are recommended.	PIU	Consultant, ICISDD	All COEs	Electricity Bill	Start and Bi-annually

Sr. No.	Project Components / Activity	Impacts	COEs	Mitigation Measures	Responsibility		Location to Implement	Parameters for Monitoring	Monitoring & Reporting Frequency
					Implementation / Reporting	Monitoring/supervision			
				Designer will also consider the green building concept.					
4	Ground Water Usage	The drinking water consumption would also increase due to increase in number of students/staff in COEs.	All COEs	There will be a general thumb rule of preserving the natural resource and not wasting it. Training sessions will be conducted on groundwater preservation	PIU	Consultant ICISDD	All COEs	Running hours of water pumping	Monthly
5	Damage to Compensatory Tree Planting	The new saplings of trees which construction contractor may grow as compensation to the expected damage to green lawns and trees during construction, can be impacted by trespassers.	All COEs	Engagement of landscape inspector to observe the growth of trees and well-being of grassy lawns.	PIU	Consultant ICISDD	All COEs	According to Trees Inventory	Monthly
6	Cleaning Mechanism of PV Solar Panels	With the passage of time, dust and soot deposit on the surface of PV modules which requires regular cleaning of PV panels on routine basis. About	All COEs	The water supply system will be installed along the solar panel array for cleanliness purpose. There will be minimal discharge of wastewater from cleaning of solar PV modules. The wastewater emanating	Concerned COE	DD Environment - PIU, ICISDD	All COEs	Inspection	Twice a month

Sr. No.	Project Components / Activity	Impacts	COEs	Mitigation Measures	Responsibility		Location to Implement	Parameters for Monitoring	Monitoring & Reporting Frequency
					Implementation / Reporting	Monitoring/supervision			
		15,000 liters of water is required for 1 MW PV modules at one time ¹⁰⁹ . If not cleaned regularly, efficiency of the solar system will be lower down day by day.		from cleaning operations will be recycled for plantation around the COEs. Periodic cleaning of the PV modules will be ensured at least bimonthly.					
7	Health and Safety Issues related to Solar Panels and System	There are occupational health and safety risks to workers who will be involved in the operation and maintenance activities of solar system. Risks generally associated to solar system's O&M are: exposure to a variety of hazards such electric shock, burn hazards; and exposure to chemicals, hazardous or	All COEs	O&M of machinery and equipment of solarpanels will be controlled and handled by efficient management, staff training, and related preventive measures. Provision of PPE's to the workers dealing with O&M of solar system. Proper training will be given to workers on health and safety measures.	Concerned COE	DD Environment - PIU, PIU, ICISDD	All COEs	Inspection	Monthly basis

¹⁰⁹ Renewable Resources (Private) Limited. 2017. *Environmental impact assessment: Zorlu Solar Power Project* (prepared for ADB).

Sr. No.	Project Components / Activity	Impacts	COEs	Mitigation Measures	Responsibility		Location to Implement	Parameters for Monitoring	Monitoring & Reporting Frequency
					Implementation / Reporting	Monitoring/supervision			
		flammable materials (if any).							
8	Solid Waste Generation from Solar Power System	Different types of waste including municipal and hazardous wastes are likely to be generated during the operation phase of the COEs. The maintenance of solar system may generate small quantities of wastes, such as pieces of metal pipes, pipe fittings, copper, aluminum, rubber, silicon, glass as well as left over materials, etc. Solid wastes can also be generated from the operations of workshops within each COE whose composition depends on the activities being performed in the workshops. For example, food	All COEs	A waste inventory of various waste generated will be prepared and periodically updated. Food waste and recyclables viz. paper, plastic, glass etc. will be stored in designated waste bins/containers. The recyclables will be periodically sold to local recyclers while food waste will be disposed through waste handling agency. Hazardous waste viz. waste oil etc. will be collected and stored in paved and bounded area and subsequently sold to authorized recyclers. Ensure immediate collection of solid waste after the completion of maintenance works. Regular trainings will be provided to staff involved in solid waste management.	Concerned COE	DD Environment - PIU, PIU, ICISDD	All COEs	Inspection	Monthly basis

Sr. No.	Project Components / Activity	Impacts	COEs	Mitigation Measures	Responsibility		Location to Implement	Parameters for Monitoring	Monitoring & Reporting Frequency
					Implementation / Reporting	Monitoring/supervision			
		technology lab may produce organic waste whereas automobile technology lab may produce waste lubricants, pieces of metals, etc. These waste can potentially cause soil and water contamination, if not properly managed.							

9.6. Contractor's SSEMPs

359. The contractor(s) will prepare SSEMP for each of the COE taking help from ADB's handbook on SSEMP, EIA and EMP, that will contain the aspects and key elements of following site-specific plans to eliminate, offset or reduce environmental, social and health and safety impacts during construction phase:

- (i) Site plans, site boundaries, sensitive receptors & environmental values
- (ii) Specify construction activities and conduct risk assessment
- (iii) Prepare environmental mitigation and monitoring plan
- (iv) Sanitation plan
- (v) Soil pollution control plan
- (vi) Dust control plan
- (vii) Waste management plan
- (viii) Occupational health and safety plan (including COVID-19 measures)
- (ix) Vibration management plan
- (x) Noise abatement plan
- (xi) Traffic management plan
- (xii) Construction camps management plan
- (xiii) Campsite restoration plan
- (xiv) Tree plantation/management plan
- (xv) Social management plan
- (xvi) Labor influx management plan
- (xvii) Community health and safety plan
- (xviii) Emergency preparedness plan
- (xix) Asbestos management plan

9.7. Environmental Monitoring and Reporting

360. Environmental Monitoring provides timely and useful information to the project management and implementation agencies. Conceptually, "monitoring" means to check and balance, on a regular basis, the status of the project activities and realization of various developmental targets during construction and operation and maintenance (O&M) phases. It helps in timely identification/analysis and removal of the bottlenecks and expedites actions. Certain environmental parameters (physical, chemical and ecological) are selected and quantitative analysis is carried out. The results of analysis are compared with the guidelines; standards and pre-project condition to investigate whether the EMP and its implementation are effective for the mitigation of impacts or not.

1. Objectives

361. The objective of environmental monitoring program during the construction phase will be as follows:

- (i) Monitor the actual project impacts on physical, ecological and socio-economic receptors;
- (ii) Recommend mitigation measures for any unforeseen impact or where the impact level exceeds than the anticipated in the EIA;
- (iii) Ensure compliance with legal and community obligations including safety during construction phase;

- (iv) Ensure the safe disposal of excess construction materials, solid waste, water and wastewater and gaseous emissions;
- (v) Appraise the adequacy of the EIA with respect to the project's predicted long-term impacts on the area's physical, ecological and socio-economic environment;
- (vi) Evaluate the effectiveness of the mitigation measures proposed in the EMP, and recommend improvements in EMP, if required; and
- (vii) Compile periodic incidents/accidents data to support analyses that will help to minimize future risks.

2. Major Receptors

362. The main receptors during the construction phase are mainly:

- (i) Students and teaching staff within CEOs and settlements near the Project Area.
- (ii) Tube wells, the sources of drinking water;
- (iii) Agricultural fields including crops;
- (iv) Trees and other plantation in vicinity of Project Area

3. Implementation of Monitoring

a. Contractor

363. Physical implementation of the EMP is the sole responsibility of Contractor during the construction of the project. Contractor will be responsible for in-house monitoring to ensure that the construction activities are being carried out as specified in the EMP.

b. DD Environment - PIU

364. DD Environment - PIU will be responsible to check the environmental monitoring activities (during construction phase) being carried out by the Contractor and will perform the following activities.

- (i) Check whether monitoring of the environmental aspects of project during construction phase is being properly carried out and to ensure that the environmental requirements of the contract and the mitigation measures proposed in the EMP are implemented;
- (ii) Undertake routine visual monitoring of construction activities, solid and liquid waste disposal, storm water drainage management, noise levels, exhaust gases etc.;
- (iii) Review the monitoring reports that would be prepared by the Contractor and make recommendations (if any); and
- (iv) To submit a monitoring report to Proponent and actions taken for rectification.

4. Environmental Monitoring Methodology

365. As mentioned earlier, the baseline environmental monitoring was originally conducted in July 2020 following all the required SOPs and guidelines. An independent environmental monitoring laboratory i.e. M/s Environmental Services of Pakistan Private Limited (ESPAK) was engaged for this purpose. The baseline environmental monitoring report prepared and submitted by M/s ESPAK is also annexed as Appendix-V to the EIA. The referred report also provides information on the methodology adopted for environmental monitoring. However, a similar process of the baseline monitoring for ground water, wastewater, ambient air and noise at all COE sites will be conducted again through an independent, EPA approved laboratory to determine the most recent baseline levels at the detail design stage and prior to the start of construction works.

Similarly, Table 8.2 below also provides information regarding parameters to be tested, their frequencies and responsibilities at each phase including detailed design, pre-construction, construction and operation of the project. Phase wise costing of environmental monitoring is also provided in Table 8.4.

366. Under the proposed monitoring methodology, it is recommended that PIU of ICISDD shall be responsible for all the monitoring activities. All the findings and results in the form of monitoring report will be finally shared with Punjab-EPA as well as with ADB as part of Semi-Annual Monitoring Report. The monitoring program has been designed carefully considering the identified impacts mentioned in Chapter-7 and some additions or deletions probably in frequency may be taken up in this program after learning lessons from one-year operation of the project through Change Record Register. Table 8.2 provides environmental monitoring schedule for construction and operations stages of the project.

367. Monitoring mechanism for groundwater and wastewater samples will be discrete grab sampling and laboratory testing of water samples by EPA approved laboratory for monitoring whereas ambient air and noise levels will be monitored through onsite monitoring through certified equipment of same laboratory. Soil testing is also recommended to be performed from certified soil testing laboratory e.g., Pakistan Council of Scientific and Industrial Research (PCSIR), Soil Survey of Pakistan, etc.

368. Detailed methodology for conducting the monitoring will be prepared and shared with ADB by Supervision Consultant / PIU prior to commencement of the monitoring exercise.

5. Monitoring Parameters and Frequency

369. The major negative impacts of the Project activities are related to ambient air & noise, and water resources, which will directly or indirectly effect the environment and will cause health problems to the receptors residing in the surrounding of the power plant. In order to counteract these problems an environmental monitoring protocol has been proposed (Table 8.2). The environmental monitoring needs to be conducted through an independent, EPA approved laboratory. The proposed protocol contains the following monitoring parameters:

a. Physical Environment

370. For physical environment, following parameters will be monitored:

- (i) Ambient air quality
- (ii) Noise levels
- (iii) Water (Ground and surface)
- (iv) Wastewater
- (v) Solid waste disposal

b. Socio-economic Environment

371. Effects on the socio-economic environment during construction phase will be monitored by Social Safeguard Team, considering parameters like employees' accommodation and food related facilities, community health and safety, mobility of local women, code of conduct with COE people.

Table 8.2: Environmental Monitoring Plan

Project Phase	Parameters	Location	Frequency	Responsibility
Detailed Design Stage				
Ambient Air Quality	PM10, PM2.5, SO2, NOx, O3 CO, and VOC.	All COEs	Once at During Detailed Design	Detailed Design Consultant
Ground Water Quality	Color, pH, Odor, Taste, Turbidity, TDS, TSS, Heavy Metals, Phosphate, NH3, Arsenic, Sulphate, Sulfide, Coliforms, Other Heavy Metals and Fecal Coliforms	All COEs	Once at During Detailed Design	Detailed Design Consultant
Noise Level	Noise levels on dB (A) scale	All COEs	Once at During Detailed Design	Detailed Design Consultant
Pre-Construction Phase				
Ambient Air Quality	PM10, PM2.5, SO2, NOx, O3 CO, and VOC.	All COEs	Once, before starting any civil works	Contractors Submission to PIU and SCs
Ground Water Quality	Color, pH, Odor, Taste, Turbidity, TDS, TSS, Heavy Metals, Phosphate, NH3, Arsenic, Sulphate, Sulfide, Coliforms, Other Heavy Metals and Fecal Coliforms	All COEs	Once, before starting any civil works	Contractors Submission to PIU and SCs
Noise Level	Noise levels on dB (A) scale	All COEs	Once, before starting any civil works	Contractors Submission to PIU and SCs
Construction Phase (Complete i.e. Start to End)				
Ambient Air Quality	PM10, PM2.5, SO2, NOx, O3 CO, and VOC. Visual monitoring of dust	All COEs	Quarterly	Contractor (s), Submission to PIU and SCs
Ground Water Quality	Color, pH, Odor, Taste, Turbidity, TDS, TSS, Heavy Metals, Phosphate, NH3, Arsenic, Sulphate, Sulfide, Coliforms, Other Heavy Metals and Fecal Coliforms	All COEs	Quarterly	Contractor (s), Submission to PIU and SCs

Project Phase	Parameters	Location	Frequency	Responsibility
Wastewater Quality	PEQS 32 Parameters.	All COEs	Quarterly	Contractor (s), Submission to PIU
Noise Level	Noise levels on dB (A) scale	All COEs	Quarterly	Contractor (s), Submission to PIU
Soil	Oil and grease, Total Toxic Metals, Nitrate and Phosphate	All COEs	Quarterly	Contractor (s), Submission to PIU
Operation Phase				
Ambient Air Quality	PM ₁₀ , PM _{2.5} , SO ₂ , NO _x , O ₃ CO, and VOC	All COEs	Quarterly	PIU
Noise	Noise levels on dB (A) scale	All COEs	Quarterly	PIU
Drinking Water	Color, pH, Odor, Taste, Turbidity, TDS, TSS, Heavy Metals, Phosphate, NH ₃ , Arsenic, Sulphate, Sulfide, Coliforms, Other Heavy Metals and Fecal Coliforms	All COEs	Quarterly	PIU
Wastewater	PEQS 32 Parameters.	All COEs	Quarterly	PIU
Soil	Oil and grease, Total Toxic Metals, Nitrate and Phosphate	All COEs	Quarterly	PIU
		All COEs		

9.8. Waste Management Framework

372. There is a possibility of exposure to hazardous substances from old building such as Asbestos. The WMF describes general procedures or guidance on waste management issues including hazardous waste. It has been assessed that various types of waste will be generated during the construction, rehabilitation phases of the proposed COEs, mainly at 15 sites. This plan also addresses how waste will be managed by Contractor. This WMF is intended to serve as;

- (i) A primary waste management reference document;
- (ii) A basis for the Contractor and Proponent (ICI & SDD) to develop a detailed WMP during construction and rehabilitation respectively; and,
- (iii) A compliance bench mark.

1. Relevant National Rules, Regulations and Institutions

373. Following is the list of relevant legal requirements:

- (i) PEPA 1997 (Amended 2012) Section 11;
- (ii) PEQS for Wastewater Effluents;
- (iii) Hospital Waste Management Rules, 2005;
- (iv) Draft Hazardous Substances Rules, Punjab;
- (v) Draft Guideline for Solid Waste Management, 2005;
- (vi) Final Report for Domestic Solid Waste Management in Pakistan, 2002;
- (vii) Public Health Engineering Department, Punjab;
- (viii) Local Government Act; and
- (ix) EPD-Punjab.

2. Type of Waste

374. Following are the main types of expected wastes:

- (i) Solid Waste;
- (ii) Wastewater; and
- (iii) Other hazardous waste.

3. Construction Wastes and their Disposal Method

375. The waste envisaged to be generated during the construction phases of the proposed project include;

- (i) Steel;
- (ii) Concrete;
- (iii) Fuel;
- (iv) Wood;
- (v) Cotton;
- (vi) Paper;
- (vii) Plastics;
- (viii) Rubbish;
- (ix) Food;
- (x) Organic Waste;
- (xi) Wastewater;
- (xii) Waste Oil;
- (xiii) Medical treatment materials such as bandages, swipes etc.; and
- (xiv) Other types of wastes.

376. The anticipated waste will be collected, handled and stored through a properly designed Waste Management System. Contractor will develop details of this system for construction phase based on the general protocols as follows:

- (i) Best management practices for safe handling and disposal of hazardous/toxic material if found will be considered. Contractor would analyze all such materials from an EPA registered laboratory. The collection of material would involve covering suits, PPEs proper packaging of hazardous material, transportation will follow the international standards avoiding any kind of spill and release into the environment, disposal will be done in collaboration with city waste management company and EPA either through engineered landfill or incineration.
- (ii) Color coded waste buckets will be provided within the contractor's camp so that the waste will be categorized and separated accordingly;

- (iii) Some of the construction waste/waste material to be generated at the construction site may be hazardous to the environment or to personnel. It is always important to read the MSDS of the materials or products that are located on-site; they may contain warning information that indicates a potential problem. All hazardous wastes will be clearly labeled. Scrap, Trash other waste will be placed in designated containers;
- (iv) Divert the filtered waste to the nearest available landfill site. If the landfill site is not available then Contractor needs to develop a landfill at the area mutually agreed with the Proponent, Social Safeguard Team, Local Community, TMA and District Government Punjab;
- (v) Based on the conditions of the region, organic waste will be frequently collected to avoid odor problems;
- (vi) Temporary waste storage area will be prepared, maintained and visually inspected and recorded on regular basis by the HSE Section of Contractor during the construction phase;
- (vii) Wastewater generated at contractor's camp will be disposed off in the soaking pit;
- (viii) The final location of the pits will be mutually agreed on-site with Social Safeguard Team, HSE Section of Contractor and Proponent;
- (ix) The contractor will keep accurate records that track the amount of waste generated and the disposal method used;
- (x) Regular clean-up of scrap material, saw dust, rags, oil, paint, grease, flammable solvents and other residue of construction operations will not only remove or reduce the fire hazard, but shall promote general safety at the same time.
- (xi) Site restoration and cleaning of all waste material after ending of contract period.

4. Transportation and Disposal Record Sample

377. Contractor will be responsible for the lawful transportation and disposal of the collected waste in approved facilities, a sample sheet of Transportation and Disposal Records is shown below in Table 8.3:

Table 8.3: Sample Sheet of Transportation and Disposal Records

NAME OF STATION				
MODE OF TRANSPORTATION				
WASTE DISPOSAL STATION				
VEHICLE NUMBER				
Waste Type	Hazardous Yes/No	Non-Hazardous Yes/No	Quality and Quantity of Waste	Disposal
SUPERVISOR SIGNATURE DATE			FACILITY SUPERVISOR SIGNATURE DATE	

9.9. Environmental Training

378. For the given EMP and all associated frameworks, it has been envisaged that training of concerned / responsible teams is an important task. Training and awareness programs will be developed for each phase. Following trainings as a minimum will be given to the implementing / executing agencies during the course of the project:

- (i) Design Phase: PIU Training on Development of SSEMPs from main EMP & Compliance Assurance
- (ii) Construction Phase: PIU Training on HSE and EMP Compliance Monitoring, Contractor Training on SSEMP implementation and HSE Management, Preventive Medical Treatment, Checkups and Pre-examination.
- (iii) Operation: COEs Management / Administration staff training on HSE awareness

9.10. Health & Safety Management Framework

379. The Health and Safety Management Framework provides a basis for Contractor to create a detailed plan to reduce and remove any harm due to construction activities to local management, construction staff and local residents' health and ensure human safety of the management and construction staff at the project site.

1. Occupational Health and Safety Hazards

380. Hazards at the construction site can occur due to:

- (i) Covid-19 spread
- (ii) Over-exertion;
- (iii) Slips and Fall;
- (iv) Working on Heights;
- (v) Exposure to heat (hot work);
- (vi) Struck by Objects;
- (vii) Moving Machinery;
- (viii) Dust;
- (ix) Confined Spaces and Excavations; and
- (x) Other Site Hazards etc.

2. Safety Planning

381. The potential safety requirements that will be taken care of during construction are as follow:

- (i) Government of Pakistan Covid-19 guidelines for construction will be followed religiously;
- (ii) Everything needs to be properly ordered;
- (iii) Confined space entry procedures;
- (iv) Compress gas cylinder safety;
- (v) Leakage and spillage control;
- (vi) Compliance with safety belt requirements;
- (vii) Provision of protection rail;
- (viii) Provision of safety signs on construction site;
- (ix) Inspection at open bulk excavation area;
- (x) Measure for operation of electrical and mechanical equipment;
- (xi) Forecasting and precautions against natural disaster;
- (xii) Providing driving/operating safety requirements;

- (xiii) Installation of traffic signs on construction roads;
- (xiv) Safety guard during transportation of dangerous products;
- (xv) Providing slip and fall trainings;
- (xvi) Use of personal protective equipment (PPE) provides additional protection to workers exposed to workplace hazards;
- (xvii) Controlled measures for confined spaces; and
- (xviii) Disciplinary sanctions against offenders.

3. Health Plan

382. The HSE Section of the Contractor will be responsible for publicizing and implementing labor protection, covid-19 inspection, isolation of those who are infected from disease, vocational health and sanitary epidemic prevention policies and standards during construction, offering health training to the staff and applying preventive measures. Some of the clauses that will be duly taken care while preparing a Health Plan will include the following:

- (i) Measures to avoid diseases on site;
- (ii) Establishment of the construction staff's vocational health file; and
- (iii) Establishment of the medical treatment room and configuring professional medical treatment and nursing staff.

4. Responsibility

383. Contractor will establish HSE Section as a standing organization for health and safety management and Covid-19 testing during the construction phase. The contractor construction units will be responsible for establishing the management system, implementation of management measures and ensuring realization of its objectives. While during the O&M phase, PIU and Contractor will be held responsible for all HSE issues.

384. The details of organizational structure, roles and responsibilities will be determined in detailed plan to be prepared by the Contractor.

5. Health and Safety Documentation

385. Contractor will be responsible for implementing the following procedure and rules during the construction phase. These include:

- (i) Covid-19 log book
- (ii) Permit to work system;
- (iii) The field safety management rules;
- (iv) Labor protection management rules;
- (v) Fire-fighting management rules;
- (vi) The field traffic management rules;
- (vii) Working order management rules for special operation;
- (viii) Emergency proposal, and location and arrangement of emergency exits;
- (ix) Management rules for safety meeting;
- (x) Various safety check records and meeting minutes; and
- (xi) Training records.

6. Suggested Contents of Health and Safety Plan

386. The suggested contents of Health and Safety Plan to be developed by the Contractor are described below:

- (i) Purpose
- (ii) Scope of Application
- (iii) Complying Basis
- (iv) Health and Safety Objectives
- (v) Organization and Responsibility
 - a) Project Manager
 - b) HSE Management Department of the Contractor
 - c) Contractor Medical Treatment Room of the Contractor
 - d) Occupational Health and Safety
 - e) Community Health and Safety
- (vi) Health Plan
 - a) Labor Protection
 - b) Sanitary Epidemic Prevention
- (vii) Safety Plan
 - a) Summary
 - b) Qualification Review
 - c) Safety Training
 - d) Construction Plans and Documents
 - e) Control Measures
 - f) Monitoring Measures
 - g) Management of the Key Safety Accidents
- (viii) Public Security Plan
- (ix) Local Community Health and Safety

9.11. Traffic Management Framework

387. During the course of the construction of proposed Project, Contractor will provide the signage and/or traffic control to the extent deemed necessary by the conditions and amount of traffic using or accessing the site roads. These signs will inform, control, warn, shift, or stop traffic on all site roads affected by the project's heavy traffic. The following measures will be taken during the construction phase for the effective implementation of the traffic plan:

- (i) Pakistan national and local traffic rules and regulations, instructions manual for motor vehicle and mobile machinery operation is to be followed;
- (ii) No one will be allowed to drive motor vehicle or operate mobile machinery without a driving license;
- (iii) It will be prohibited to drive or operate vehicle in case of over fatigued or mental disease;
- (iv) Traffic speeds on unpaved roads will be limited to no more than 30 Km per hour;
- (v) Traffic speed signs will be displayed prominently at all site entrances;
- (vi) A daily routine checkup of vehicles will be conducted no less than 5 minutes before its service;
- (vii) Use of appropriate signs, equipment, and traffic control measures that conform to the provisions in the Traffic Manual of city traffic police;
- (viii) Traffic inspection and security during transportation;
- (ix) Limit vehicular traffic designated access roads, construction laydown area worker, parking areas and the project site;
- (x) All damaged, destroyed or modified pavement legend, traffic control devices, signing and striping associated with the proposed development will be replaced as required prior to issuance of a certificate of Occupancy; and
- (xi) Construction signs, lighting and barricading will be provided during construction as required.

1. Material Transportation Routes

388. These routes would be specified for construction camp and will be established in such a way that there is a minimum hindrance or disturbance to the local communities and to the flow of traffic. The routes will be marked on a map by the Contractor and approved by District Traffic Police, District Government and concerned road authority.

2. Material Transportation and HSE Arrangements

389. Following arrangements will be made for Material Transportation and HSE:

- (i) Transportation timings will preferably be at night, to minimize the traffic conflicts;
- (ii) Filled trucks will be covered with tarpaulin to avoid fugitive dust and will be visually inspected for proper loading, sealing and decontamination;
- (iii) Bulk solid debris will be removed from the trucks with shovels before leaving the site. Where necessary, trucks will be pressure washed before leaving the site. Pressure washing will only be used if other methods do not work;
- (iv) Vehicles will be passed an annual inspection and carry a fitness certificate;
- (v) A summary chart representing the load and maps showing the proposed route to the disposal facility will accompany with each truckload. In the event of an accident involving the transported material, it will immediately be notified to Social Safeguard Team of Proponent, Traffic Police; and
- (vi) The truck drivers will be strictly instructed not to play music and use horns at night time to minimize disturbances.

3. Material Transportation Documentation

390. A field logbook will be maintained for the documentation. This logbook will additionally serve to document observations, onsite personnel, equipment arrival and departure times, a truck exit inspection checklist and other project information.

391. Field logbooks will document where, when, how, and from whom any vital project information is obtained. Logbook entries will be completed and accurate enough to permit reconstruction of field activities. Logbooks will be bound with consecutively numbered pages. Each page will be dated and the time of entry will be noted. All entries will be legible, written in black ink, and signed by the individual making the entries. Language will be factual, objective, and free of personal opinions or inappropriate terminology. If an error is made, corrections will be made by crossing a line through the error and entering the correct information. Correction will be dated and initialed. No entries will be obliterated or otherwise rendered unreadable.

392. Entries in the field logbook will include at a minimum the following for each field work date:

- (i) Site name and address;
- (ii) Recorder's name;
- (iii) Time of site arrival/entry at site and time of site departure;
- (iv) A Summary of any onsite meeting;
- (v) Description of transport vehicles;
- (vi) Quantity of materials in truck (approximate percentage of full load);
- (vii) Names of waste transporters and proposed disposal facilities;
- (viii) Quantity of material in truckloads; and
- (ix) Levels of safety protection.

9.12. Environmental Enhancement Measures

393. Following environmental enhancement measures are proposed for effective implementation of the project:

- (i) Installation of solar panel systems
- (ii) Introduction of environment, health and safety in the curriculum
- (iii) Environmental and Social Safeguards training
- (iv) Inclusion of Environmental aspects in the building design construction i.e. green building or energy efficient buildings, using LEDs
- (v) Drinking water improvement
- (vi) Sanitation and Sewerage Improvement
- (vii) Plantation of trees in 1:5 ratio

9.13. Environmental Management Costs

1. Environmental Monitoring Cost

394. An estimated cost for instrumental monitoring (including security, transportation, preservation collection cost) for Pre-Construction and Construction phases of the Project is given in Table 8.4. For details such as sampling parameters, location, frequency and estimated number of points please refer to EMP (Table 8.1). Further, during construction phase, as estimate of cost for usage of PPE, construction camps' emissions controls and salaries of environmental monitors to be hired by contractor(s) is also given.

Table 8.4: Environmental Monitoring Cost

Project Phase / Activity	Per unit (Monthly) Cost (PKR)		Annual Cost for One COE (PKR)	Total Annual Cost for 19 COEs (PKR)	Total Duration Cost for 19 COEs (PKR)
	Measuring Parameter	Unit Cost			
Detailed Design Stage (Environmental Monitoring, Once)	Air Quality	30,000	150,000 x 1 = 150,000	3,000,000	3,000,000
	Noise	25,000			
	Drinking Water	45,000			
	Wastewater	50,000			
Construction (Environmental Monitoring Quarterly, for One Year)	Air Quality	30,000	150,000 x 4 = 600,000	12,000,000	24,000,000
	Noise	25,000			
	Drinking Water	45,000			
	Wastewater	50,000			
Operational (Environmental Monitoring Quarterly, for One Year)	Air Quality	30,000	150,000 x 4 = 600,000	12,000,000	12,000,000
	Noise	25,000			
	Drinking Water	45,000			
	Wastewater	50,000			

Project Phase / Activity	Per unit (Monthly) Cost (PKR)		Annual Cost for One COE (PKR)	Total Annual Cost for 19 COEs (PKR)	Total Duration Cost for 19 COEs (PKR)
	Measuring Parameter	Unit Cost			
	Soil	100,000	100,000 x 4 (quarterly) = 400,000	8,000,000	8,000,000
Salary of Environmental Expert	Deputy Director (Environment) (60 man-months)	30,000	30,000 x 12 = 360,000	7,200,000	36,000,000
	Lead EHS Specialists (18 man-months)	25,000	25,000x12= 300,000	6,000,000	9,000,000
	02 Deputy EHS Specialists (18 man-months)	40,000	40,000x12= 480,000	4,800,000	7,200,000
	Environment Specialist(s) of Contractor at each site (18 man-months)	20,000	20,000x12= 240,000	4,800,000	7,200,000
EHS Control Measures including PPEs, trainings, solid waste management, etc. Monthly for One Year)	Monthly	100,000	100,000 x 12 = 1,200,000	24,000,000	60,000,000
Total					166.4 Million PKR (0.804 Million USD)

2. Plantation Cost

395. The minimum number of trees to be raised will be 5 times the number to be removed, thus 750 number of plants will be raised in lieu of approximately 150 trees which are liable to be affected during construction phase of the project. The cost of raising one avenue mile i.e. 500 plants, has been estimated as Rs. 500,000/- including price of plants, earthwork, procurement of manures, continued supply of water to young plants throughout the year and its maintenance five (5) years keeping the labor rate as Rs. 500 per day per man (MD):

Table 8.5: Tree Plantation Cost

Sr. No.	Item	Cost (PKR)	Cost (USD)
Construction Phase			
1	Total cost for purchasing and raising 750 plants inside and along the boundary	750,000	3,658.54 (would be covered under civil works package)
Operation Phase			
2	Total cost for maintaining 750 trees per year	750,000	3,658.54

3. Other Costs

396. The Project implementation would require installation of environmental enhancement measures as bulleted above. Cost for each of the environmental enhancement measure is given below:

Table 8.6: Cost for Environmental Enhancement Measures

Environmental Enhancement Measure	Total Cost (USD)
Installation of solar panel systems in Design Phase	<i>Would be covered under equipment supplier package</i>
Environmental and Social Safeguards training during Construction	<i>Would be covered under Architectural Design and construction supervision firm package</i>
Drinking water improvement in Construction Phase	<i>Would be covered under equipment supplier</i>
Sanitation and sewerage Improvement in Construction Phase	<i>Would be covered under construction and design package</i>

4. Summary of Environmental Costs

397. Table 8.7 below presents a summary of all the environmental costs.

Table 8.7: Summary of Environmental Costs

Project Phase / Activity	Environmental Cost (PKR)	Environmental Cost (USD)
Environmental Monitoring	166.4 Million	0.804 Million
Tree Plantation & Maintenance Cost	1.5 Million	0.0036 Million
Total	83.83 Million	0.8036 Million

10. GRIEVANCE REDRESS MECHANISM

10.1. General

398. In order to receive and facilitate the resolution of public concerns, complaints and grievances about the Project's environmental performance, a Grievance Redress Mechanism (GRM) will be established at the province level. The GRM will address all the concerns and complaints proactively and promptly, using an understandable and transparent process that is gender responsive, culturally appropriate, and readily accessible to all segments of the stakeholders at no costs and without retribution. The mechanism will not impede the citizen's right of access to the country's judicial or administrative remedies, if he/she is not satisfied with mechanism.

399. This section describes mechanism to receive and facilitate the resolution of grievances. It explains how the procedures are accessible to public, COEs/TVET sector personnel including women. A Grievance Redress Mechanism (GRM) will be established to allow anyone appealing against any decision, practice or activity arising out of survey, data collection, compensation rates/awards, and resettlement-related benefits (grievances could also be caused by other social and environmental impacts/issues). Stakeholders will be fully informed of their rights and of the procedures for addressing complaints under GRM during Project information disclosure at various villages/community meetings.

1. Grievance Redress Procedure (GRP)

400. The following modus operandi of the GRM has been envisaged for its efficient and effective functioning.

a. Formation of a Grievance Redress Committee (GRC)

401. The formation of a Grievance Redress Committee (GRC) will be constituted at project level as part of institutional arrangements for successful implementation of the project.

402. The Committee will meet at least twice a month and provide decision to resolve the issues at the end of the meeting. The non-official members will be provided logistics for the committee meetings. The committee may request the complainant to attend and present his case. The representative of the Contractor will attend the proceedings of the Committee if some matter relating to the Contractor's behavior is put before the committee. In case of disagreement of the complainants with the decision of the GRC, the case will be referred to the Project Director, PIU by the Committee with their observations and recommendations. The PD, PIU is the final authority at the project level to decide a case. However, the aggrieved person will have the right to go to proper court of law, in case he is not satisfied with the decisions of the PD. The members of the GRC may be included as follows:

1- Project Director	Convener
2- Deputy Director Environment	Chairman
2- Project Manager	Member
3- Senior Engineer	Member
4- Lead EHS Specialist	Member
5- Gender Specialist	Member
6- COE representatives, male/female	Member
7- Representative of the Contractor	Member

b. Maintenance of a Complaint Register (CR)

403. Additional deputy director (Environment) -PIU, will maintain the Complaint Register (CR) at site to document all complaints received from the complainants. The information recorded in the Register will include date of the complaint, particulars of the complainant, description of the grievance, actions to be taken, the person responsible to take the action, movement of the document (forwarded to whom/which Committee), follow up requirements and the target date for the implementation of mitigation measure. The register will also record the actual measures taken to mitigate these concerns. All complaints received in writing or received verbally will be (written), properly recorded and documented.

c. Conflict Resolution Procedure

404. The PD, PIU has the overall responsibility for ensuring compliance with the environmental and social provisions for satisfactory project implementation. The PD, PIU will be supported by the DD Environment - PIU; in turn assisted by the Lead EHS Specialist - Consultant and C&W Deptt to attend matters relating to environment and social issues.

405. The deputy director (environment) - PIU will be the initiating authority to address the issues. He will be bound to resolve the issue and will inform the complainant. However, if in some case, policy matters are involved, the case will be referred to the appropriate authority or committee appointed by the Project Director to decide the matter.

406. If complainant is not satisfied with his decision / action, the deputy director (environment) - PIU will refer the case to GRC. The complainant will be kept associated with the proceedings of the GRC. The GRC will take a decision within 15 days and will intimate the decision to the complainant. In case some response on the complaint is not received within 21 days of the lodging of the complaint, the complainant may send a reminder to the GRC with 07 days' notice to take legal remedial measures.

407. In case of complainant's disagreement with the decision of the GRC, the deputy director (environment) - PIU, as Chairman of the Committee, will send the case to PD, PIU. The deputy director (environment) - PIU will submit the case to PD, PIU with his observations on the matter and will respond within 07 days of the receipt of case in the PD office. If the complainant is not satisfied, the complaint will have the option to go to the court of law.

408. In case of such eventualities, all complainants will be exempted from legal and administrative fees made / paid / incurred pursuant to the grievance redress procedures. The conflict resolution process at project level is provided in the following Table 9.1.

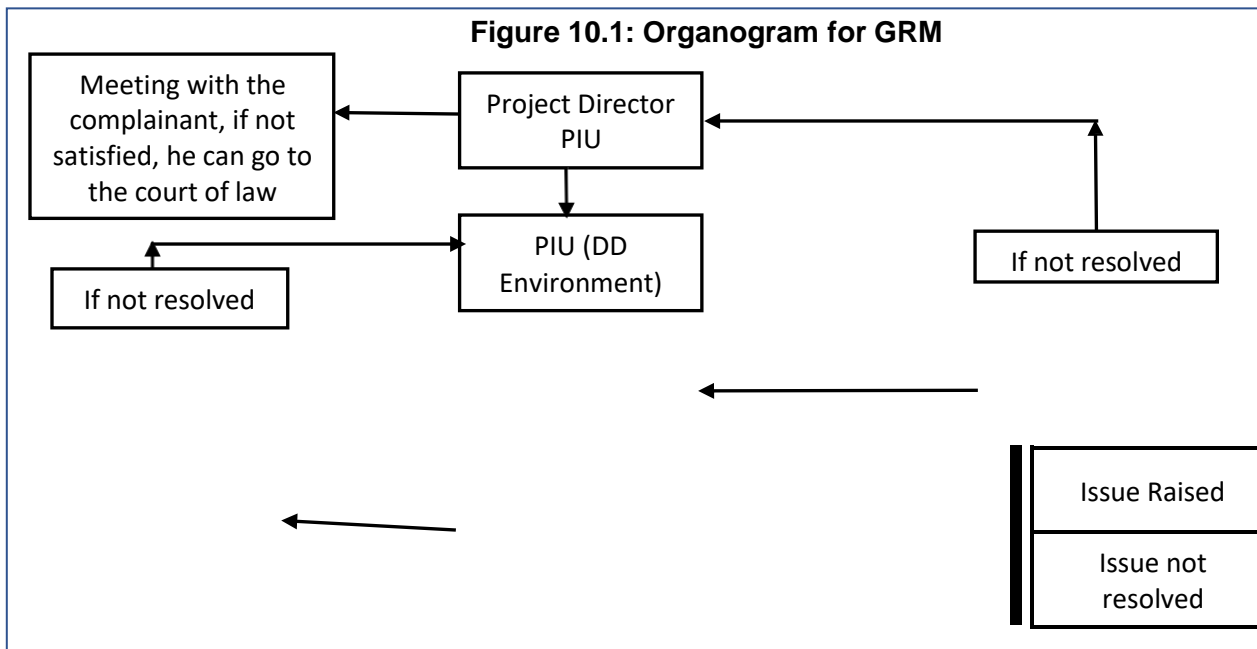
Table 9.1: Conflict Resolution Process at Project Level

Stage	Action	Location	Responsible Party	Complaint Resolution Period
1	Complaint is received and registered	PD Office	deputy director (environment) - PIU, PIU	07 days from the date of registration (if not settled then Stage – 2)
2	Passed on to Grievance	at COE	GRC	Within 15 days

Stage	Action	Location	Responsible Party	Complaint Resolution Period
	Redress Committee			(if not settled then Stage-3)
3	Referred to PD, PIU by the GRC	deputy director (environment) - PIU office	PD, PIU, through deputy director (environment) - PIU	07 days from the date of receipt of case in the PD office. If complainant is not agreed with the mitigation/decision provided, he has the option to go to court of law.

2. GRM Organogram

409. The following organogram will be followed to address grievances by any stakeholders.



11. CONCLUSION AND RECOMMENDATIONS

11.1. Conclusion

410. The development of the proposed project work on all COEs is of provincial level and is of critical importance considering the significant TVET sector weaknesses and serious shortage of skilled workers in Punjab for the past several years.

411. Due to prevailing global pandemic i.e. Covid-19, both primary and secondary sources of information have been used to assess the environmental impacts of the project activities at all the 19 COEs.

412. The consultations were conducted through phone calls during lockdown situation in 2020 and through field visits in 2022

413. This EIA report highlights any potential environmental impacts associated with the development of the proposed COEs and recommends mitigation measures, wherever felt necessary. All environmental impacts associated with the project development need to be properly mitigated, wherever required, through the existing institutional arrangements described in this report.

414. The project has been assigned environmental category 'B' in accordance with the ADB's Safeguard Policy Statement (2009) and Schedule II (I) as per PEPA Review of EIA and EIA Regulations, 2022. Thus, this EIA report with the associated EMP is regarded as sufficient environmental assessment of the project.

415. Most of the environmental impacts, however site specific and temporary in nature, are associated with the construction phase of the COEs. These potential risks have been properly evaluated through ERA, therefore resulting EMP is applicable to all sites. However, the implementation of mitigation measures during this period will be the responsibility of the Contractor through development and implementation of SSEMPs. Site-specific EMP also known as SSEMP or Contractor's EMP will be prepared by the contractor and approved by the DD Environment-PIU after the review of Lead EHS Specialists of the Supervision Consultant with endorsement of ADB Environment Team. The Contractor's SSEMP will be submitted and approved at least ten days prior to start of any civil work at each COE. Therefore, the required environmental mitigation measures will have to be clearly defined in the bidding and Contract documents, and appropriately qualified environmental staff retained by the Consultant to supervise the implementation process.

416. This EIA concludes that no significant negative environmental impacts are likely to occur due to construction and equipment transfer of the proposed project, provided mitigation measures are implemented and the proposed monitoring program is adequately carried out. The EMP includes measures to minimize project impacts due to noise and air pollution, waste generation etc. However, most of the environmental impacts, however site specific and temporary in nature, are associated with the construction phase of the COEs. These potential risks have been properly evaluated through ERA, therefore resulting EMP is applicable to all sites. However, the implementation of mitigation measures during this period will be the responsibility of the Contractor through development and implementation of SSEMPs. Specific EMP also known as SSEMP or Contractor's EMP will be prepared by the contractor and approved by the EHS Specialists of the Supervision Consultant with endorsement of ADB Environment Team. The Contractor's SSEMP will be submitted and approved at least ten days prior to start of any civil

work at each COE. Therefore, the required environmental mitigation measures will have to be clearly defined in the bidding and Contract documents, and appropriately qualified environmental staff retained by the Consultant to supervise the implementation process to be developed prior to construction using the information in EMP and EIA that would help the contractor to effectively comply with environmental measures as per site requirements.

11.2. Recommendations

417. Although comprehensive mitigation measures have been proposed in the report to minimize the negative impacts and to enhance the positive impacts of the project, however, major recommended mitigation measures are summarized as under:

- (i) Soil erosion and contamination, water contamination, air pollution and high noise levels will be controlled with the use of good engineering/construction practices.
- (ii) Contractor will develop Site Specific EMPs and specific plans such as health and safety management plan, traffic management, solid waste management and material management etc. before commencing the construction activities. The Site Specific EMPs shall be approved by the environmental specialist of the Firm with endorsement from ADB Environment Team.
- (iii) Contractor will warn the workers to follow HSE management principals and social / ethical guidelines.
- (iv) EMP proposed in Chapter 8 shall be implemented in its true letter and spirit

REFERENCES:

ADB (July 2020). Pakistan: Improving Workforce Readiness in Punjab Project, Project Administration Manual.

ADB (April 2020). Pakistan: Improving Workforce Readiness in Punjab Project, RRP.

ADB. (23 March 2020) Proposed Improving Workforce Readiness in Punjab Project Design Deck Presentation.

Bharwana, S. A., Ali, S., Farid, M., and Hannan, F. (2014). Noise and ambient air pollution monitoring and its effects on local community in Faisalabad, Pakistan. *Academia Journal of Environmental Sciences* 2(2): pp. 015-028.

D.W. Gould, M. King, B.R. Mohapatra, R.A. Cameron, A. Kapoor, D.W. Koren, A critical review on destruction of thiocyanate in mining effluents, *Minerals Engineering* 34 (2012) 38-47.

Directorate General Agriculture (Water Management), Agriculture Department Government of Punjab. (2011). Punjab Irrigated Agriculture Productivity Improvement Project. Environmental Impact Assessment

Ghuri, B., Lodhi, A., and Mansha, M. (2007). Development of baseline (air quality) data in Pakistan. *Environ Monit Assess*. Vol 127. Pp 237-252

IWRPP (March 2020). Environment & Social Safeguards Due Diligence report (24 Feb-07 Mar. 2020).

Javed, A., Farooqi, A., Baig, Z.U., Ellis, T., van Geen, A., 2020. Soil arsenic but not rice arsenic increasing with arsenic in irrigation water in the punjab plains of Pakistan. *Plant Soil* 1–11

Khan, S. A. (January 2016). Environmental Impact Assessment Report 500 kV Faisalabad West Grid Station and Associated Transmission Project. Environment & Social Impact Cell (ESIC), NTDC

Khanum, F., Chaudhry, M. N., and Kumar, P. (2017). Characterization of five-year observation data of fine particulate matter in the metropolitan area of Lahore. *Air Qual Atmos Health*. Vol 10. pp: 725-736

PMU-PICIIP. (March 2020). Punjab Intermediate Cities Improvement Investment Program (PICIIP) Sahiwal Component TA 8683 (PAK) Environmental impact assessment. Asian Development Bank.

Punjab Growth Strategy, 2023. https://www.punjab.gov.pk/system/files/PGS_2023.pdf, web assessed on 4th March, 2022.

(PCRWR, 2021). Drinking water quality in Pakistan: current status and challenges, <https://pcrwr.gov.pk/wp-content/uploads/2021/10/Drinking-Water-Quality-in-Pakistan-2021.pdf>, web accessed on 4th March, 2022.

PCRWR (2014). Arsenic assessment in rice growing areas of Pakistan, [http://www.pcrwr.gov.pk/Publications/Water%20Management/Assessment-of-Arsenic-in-Rice-Growing- Areas-of-Pakistan-April-2014.pdf](http://www.pcrwr.gov.pk/Publications/Water%20Management/Assessment-of-Arsenic-in-Rice-Growing-Areas-of-Pakistan-April-2014.pdf), web accessed on 4th March, 2022.

Saaf Consultant BV Netherlands., Dev-Consult Pakistan., and NEC Consultants. (December 2016). PAK: Punjab Intermediate Cities Improvement Investment Program (PICIIP) - Sialkot City. Asian Development Bank.

Shajar Roads Limited. (August 2017). Environmental Impact Assessment Report Dualization of Sheikhpura-Gujranwala Road Under PPP Mode (43 km). Communication and Works Department Government of Punjab

The Urban Unit. Punjab Cities Improvement Investment Program. Sheikhpura City Profile <http://uu.urbanunit.gov.pk/Documents/Publications/0/115.pdf>.

Triana, E. S., Enriquez, S., Afzal, J., Nakagawa, A., and Khan, A. S. (2014). Cleaning Pakistan's Air: Policy Options to Address the Cost of Outdoor Air Pollution. Directions in Development Energy and Mining. The World Bank

van Geen, A., Farooqi, A., Kumar, A., Khattak, J.A., Mushtaq, N., Hussain, I., Ellis, T., Singh, C.K., 2019. Field testing of over 30,000 wells for arsenic across 400 villages of the punjab plains of Pakistan and India: Implications for prioritizing mitigation. Sci. Total Environ. 654, 1358–1363.

How do I remove arsenic from my drinking water?
<https://www.cdc.gov/healthywater/drinking/private/wells/disease/arsenic.html>

Sheikh, M. M., N. Manzoor, M. Adnan, J. Ashraf, and Arshad M. Khan, (2009), Climate Profile and Past Climate Changes in Pakistan, GCISC-RR01, Global Change Impact Studies Centre (GCISC), Islamabad, Pakistan

World Bank and Asian Development Bank (2021). Climate Risk Country Profile. https://climateknowledgeportal.worldbank.org/sites/default/files/2021-05/15078-WB_Pakistan%20Country%20Profile-WEB.pdf

Saqib & Gill, 2019. Pakistan Geographical Review, Vol.74 (2), 74-89.

EPA (2017). Punjab Climate Change Policy. https://epd.punjab.gov.pk/system/files/PCCP%20Draft%20%28internatl%29_0.pdf

Climate Change Portal. 2022. https://climateknowledgeportal.worldbank.org/sites/default/files/201810/wb_gfdr气候_change_country_profile_for_PAK.pdf

Nasim, W., Amin, A., Fahad, S., Awais, M., Khan, N., Mubeen, M., Jamal, Y. (2018). Future risk assessment by estimating historical heat wave trends with projected heat accumulation using SimCLIM climate model in Pakistan. Atmospheric Research: 205: 118–133. URL: <https://ui.adsabs.harvard.edu/abs/2018AtmRe.205..118N/abstract>

W.H.O., 2021, <https://www.who.int/emergencies/disease-outbreak-news/item/dengue-fever-pakistan>

Asian Development Bank, (2017). Climate Change Profile of Pakistan.
<https://www.adb.org/sites/default/files/publication/357876/climate-change-profile-pakistan.pdf>)

Pakistan Metrological Department, (2021). Drought Bulletin of Pakistan.
<https://ndmc.pmd.gov.pk/new/assets/bulletins/1634554283.pdf>

APPENDICES

ANNEX-I: Punjab Environmental Quality Standards for Drinking Water

EXTRA ORDINARY ISSUE

REGISTERED No. L-7532

**The Punjab Gazette**
PUBLISHED BY AUTHORITY

LAHORE MONDAY AUGUST 15, 2016

**GOVERNMENT OF THE PUNJAB
LAW AND PARLIAMENTARY AFFAIRS DEPARTMENT****NOTIFICATION
(124 of 2016)**12th August 2016

The following Notification No. SO(G)/EPD/7-26/2013, dated 05.08.2016 regarding the Punjab Environmental Quality Standards for Drinking Water is published for general information:

DR SYED ABUL HASSAN NAJMEE
Secretary
Government of the Punjab
Law and Parliamentary Affairs
Department

**Government of the Punjab
Environment Protection Department**

NOTIFICATION: No. SO(G)/EPD/7-26/2013 - In exercise of the powers conferred under clause (c) of sub-section (1) of section 4 of the Punjab Environmental Protection Act, 1997 (XXXIV of 1997), the Environmental Protection Council has approved the following as the Punjab Environmental Quality Standards for Drinking Water:

Punjab Environmental Quality Standards for Drinking Water

Properties/Parameters	Standard Values	WHO Standards	Remarks
All water intended for drinking (E. Coli or Thermo-tolerant Coliform bacteria)	Must not be detectable in any 100 ml sample	Must not be detectable in any 100 ml sample	Most Asian countries also follow WHO standards
Treated water entering the distribution system (E. Coli or thermo tolerant coliform and total coliform bacteria)	Must not be detectable in any 100 ml sample	Must not be detectable in any 100 ml sample	Most Asian countries also follow WHO standards
Treated water in the distribution system (E. Coli or thermo tolerant coliform and total coliform bacteria)	Must not be detectable in any 100 ml sample In case of large supplies, where sufficient samples are examined, must not be present in 95% of the samples taken throughout any 12- month period.	Must not be detectable in any 100 ml sample In case of large supplies, where sufficient samples are examined, must not be present in 95% of the samples taken throughout any 12- month period.	Most Asian countries also follow WHO standards
Colour	≤15 TCU	≤15 TCU	
Taste	Non objectionable/ Acceptable	Non objectionable/ Acceptable	
Odour	Non objectionable/ Acceptable	Non objectionable/ Acceptable	
Turbidity	<5 NTU	<5 NTU	

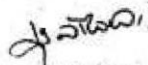
Properties/Parameters	Standard Values	WHO Standards	Remarks
Total hardness as CaCO ₃	< 500 mg/l	---	
TDS	<1000	<1000	
pH	6.5-8.5	6.5-8.5	
Essential Inorganic			
	mg/Litre	mg/Litre	
Aluminum (Al) mg/l	≤0.2	0.2	
Antimony (Sb)	≤0.005 (P)	0.02	
Arsenic (As)	≤0.05 (P)	0.01	Standard for Pakistan similar to most Asian developing countries
Barium (Ba)	0.7	0.7	
Boron (B)	0.3	0.3	
Cadmium (Cd)	0.01	0.003	Standard for Pakistan similar to most Asian developing countries
Chloride (Cl ⁻)	<250	250	
Chromium (Cr)	≤0.05	0.05	
Copper (Cu)	2	2	
Toxic Inorganic			
	mg/l	mg/l	
Cyanide (CN)	≤0.05	0.07	Standard for Pakistan similar to Asian developing countries
Fluoride (F)*	≤1.5	1.5	
Lead (Pb)	≤0.05	0.01	Standard for Pakistan similar to most Asian developing countries
Manganese (Mn)	≤ 0.5	0.5	
Mercury (Hg)	≤0.001	0.001	
Nickel (Ni)	≤0.02	0.02	
Nitrate (NO ₃)*	≤50	50	
Nitrite (NO ₂)*	≤3 (P)	3	
Selenium (Se)	0.01(P)	0.01	

1210 THE PUNJAB GAZETTE (EXTRAORDINARY) AUGUST 15, 2016

Properties/Parameters	Standard Values	WHO Standards	Remarks
Residual chlorine	0.2-0.5 at consumer end 0.5-1.5 at source		
Zinc (Zn)	5.0	3	Standard for Pakistan similar to most Asian developing countries
Organic			
Pesticides mg/l			PSQCA No. 4639-2004, Page No. 4 Table No. 3 Serial No. 20-58 may be consulted.**
Phenolic compounds (as Phenols) mg/l		0.1	
Poly-nuclear aromatic hydrocarbons (as PAHs) g/l		0.01 (By GC/MS method)	
Radioactive			
Alpha Emitters bq/L or pCi	0.1	0.1	
Beta emitters	1	1	

* Indicates priority health related inorganic constituents, which need regular monitoring.

** PSQCA: Pakistan Standards Quality Control Authority.


(IQBAL MOHAMMED CHAUHAN)
Secretary, Government of the Punjab
Environment Protection Department

ANNEX-II: Punjab Environmental Quality Standards for Ambient Air

EXTRA ORDINARY ISSUE

REGISTERED No. L-7532



The Punjab Gazette

PUBLISHED BY AUTHORITY

LAHORE MONDAY AUGUST 15, 2016

**GOVERNMENT OF THE PUNJAB
LAW AND PARLIAMENTARY AFFAIRS DEPARTMENT**

**NOTIFICATION
(122 of 2016)**

12th August 2016.

The following Notification No. SO(G)/EPD/7-26/2013, dated 05.08.2016 regarding the Punjab Environmental Quality Standards for Ambient Air is published for general information:

DR SYED ABUL HASSAN NAJMEE
Secretary
Government of the Punjab
Law and Parliamentary Affairs
Department

**Government of the Punjab
Environment Protection Department**

NOTIFICATION: No. SO(G)/EPD/7-24/2013. - In exercise of the powers conferred under clause (c) of sub-section (1) of section 4 of the Punjab Environmental Protection Act, 1997 (XXXIV of 1997), Environmental Protection Council has approved the following as the Punjab Environmental Quality Standards for Ambient Air:

Punjab Environmental Quality Standards for Ambient Air

Pollutant	Time-weighted average	Concentration in Ambient Air	Method of measurement
Sulfur Dioxide (SO ₂)	Annual Average*	80 µg/m ³	Ultraviolet Fluorescence method
	24 hours**	120 µg/m ³	
Oxides of Nitrogen as (NO)	Annual Average*	40 µg/m ³	Gas Phase Chemiluminescence
	24 hours**	40 µg/m ³	
Oxides of Nitrogen as (NO ₂)	Annual Average*	40 µg/m ³	Gas Phase Chemiluminescence
	24 hours**	80 µg/m ³	
Ozone (O ₃)	1 hour	130µg/m ³	Non dispersive UV absorption method
Suspended Particulate Matter (SPM)	Annual Average*	360µg/m ³	High Volume Sampling, (Average flow rate not less than 1.1 m ³ /min).
	24 hours**	500µg/m ³	
Respirable Particulate Matter PM ₁₀	Annual Average*	120µg/m ³	Preferably β-Ray absorption method
	24 hours**	150µg/m ³	
Respirable Particulate Matter PM _{2.5}	Annual Average*	15µg/m ³	Preferably β-Ray absorption method
	24 hours**	35µg/m ³	

THE PUNJAB GAZETTE (EXTRAORDINARY) AUGUST 15, 2016 1199

Pollutant	Time-weighted average	Concentration in Ambient Air	Method of measurement
	1 hour	15 μ g/m ³	
Lead (Pb)	Annual Average*	1 μ g/m ³	ASS Method after sampling using EPM 2000 or equivalent Filter paper
	24 hours**	1.5 μ g/m ³	
Carbon Monoxide (CO)	8 hours**	5 mg/m ³	Non Dispersive Infra Red (NDIR) method
	1 hour	10 mg/m ³	

* Annual arithmetic mean of minimum 104 measurements in a year taken twice a week 24 hourly at uniform interval.

** 24 hourly / 8 hourly values should be met 98% of the in a year. 2% of the time, it may exceed but not on two consecutive days.

Signature

(IQBAL MOHAMMED CHAUHAN)
Secretary, Government of the Punjab
Environment Protection Department

ANNEX-III: Punjab Environmental Quality Standards for Noise

EXTRA ORDINARY ISSUE

REGISTERED No. L-7532



The Punjab Gazette

PUBLISHED BY AUTHORITY

LAHORE MONDAY AUGUST 15, 2016

GOVERNMENT OF THE PUNJAB
LAW AND PARLIAMENTARY AFFAIRS DEPARTMENT

NOTIFICATION
(121 of 2016)

12th August 2016

The following Notification No. SO(G)/EPD/7-26/2013, dated 05.08.2016 regarding the Punjab Environmental Quality Standards for Noise is published for general information:

DR SYED ABUL HASSAN NAJMEE
 Secretary
 Government of the Punjab
 Law and Parliamentary Affairs
 Department

1196 THE PUNJAB GAZETTE (EXTRAORDINARY) AUGUST 15, 2016

**Government of the Punjab
Environment Protection Department**

NOTIFICATION: No. SO(G)/EPD/7-26/2013. In exercise of the powers conferred under clause (c) of sub-section (1) of section 4 of the Punjab Environmental Protection Act, 1997 (XXXIV of 1997), the Environmental Protection Council has approved the following as the Punjab Environmental Quality Standards for Noise:

Punjab Environment Quality Standards for Noise

No.	Category of Area/Zone	Effective from 1 st July, 2010		Effective from 1 st July, 2013	
		Limits in dB(A) Leq*			
		Day Time	Night Time	Day Time	Night Time
1	Residential Area (A)	65	50	55	45
2	Commercial Area (B)	70	60	65	55
3	Industrial Area (C)	80	75	75	65
4	Silence Zone (D)	55	45	50	45

Note:

1. Day time hours; 6:00am to 10:00pm.
2. Night Time hours; 10:00 pm to 6:00 am.
3. Silence Zone: Zones which are declared as such by the competent authority. An area comprising not less than 100 meters around hospital, educational institutions and courts
4. Mixed categories of areas may be declared as one of the four above mentioned categories by the competent authority

* dB(A) Leq: Time weighted average of the level of sound in decibel on scale A which is relatable to human hearing.

(Signature)
(IQBAL MOHAMMED CHAUHAN)
Secretary, Government of the Punjab
Environment Protection Department

ANNEX-V: Environmental Monitoring Report



1.3 Environmental Monitoring and Testing Team

The ESPAK Environmental Monitoring and Testing Team consisted of the following staff members:

Sr. #	Employees Name	Project Responsibilities
1.	Mr. Muhammad Arfan	Chief Analyst
2.	Mr. Hussain Zahid	Project Coordinator
3.	Engineer Waleed Farooq	Field Team In-charge (Environmental Engineer)
4.	Mr. Waqas Ahmad	ICP Analyst
5.	Ms. Musharaf Jabeen	Quality Control Manager
6.	Mr. Muhammad Irfan	Lab Analyst
7.	Ameer Usama	Assistant Lab Analyst
8.	Engineer Amaad Tallat	Senior Field Analyst
9.	Mr. Ameer Hamza	Field Analyst
10.	Engineer Nadeem Malik	Assistant Field Analyst



2. Sampling and Testing Methodology

Following is the brief description of methodology adopted for this environmental monitoring:

2.1 Survey Planning

The project started with a plan of proposed project activities with the management of ADB, Asian Development Bank.

2.2 Identification of Monitoring Location

ADB as a client clearly identified all location points for monitoring.

Following criterion was used to finalize the sampling locations on the given site.

- Area where there will be project activities
- Present environmental conditions at the site
- Potential environmental receptors/polluters

2.2.1 Monitoring Plan

Detailed Environmental Monitoring was carried out on consideration of sampling locations; a monitoring plan was structured in order to achieve precision and accuracy in the monitoring and sampling of the required environmental parameters. The monitoring plan was developed in consultation with client's representatives. Monitoring activity was started on 03-07-2020 and completed on 11-07-2020. **Detailed monitoring plan is attached in annexures.**

2.3 Sampling and Analysis Methods

The sampling and testing methods are given in following sections of the report.

2.3.1 Ambient Air Quality Monitoring

Ambient air quality monitoring is conducted at recommended sampling locations to assess the concentration of pollutants i.e. Carbon monoxide, Sulphur dioxide (SO₂), Ozone (O₃), Oxides of Nitrogen as Nitrogen Monoxide and Nitrogen Dioxide (NO & NO₂), particulate matter as PM_{2.5}, PM₁₀ and suspended particulate matter (SPM) and. Selection of monitoring locations was based on the environmental factors including wind direction on the particular day and amount of turbulence in the air etc.

Reference method used for the measurements are included as Table 1.1 while the description is provided in subsequent sections.



Table 1.1: Methodology of Ambient Air Quality Monitoring

Air Pollutant	Methodologies	Reference Method	Measurement Range	Lowest Detection Limit	Sampling Duration
Carbon Monoxide (CO)	Non-Dispersive Infrared Absorption (NDIR)	40 CFR Part 50, App. C (US-EPA)	0 – 25 ppm	<0.04 ppm	24 hours
Sulfur Dioxide (SO ₂)	UV Fluorescence (UVF)	EQSA-0197-114 (US-EPA)	0-10 ppm	0.009 ppb	24hours
Ozone (O ₃)	Non-dispersive UV Absorption	EQOA-0410-190	0-0.5 ppm	2 µg/m ³	1 hour
Oxides of Nitrogen (NO, NO ₂)	Chemiluminescence Detection	40 CFR Part 50, App F (US-EPA)	0-0.2 ppm	0.001 ppb	24 hours
Particulate Matter PM ₁₀ , PM _{2.5}	B-Ray Absorption Method	40 CFR Part 50, App L (US-EPA)	0 – 2000 µg/m ³	1 µg/m ³	24 hours
Suspended Particulate Matter (SPM)	Gravimetric Technique (High-Volume Sampler Method)	40 CFR Part 50, App B (US-EPA)	-	-	24 hours



2.3.1.1 Carbon Monoxide (CO)

Carbon monoxide (CO) was monitored using CO12e Non-dispersive Infrared CO Analyzer. The analyzer measures CO concentration by measuring the quantity of infrared light the sample gas absorbs as it flows through a multi-reflection chamber.

Measurement range of the analyzer is 0-300 ppm. Continuous data was recorded for 24 hr.

2.3.1.2 Sulphur Dioxide (SO₂)

Sulphur dioxide was monitored using AF22e UV Fluorescent SO₂ Analyzer. The SO₂ analyzer measures SO₂ using UV fluorescence method that operates on the principle that when the SO₂ molecules contained in the sample gas are excited by ultraviolet radiation they emit a characteristic fluorescence. This fluorescence is measured and the SO₂ concentration is obtained from changes in the intensity of the fluorescence.

Measurement range of the analyzer is 0-20 ppm. Continuous data was recorded for 24 hr.

2.3.1.3 Ozone (O₃)

Ozone (O₃) was monitored using O342e Non-dispersive UV Absorption Analyzer. The analyzer measures O₃ concentration by measuring the quantity of UV absorption in the sample gas as it flows through the analyzer chamber.

Measurement range of the analyzer is 0-0.5 ppm. Continuous data was recorded for 24 hr.

2.3.1.4 Oxides of Nitrogen (NO & NO₂)

Oxides of Nitrogen (NO & NO₂) were monitored using AC32e Chemiluminescent NO, NO₂ & NO_x Analyzer. The analyzer measures NO, NO₂ and NO_x using chemiluminescence (CLD) method with the help of chemical reaction between NO and O₃.

Measurement range of the analyzer is 0-10 ppm. Continuous data was recorded for 24 hr.

2.3.1.5 Particulate Matter (SPM, PM₁₀ and PM_{2.5})

High Volume Air Sampler (Hi Vol 3000) is used to collect the representative sample of ambient air for the monitoring of particulate matter as Suspended Particulate Matter (SPM). Sampling was conducted for period of 24 hours using glass fiber filter paper.

The sampler incorporates advanced programming functions and electronic volumetric flow control to maintain a consistent flow. The sampler draws a large known volume of air through a pre-weighed filter. After sampling the filter is re-weighed and the difference in filter weight is collected particulate matter mass. Dividing the mass by the volume of air sampled gives the concentration of particulate matter.

Monitoring of PM₁₀ & PM_{2.5} is done using a nephelometer. A sharp cut cyclone fitted to the inlet physically selects a target mass fraction. The combination of nephelometer and sharp cut cyclone ensures high accuracy and durability.



2.3.2 Weather Station

Weather station was installed on each preferred point measurement to assess some major environmental parameters like Ambient Temperature, Relative Humidity, Wind Speed and other weather conditions.

2.3.3 Noise Level

Noise level monitoring is conducted at identified locations using Benetech Sound Meter. All noise monitoring is conducted in accordance with the guidance set out in standard methods. Meters are calibrated and checked before and after each measurement period by using sound level calibrator.

2.3.4 Drinking and Waste Water Analysis

Following methodology was adopted for water sampling and analysis:

2.3.4.1 Sample Collection

The water samples are collected from identified sampling points. The sampling is carried out in accordance with the Laboratory Standard Operating Procedures (SOP) based on the recognized methods of United State Environmental Protection Agency (USEPA), World Health Organization (WHO) and American Public Health Association (APHA) for water sampling and analysis.

2.3.4.2 Measurement of Field Parameters

Parameters that quickly degrade after they are sampled must be tested in the field. Following parameters are measured in field that can significantly change during storage and transportation. These includes: -

- Temperature or Temperature Increase
- pH

2.3.4.3 Preservation

Preservation is significant in order to minimize the changes in the sample. The water samples collected are preserved in separate bottles as per sampling and analysis work plan worked out beforehand keeping in view the parameters to be tested. To cover the regulated parameters analysis in Pakistan, five portions of the sample are naturally required. Decontaminated and/or pre-cleaned plastic and glass bottles of various capacities are available to use as required. Some examples follow:

- For COD, organics and nitrates sample is preserved below pH – 2 by addition of sulphuric acid.
- For metals sample is preserved below pH – 2 by adding nitric acid.
- For BOD and inorganic sample is stored below 4°C.
- For microbial analysis, sample will be taken in sterile bottles.
- Oil and Grease requires separate marked bottle.



2.3.4.4 Sample Identification and Chain of Custody

The collected samples are labeled and assigned a unique sample field identification number, sampling date and time of collection to collected samples. All the relevant information (sample location, time of collection, sample identification, field measurement data, collected by, preservation techniques etc.) is recorded immediately on the Chain of Custody form signed by ESPAK field Analyst to keep track of the collected samples. For regulatory compliance, the samples are sealed in accordance with local regulations and relevant forms are filled out.

2.3.4.5 Transportation

After the completion of field analysis of samples i.e., Checking temperature and pH, the above taken samples collected are immediately preserved at $4^{\circ}\text{C} \pm 5^{\circ}\text{C}$ in an icebox and transported to ESPAK laboratory in Lahore maintaining the chain of protection, where they are individually analyzed with the given time span.



3. Ambient Air Monitoring Report



3.1.9 Government Staff Training College, Murree

Start Date	Completion Date	Latitude	Longitude
08/07/2020	09/07/2020	33.915823	73.417403

Sr. No.	Parameters	Limit Values (PEQS)	Concentration	Method / Equipment Used	Remarks
1	Lead (Pb)	1.5 µg/m ³ (24 hours)	1.12 mg/m ³	ASS Method	Within Prescribed Limits
2	Carbon Monoxide (CO)	5 mg/m ³ (8 hours)	0.7-1.1 mg/m ³	Non-Dispersive Infrared (NDIR) Method	Within Prescribed Limits
3	Sulfur Dioxide (SO ₂)	120 µg/m ³	10.1 µg/m ³	UV Fluorescence (UVF)	Within Prescribed Limits
4	Ozone (O ₃)	130 µg/m ³ (1 hours)	2.6-35.7 µg/m ³	Non-Dispersive UV Absorption	Within Prescribed Limits
5	Oxides of Nitrogen (as NO)	40 µg/m ³	10.5 µg/m ³	Chemiluminescence Detection	Within Prescribed Limits
6	Oxides of Nitrogen (as NO ₂)	80 µg/m ³	17.4 µg/m ³	Chemiluminescence Detection	Within Prescribed Limits
7	Particulate Matter PM _{2.5}	35 µg/m ³	26.7 µg/m ³	β-Ray Absorption Method	Within Prescribed Limits
8	Particulate Matter PM ₁₀	150 µg/m ³	115 µg/m ³	β-Ray Absorption Method	Within Prescribed Limits
9	Suspended Particulate Matter (SPM)	500 µg/m ³	117 µg/m ³	High Volume Sampler (HVS)	Within Prescribed Limits
10	Temperature	NGVS	18.9 °C	Weather Station	---
11	Humidity	NGVS	82%	Weather Station	---
12	Wind Speed	NGVS	0.5 m/s	Weather Station	---

*For detailed monitoring results please see Log Table 9.0

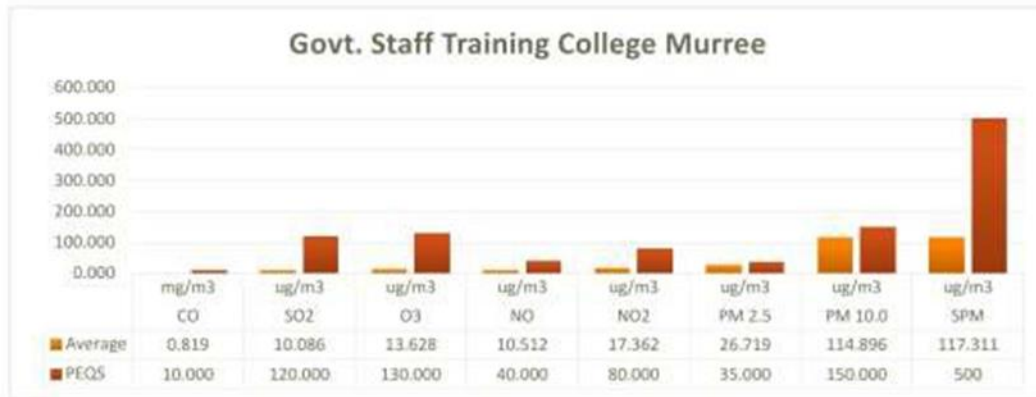


4. Log Table



4.9 Log Table 9.0

Date - Time	CO	SO2	O3	NO	NO2	PM 2.5	PM 10.0	Temp.	Humid.	Wind Speed	Wind Dir.
	mg/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	°C	%RH	m/s	
08/07/2020 9:02	1.011	10.193	21.754	9.942	15.013	33.112	115.983	22	84	0.7	N
08/07/2020 10:02	1.097	11.793	27.328	10.853	14.853	27.227	139.917	22	84	0.6	N
08/07/2020 11:02	1.105	11.076	30.887	11.369	15.565	28.859	137.438	23	84	0.1	N
08/07/2020 12:02	1.079	11.362	29.669	10.845	15.039	29.044	134.092	23	85	0.4	N
08/07/2020 13:02	1.096	13.383	30.718	11.805	15.942	33.798	135.908	22	85	0.3	N
08/07/2020 14:02	1.064	13.025	35.747	12.634	16.911	27.261	130.665	21	85	0.2	N
08/07/2020 15:02	0.855	13.556	19.587	12.143	17.567	30.081	151.648	19	85	0.9	N
08/07/2020 16:02	1.101	9.603	13.184	16.640	18.190	26.151	107.020	19	85	0.4	N
08/07/2020 17:02	0.953	10.251	14.535	12.860	18.643	27.985	113.574	19	85	0.4	N
08/07/2020 18:02	0.609	10.013	7.994	11.551	19.707	31.184	113.068	18	86	0.5	N
08/07/2020 19:02	0.502	10.667	2.573	12.462	19.542	30.510	119.621	18	86	0.9	N
08/07/2020 20:02	0.554	7.931	2.593	13.925	17.652	23.981	121.296	17	86	1.1	N
08/07/2020 21:02	0.679	7.881	2.623	14.833	19.546	28.328	123.758	17	86	0.4	N
08/07/2020 22:02	0.613	8.961	4.199	6.427	17.370	19.853	108.334	16	87	0	N
08/07/2020 23:02	0.668	8.619	4.232	8.432	17.383	23.050	98.118	16	86	0.1	N
09/07/2020 0:02	0.633	9.541	6.008	7.506	16.948	23.641	84.898	16	86	0.1	N
09/07/2020 1:02	0.680	8.963	6.164	8.082	17.011	20.843	86.005	15	86	0.1	N
09/07/2020 2:02	0.759	8.107	2.744	7.823	17.934	19.938	108.613	16	84	0	SE
09/07/2020 3:02	0.595	9.222	5.978	7.565	16.937	26.712	84.705	16	78	0	SE
09/07/2020 4:02	0.808	9.630	5.544	6.084	18.234	21.509	107.312	17	77	0	SE
09/07/2020 5:02	0.645	8.771	5.610	8.977	16.790	25.943	82.143	18	74	0	SE
09/07/2020 6:02	0.856	8.623	4.241	6.531	16.246	23.079	112.555	19	72	0.7	SE
09/07/2020 7:02	0.951	10.557	20.872	11.913	18.693	34.857	117.585	21	69	1.3	SE
09/07/2020 8:02	0.743	10.332	22.302	11.089	18.965	24.305	123.240	23	66	2.3	SE
Average	0.819	10.086	13.628	10.512	17.362	26.719	114.896				
Maximum	1.105	13.556	35.747	16.640	19.707	34.857	151.648				
Minimum	0.502	7.881	2.573	6.084	14.853	19.853	82.143				





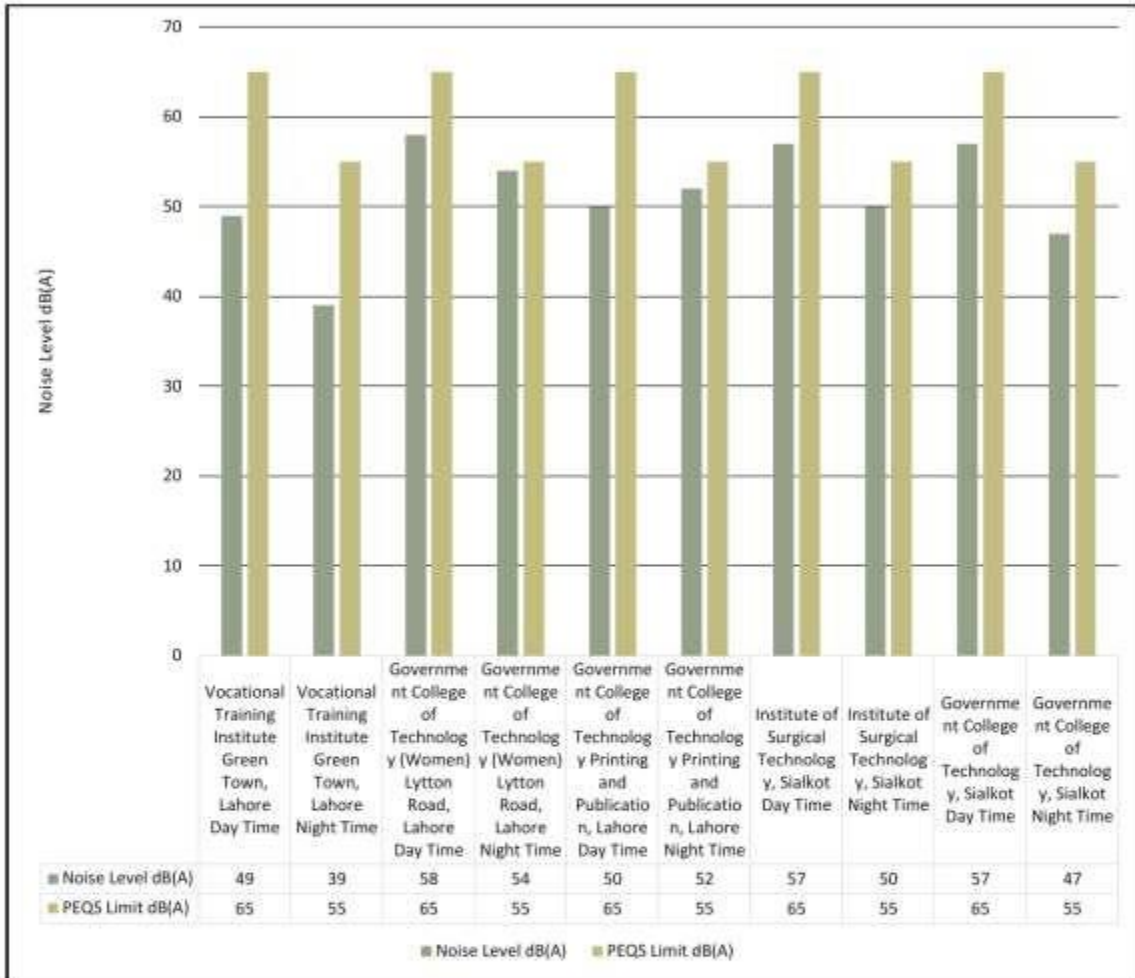
5.Ambient Noise Level Monitoring



5.1 Ambient Noise level Results

Following are the results of ambient noise at 2 identified locations as per PEQS.

Sr. No.	Measurement Locations	Day/Night	Comparison Values (PEQS)	Noise Level in dB(A) Leq	Remarks
1	Vocational Training Institute Green Town, Lahore	Day	65 dB(A)	49	Within Prescribed Limits
		Night	55 dB(A)	39	Within Prescribed Limits
2	Government College of Technology (Women) Lytton Road, Lahore	Day	65 dB(A)	58	Within Prescribed Limits
		Night	55 dB(A)	54	Within Prescribed Limits
3	Government College of Technology Printing and Publication, Lahore	Day	65 dB(A)	50	Within Prescribed Limits
		Night	55 dB(A)	52	Within Prescribed Limits
4	Institute of Surgical Technology, Sialkot	Day	65 dB(A)	57	Within Prescribed Limits
		Night	55 dB(A)	50	Within Prescribed Limits
5	Government College of Technology, Sialkot	Day	65 dB(A)	57	Within Prescribed Limits
		Night	55 dB(A)	47	Within Prescribed Limits





Environmental Services Pakistan (ESPAK)

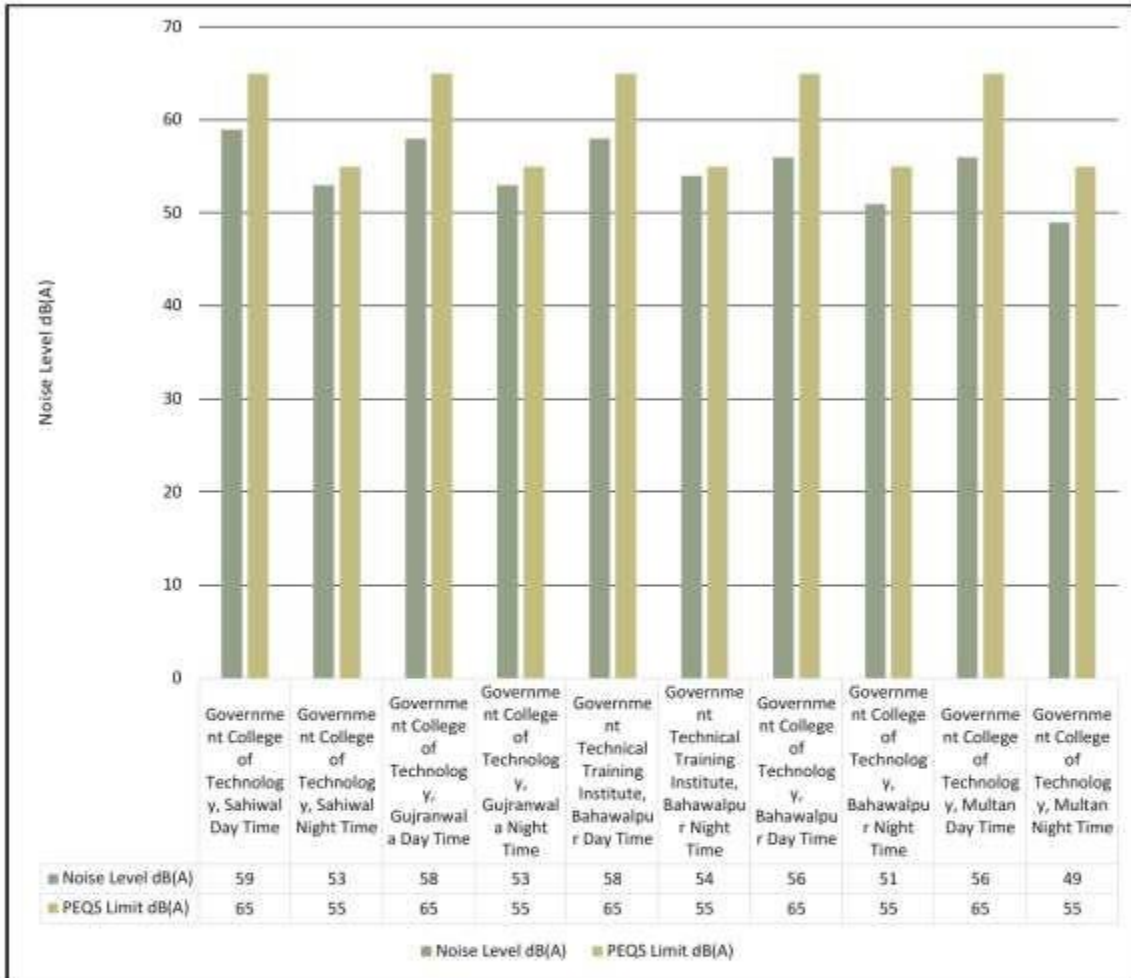
PAK EPA & PUNJAB EPD CERTIFIED

Sr. No	Measurement Locations	Day/Night	Comparison Values (PEQS)	Noise Level in dB(A) Leq	Remarks
6	Government College of Technology, Sahiwal	Day	65 dB(A)	59	Within Prescribed Limits
		Night	55 dB(A)	53	Within Prescribed Limits
7	Government College of Technology, Gujranwala	Day	65 dB(A)	58	Within Prescribed Limits
		Night	55 dB(A)	53	Within Prescribed Limits
8	Government Technical Training Institute, Bahawalpur	Day	65 dB(A)	58	Within Prescribed Limits
		Night	55 dB(A)	54	Within Prescribed Limits
9	Government College of Technology, Bahawalpur	Day	65 dB(A)	56	Within Prescribed Limits
		Night	55 dB(A)	51	Within Prescribed Limits
10	Government College of Technology, Multan	Day	65 dB(A)	56	Within Prescribed Limits
		Night	55 dB(A)	49	Within Prescribed Limits



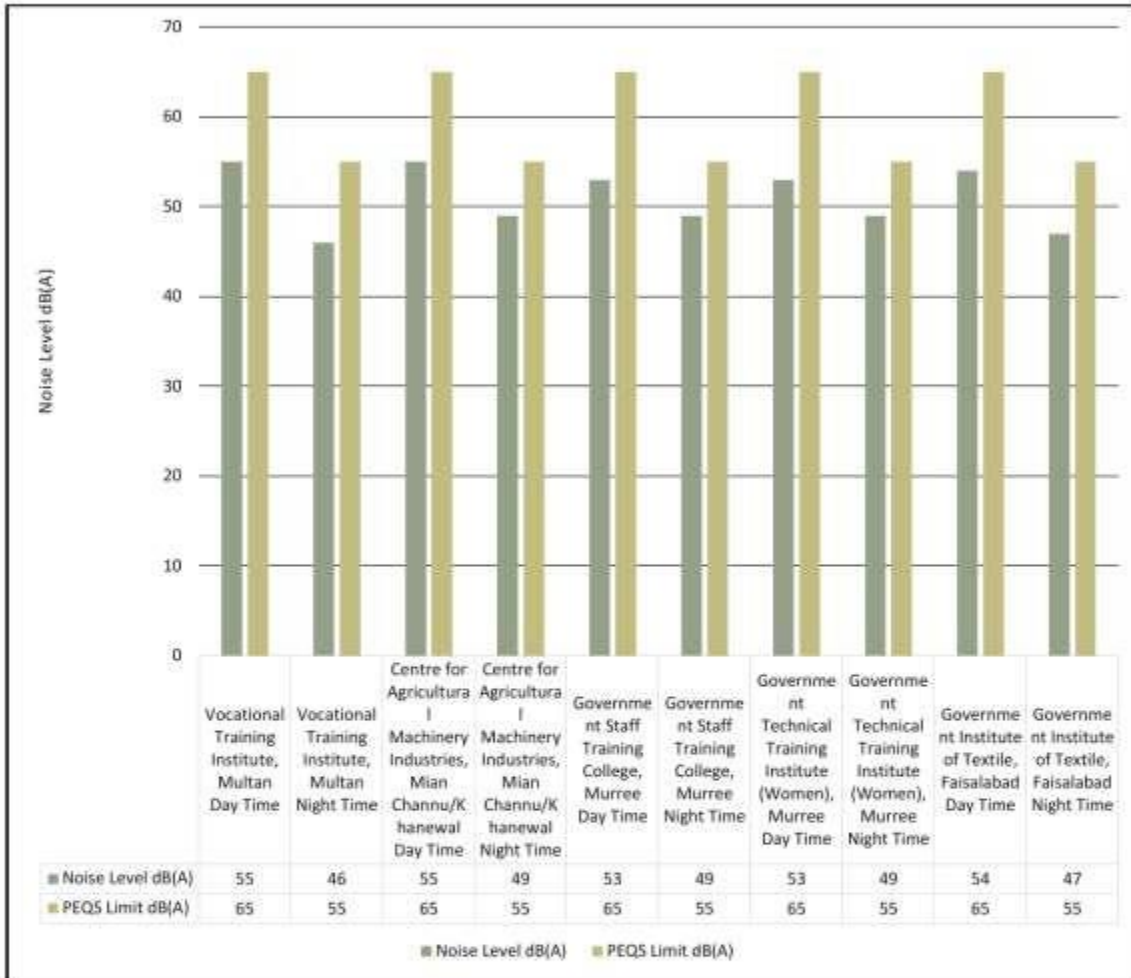
Environmental Services Pakistan (ESPAK)

PAK EPA & PUNJAB EPD CERTIFIED





Sr No.	Measurement Locations	Day/Night	Comparison Values (PEQS)	Noise Level in dB(A) Leq	Remarks
11	Vocational Training Institute, Multan	Day	65 dB(A)	55	Within Prescribed Limits
		Night	55 dB(A)	46	Within Prescribed Limits
12	Centre for Agricultural Machinery Industries, Mian Channu/Khanewal	Day	65 dB(A)	55	Within Prescribed Limits
		Night	55 dB(A)	49	Within Prescribed Limits
13	Government Staff Training College, Murree	Day	65 dB(A)	53	Within Prescribed Limits
		Night	55 dB(A)	49	Within Prescribed Limits
14	Government Technical Training Institute (Women), Murree	Day	65 dB(A)	53	Within Prescribed Limits
		Night	55 dB(A)	49	Within Prescribed Limits
15	Government Institute of Textile, Faisalabad	Day	65 dB(A)	54	Within Prescribed Limits
		Night	55 dB(A)	47	Within Prescribed Limits

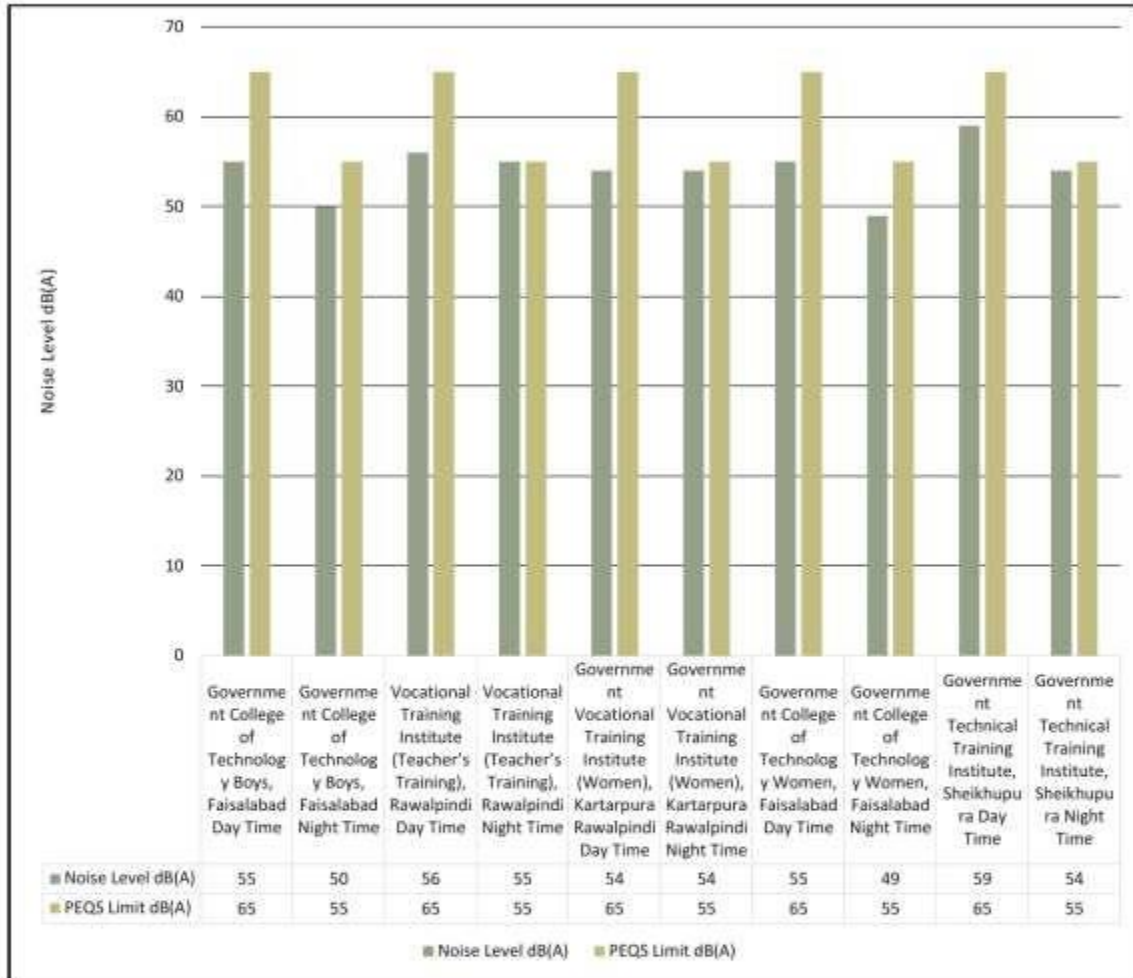




Environmental Services Pakistan (ESPAK)

PAK EPA & PUNJAB EPD CERTIFIED

Sr No.	Measurement Locations	Day/Night	Comparison Values (PEQS)	Noise Level in dB(A) Leq	Remarks
16	Government College of Technology Boys, Faisalabad	Day	65 dB(A)	55	Within Prescribed Limits
		Night	55 dB(A)	50	Within Prescribed Limits
17	Vocational Training Institute (Teacher's Training), Rawalpindi	Day	65 dB(A)	56	Within Prescribed Limits
		Night	55 dB(A)	55	Within Prescribed Limits
18	Government Vocational Training Institute (Women), Kartarpura Rawalpindi	Day	65 dB(A)	54	Within Prescribed Limits
		Night	55 dB(A)	54	Within Prescribed Limits
19	Government College of Technology Women, Faisalabad	Day	65 dB(A)	55	Within Prescribed Limits
		Night	55 dB(A)	49	Within Prescribed Limits
20	Government Technical Training Institute, Sheikhpura	Day	65 dB(A)	59	Within Prescribed Limits
		Night	55 dB(A)	54	Within Prescribed Limits





6. Drinking Water Analysis Results



Environmental Services Pakistan (ESPAK)

PAK EPA & PUNJAB EPD CERTIFIED

Sample Collection Site	Sample Collection Date	Analysis Completion Date
13. Government Staff Training College, Murree	09/07/2020	16/07/2020

Sr. No.	Parameters	Limits Values (PEQS)	Concentration	Method / Equipment Used	Remarks
1.	pH	6.5 – 8.5	8.4	SMWW 4500H+B	Within Prescribed Limits
2.	Total Dissolved Solids (TDS)	<1000 mg/L	213 mg/L	SMWW 2540C	Within Prescribed Limits
3.	Chloride (as Cl)	<250 mg/L	12 mg/L	SMWW 4500Cl-B	Within Prescribed Limits
4.	Cadmium (Cd)	0.01 mg/L	ND	U.S. EPA-200.7	Within Prescribed Limits
5.	Chromium (Cr)	≤ 0.05 mg/L	ND	U.S. EPA-200.7	Within Prescribed Limits
6.	Copper (Cu)	2 mg/L	0.072 mg/L	U.S. EPA-200.7	Within Prescribed Limits
7.	Lead (Pb)	≤ 0.05 mg/L	ND	U.S. EPA-200.7	Within Prescribed Limits
8.	Manganese (Mn)	≤ 0.5 mg/L	0.007 mg/L	U.S. EPA-200.7	Within Prescribed Limits
9.	Nickel (Ni)	≤ 0.02 mg/L	ND	U.S. EPA-200.7	Within Prescribed Limits
10.	Zinc (Zn)	5.0 mg/L	0.223 mg/L	U.S. EPA-200.7	Within Prescribed Limits
11.	Antimony	≤ 0.005 mg/L	ND	U.S. EPA-200.7	Within Prescribed Limits
12.	Aluminum (Al)	≤ 0.2 mg/L	0.172 mg/L	U.S. EPA-200.7	Within Prescribed Limits
13.	Arsenic (As)	≤ 0.05 mg/L	ND	U.S. EPA-200.7	Within Prescribed Limits
14.	Boron (B)	0.3 mg/L	0.078 mg/L	U.S. EPA-200.7	Within Prescribed Limits
15.	Barium (Ba)	0.7 mg/L	0.215 mg/L	U.S. EPA-200.7	Within Prescribed Limits
16.	Mercury (Hg)	≤ 0.001 mg/L	ND	U.S. EPA-200.7	Within Prescribed Limits
17.	Selenium (Se)	0.01 mg/L	ND	U.S. EPA-200.7	Within Prescribed Limits



Sr. No.	Parameters	Limits Values (PEQS)	Concentration	Method / Equipment Used	Remarks
18.	E. Coli	Must not be detectable in any 100mL sample	Negative	SMWW 9221F	Within Prescribed Limits
19.	Fecal Coliform	Must not be detectable in any 100mL sample	Negative	SMWW 9223B	Within Prescribed Limits
20.	Total Coliform Bacteria	---	Negative	SMWW 9223B	---
21.	Color	≤15 TCU	Nil	SMWW 2120 C	Within Prescribed Limits
22.	Taste	Non-Objectionable/ Acceptable	Acceptable	Organoleptic	Within Prescribed Limits
23.	Odor	Non-Objectionable/ Acceptable	Acceptable	Organoleptic	Within Prescribed Limits
24.	Turbidity	<5 NTU	0.63 NTU	SMWW 2130B	Within Prescribed Limits
25.	Total Hardness as CaCO ₃	<500 mg/L	184 mg/L	SMWW 2340C	Within Prescribed Limits
26.	Cyanide	≤ 0.05 mg/L	0.02 mg/L	SMWW 4500 CN-E	Within Prescribed Limits
27.	Fluoride	≤ 1.5 mg/L	0.15 mg/L	U.S. EPA 9214	Within Prescribed Limits
28.	Nitrate	≤ 50 mg/L	3.95 mg/L	SMWW 4500NO ₃ -B	Within Prescribed Limits
29.	Nitrite	≤ 3 mg/L	0.01 mg/L	SMWW 4500 NO ₂ -B	Within Prescribed Limits
30.	Residual Chlorine	0.2 – 0.5 mg/L	ND	SMWW 4500-Cl B	---
31.	Phenol Compounds	NGVS	ND	SMWW 5530D	---



Environmental Services Pakistan (ESPAK)

PAK EPA & PUNJAB EPD CERTIFIED

Sample Collection Site	Sample Collection Date	Analysis Completion Date
14. Government Technical Training Institute Women, Murree	09/07/2020	16/07/2020

Sr. No.	Parameters	Limits Values (PEQS)	Concentration	Method / Equipment Used	Remarks
1.	pH	6.5 – 8.5	8.4	SMWW 4500H+B	Within Prescribed Limits
2.	Total Dissolved Solids (TDS)	<1000 mg/L	223 mg/L	SMWW 2540C	Within Prescribed Limits
3.	Chloride (as Cl)	<250 mg/L	14 mg/L	SMWW 4500Cl-B	Within Prescribed Limits
4.	Cadmium (Cd)	0.01 mg/L	ND	U.S. EPA-200.7	Within Prescribed Limits
5.	Chromium (Cr)	≤ 0.05 mg/L	ND	U.S. EPA-200.7	Within Prescribed Limits
6.	Copper (Cu)	2 mg/L	0.077 mg/L	U.S. EPA-200.7	Within Prescribed Limits
7.	Lead (Pb)	≤ 0.05 mg/L	ND	U.S. EPA-200.7	Within Prescribed Limits
8.	Manganese (Mn)	≤ 0.5 mg/L	0.012 mg/L	U.S. EPA-200.7	Within Prescribed Limits
9.	Nickel (Ni)	≤ 0.02 mg/L	0.005 mg/L	U.S. EPA-200.7	Within Prescribed Limits
10.	Zinc (Zn)	5.0 mg/L	0.307 mg/L	U.S. EPA-200.7	Within Prescribed Limits
11.	Antimony	≤ 0.005 mg/L	ND	U.S. EPA-200.7	Within Prescribed Limits
12.	Aluminum (Al)	≤ 0.2 mg/L	0.200 mg/L	U.S. EPA-200.7	Within Prescribed Limits
13.	Arsenic (As)	≤ 0.05 mg/L	ND	U.S. EPA-200.7	Within Prescribed Limits
14.	Boron (B)	0.3 mg/L	0.079 mg/L	U.S. EPA-200.7	Within Prescribed Limits
15.	Barium (Ba)	0.7 mg/L	0.231 mg/L	U.S. EPA-200.7	Within Prescribed Limits
16.	Mercury (Hg)	≤ 0.001 mg/L	ND	U.S. EPA-200.7	Within Prescribed Limits
17.	Selenium (Se)	0.01 mg/L	ND	U.S. EPA-200.7	Within Prescribed Limits



Environmental Services Pakistan (ESPAK)

PAK EPA & PUNJAB EPD CERTIFIED

Sr. No.	Parameters	Limits Values (PEQS)	Concentration	Method / Equipment Used	Remarks
18.	E. Coli	Must not be detectable in any 100mL sample	Negative	SMWW 9221F	Within Prescribed Limits
19.	Fecal Coliform	Must not be detectable in any 100mL sample	Negative	SMWW 9223B	Within Prescribed Limits
20.	Total Coliform Bacteria	---	Negative	SMWW 9223B	----
21.	Color	≤15 TCU	Nil	SMWW 2120 C	Within Prescribed Limits
22.	Taste	Non-Objectionable/ Acceptable	Acceptable	Organoleptic	Within Prescribed Limits
23.	Odor	Non-Objectionable/ Acceptable	Acceptable	Organoleptic	Within Prescribed Limits
24.	Turbidity	<5 NTU	1.07 NTU	SMWW 2130B	Within Prescribed Limits
25.	Total Hardness as CaCO ₃	<500 mg/L	188 mg/L	SMWW 2340C	Within Prescribed Limits
26.	Cyanide	≤ 0.05 mg/L	0.03 mg/L	SMWW 4500 CN-E	Within Prescribed Limits
27.	Fluoride	≤ 1.5 mg/L	0.15 mg/L	U.S. EPA 9214	Within Prescribed Limits
28.	Nitrate	≤ 50 mg/L	3.88 mg/L	SMWW 4500NO ₃ -B	Within Prescribed Limits
29.	Nitrite	≤ 3 mg/L	0.01 mg/L	SMWW 4500 NO ₂ -B	Within Prescribed Limits
30.	Residual Chlorine	0.2 – 0.5 mg/L	ND	SMWW 4500-Cl B	----
31.	Phenol Compounds	NGVS	ND	SMWW 5530D	----



7.Sewerage Waste Water Analysis Results



Environmental Services Pakistan (ESPAK)

PAK EPA & PUNJAB EPD CERTIFIED

Sample Collection Site	Sample Collection Date	Analysis Completion Date
13.Government Staff Training College, Murree	09/07/2020	16/07/2020

Sr. No.	Parameters	Comparison Values (PEQS)	Concentration	Method / Equipment Used	Remarks
1.	Temperature	NGVS	25 °C	Thermometer	----
2.	pH	6 - 9	8.5	SMWW 4500H-B	Within Limits
3.	Chemical Oxygen Demand (COD)	150 mg/L	17 mg/L	SMWW 5220D	Within Limits
4.	Total Dissolved Solids (TDS)	3500 mg/L	257 mg/L	SMWW 2540C	Within Limits
5.	Chloride	1000 mg/L	10 mg/L	SMWW 4500Cl-B	Within Limits
6.	Cadmium (Cd)	0.1 mg/L	ND	U.S. EPA-200.7	Within Limits
7.	Chromium (Trivalent and Hexavalent)	1.0 mg/L	ND	U.S. EPA-200.7	Within Limits
8.	Copper (Cu)	1.0 mg/L	0.091 mg/L	U.S. EPA-200.7	Within Limits
9.	Iron (Fe)	8.0 mg/L	0.133 mg/L	U.S. EPA-200.7	Within Limits
10.	Lead (Pb)	0.5 mg/L	0.003 mg/L	U.S. EPA-200.7	Within Limits
11.	Manganese (Mn)	1.5 mg/L	0.015 mg/L	U.S. EPA-200.7	Within Limits
12.	Mercury (Hg)	0.01 mg/L	ND	U.S. EPA-200.7	Within Limits
13.	Selenium (Se)	0.5 mg/L	ND	U.S. EPA-200.7	Within Limits
14.	Nickel (Ni)	1.0 mg/L	0.004 mg/L	U.S. EPA-200.7	Within Limits
15.	Silver (Ag)	1.0 mg/L	0.003 mg/L	U.S. EPA-200.7	Within Limits
16.	Zinc (Zn)	5.0 mg/L	0.113 mg/L	U.S. EPA-200.7	Within Limits
17.	Arsenic (As)	1.0 mg/L	ND	U.S. EPA-200.7	Within Limits
18.	Barium (Ba)	1.5 mg/L	0.327 mg/L	U.S. EPA-200.7	Within Limits
19.	Boron (B)	6.0 mg/L	0.097 mg/L	U.S. EPA-200.7	Within Limits
20.	Total Toxic Metals	2.0 mg/L	0.505 mg/L	Calculated Value	Within Limits



Sr. No.	Parameters	Comparison Values (PEQS)	Concentration	Method / Equipment Used	Remarks
21.	Biochemical Oxygen Demand (BOD ₅) at 20°C	80mg/L	11 mg/L	SMWW 5210D	Within Limits
22.	Total Suspended Solids (TSS)	200 mg/L	ND	SMWW 2540D	Within Limits
23.	Phenolic Compounds (as Phenolic)	0.1 mg/L	0.05 mg/L	SMWW 5530D	Within Limits
24.	Grease and Oil	10 mg/L	1.6 mg/L	US. EPA 1664 B	Within Limits
25.	Fluoride	10 mg/L	0.22 mg/L	U.S. EPA 9214	Within Limits
26.	Cyanide	1 mg/L	0.03 mg/L	SMWW 4500 CN·F	Within Limits
27.	An-ionic detergents (as MBAs)	20 mg/L	0.04 mg/L	SMWW 5540 C	Within Limits
28.	Sulfate (SO ₄ ²⁻)	600 mg/L	18 mg/L	SMWW 4500 - SO ₄ ²⁻ C	Within Limits
29.	Sulfide (S ²⁻)	1.0 mg/L	ND	SMWW 4500 - S ²⁻ F	Within Limits
30.	Ammonia (NH ₃)	40 mg/L	2.59 mg/L	SMWW 4500 - NH ₃ - D	Within Limits
31.	Chlorine (Cl)	1.0 mg/L	ND	SMWW 4500 - Cl B	Within Limits
32.	Pesticides	0.15 mg/L	ND	Screening Method	Within Limits



Sample Collection Site	Sample Collection Date	Analysis Completion Date
14. Government Technical Training Institute Women, Murree	09/07/2020	16/07/2020

Sr. No.	Parameters	Comparison Values (PEQS)	Concentration	Method / Equipment Used	Remarks
1.	Temperature	NGVS	23 °C	Thermometer	----
2.	pH	6 - 9	8.4	SMWW 4500H-B	Within Limits
3.	Chemical Oxygen Demand (COD)	150 mg/L	34 mg/L	SMWW 5220D	Within Limits
4.	Total Dissolved Solids (TDS)	3500 mg/L	236 mg/L	SMWW 2540C	Within Limits
5.	Chloride	1000 mg/L	19 mg/L	SMWW 4500Cl-B	Within Limits
6.	Cadmium (Cd)	0.1 mg/L	ND	U.S. EPA-200.7	Within Limits
7.	Chromium (Trivalent and Hexavalent)	1.0 mg/L	ND	U.S. EPA-200.7	Within Limits
8.	Copper (Cu)	1.0 mg/L	0.112 mg/L	U.S. EPA-200.7	Within Limits
9.	Iron (Fe)	8.0 mg/L	0.199 mg/L	U.S. EPA-200.7	Within Limits
10.	Lead (Pb)	0.5 mg/L	0.003 mg/L	U.S. EPA-200.7	Within Limits
11.	Manganese (Mn)	1.5 mg/L	0.251 mg/L	U.S. EPA-200.7	Within Limits
12.	Mercury (Hg)	0.01 mg/L	ND	U.S. EPA-200.7	Within Limits
13.	Selenium (Se)	0.5 mg/L	ND	U.S. EPA-200.7	Within Limits
14.	Nickel (Ni)	1.0 mg/L	ND	U.S. EPA-200.7	Within Limits
15.	Silver (Ag)	1.0 mg/L	0.188 mg/L	U.S. EPA-200.7	Within Limits
16.	Zinc (Zn)	5.0 mg/L	0.071 mg/L	U.S. EPA-200.7	Within Limits
17.	Arsenic (As)	1.0 mg/L	ND	U.S. EPA-200.7	Within Limits
18.	Barium (Ba)	1.5 mg/L	0.180 mg/L	U.S. EPA-200.7	Within Limits
19.	Boron (B)	6.0 mg/L	0.093 mg/L	U.S. EPA-200.7	Within Limits
20.	Total Toxic Metals	2.0 mg/L	0.576 mg/L	Calculated Value	Within Limits



Sr. No.	Parameters	Comparison Values (PEQS)	Concentration	Method / Equipment Used	Remarks
21.	Biochemical Oxygen Demand (BOD ₅) at 20°C	80mg/L	19 mg/L	SMWW 5210D	Within Limits
22.	Total Suspended Solids (TSS)	200 mg/L	156 mg/L	SMWW 2540D	Within Limits
23.	Phenolic Compounds (as Phenolic)	0.1 mg/L	0.03 mg/L	SMWW 5530D	Within Limits
24.	Grease and Oil	10 mg/L	1.6 mg/L	US. EPA 1664 B	Within Limits
25.	Fluoride	10 mg/L	0.21 mg/L	U.S. EPA 9214	Within Limits
26.	Cyanide	1 mg/L	0.42 mg/L	SMWW 4500 CN F	Within Limits
27.	An-ionic detergents (as MBAs)	20 mg/L	0.02 mg/L	SMWW 5540 C	Within Limits
28.	Sulfate (SO ₄ ²⁻)	600 mg/L	20 mg/L	SMWW 4500 - SO ₄ ²⁻ C	Within Limits
29.	Sulfide (S ²⁻)	1.0 mg/L	ND	SMWW 4500 - S ²⁻ F	Within Limits
30.	Ammonia (NH ₃)	40 mg/L	0.82 mg/L	SMWW 4500 - NH ₃ - D	Within Limits
31.	Chlorine (Cl)	1.0 mg/L	ND	SMWW 4500 - Cl B	Within Limits
32.	Pesticides	0.15 mg/L	ND	Screening Method	Within Limits



Environmental Services Pakistan (ESPAK)

PAK EPA & PUNJAB EPD CERTIFIED

8. SUMMARY TABLES FOR PARAMETERS EXCEEDING PEQS

Drinking Water Quality Analysis

Sampling Locations	Parameters Exceeding DW-PEQS				
	TDS	Chloride	Hardness	E. Coli	Fecal Coliform
Government Technical Training Institute Bahawalpur	2514	357	1008	2.6 MPN/100mL	4.6 MPN/100mL
Government College of Technology, Multan	--	--	--	2.6 MPN/100mL	2.6 MPN/100mL
Centre for Agricultural Machinery Industries, Mian Channu/Khanewal	1807	--	636	--	--
Government Institute of Textile, Faisalabad	--	--	--	2.6 MPN/100mL	2.6 MPN/100mL
Government College of Technology (Boys), Faisalabad	--	--	--	2.6 MPN/100mL	2.6 MPN/100mL
DW-PEQS	<1000 mg/L	<250 mg/L	< 500 mg/L	Must not be detectable in any 100mL Sample	Must not be detectable in any 100mL Sample



Sewerage Waste Water Quality Analysis

Sampling Locations	COD	BOD	TSS	Iron (Fe)	Sulfide	Sulphate	Ammonia	Cyanide
Government College of Technology (Women) Lytton Road, Lahore	280	98	442	--	2.2	--	--	4.95
Government College of Technology Printing and Publication, Lahore	510	364	--	--	2.70	--	42.3	2.35
Government Technical Training Institute Bahawalpur	382	144	--	--	--	--	--	--
Government College of Technology Bahawalpur	197	--	--	--	--	--	--	--
Government College of Technology, Multan	229	107	--	--	--	--	--	--
Centre for Agricultural Machinery Industries, Mian Channu/Khanewal	859	379	419	--	45.1	--	93.9	--
Government Institute of Textile, Faisalabad	1100	726	3476	58	3.3	--	--	--
Government College of Technology (Boys), Faisalabad	--	--	--	--	--	--	--	3.48
Government College of Technology (Women), Faisalabad	--	--	--	--	--	842	--	--
PEQS	150 mg/L	80 mg/L	200 mg/L	8.0 mg/L	1.0 mg/L	600 mg/L	1 mg/L	2.0 mg/L



9. PHOTOLOG



9.1 Ambient Air Monitoring



Fig1: Ambient Air Monitoring day time at Vocational Training Institute, Green Town Lahore using Mobile Ambient Air Monitoring Station



Fig2: Ambient Air Monitoring night time at Government College of Technology, Gujranwala using Mobile Ambient Air Monitoring Station



Fig3: Ambient Air Monitoring at day time at Government College of Technology, Sahiwal using Mobile Ambient Air Monitoring Station



Fig4: Ambient Air Monitoring at day time at Government Staff Training College, Murree using Mobile Ambient Air Monitoring Station



Fig5: Ambient Air Monitoring at day time at Government College of Technology Printing and Publication, Lahore using Mobile Ambient Air Monitoring Station



Fig6: Ambient Air Monitoring at day time at Institute of Surgical Technology, Sialkot using Mobile Ambient Air Monitoring Station



Fig7: Ambient Air Monitoring at day time at Govt. College of Technology, Bahawalpur using Mobile Ambient Air Monitoring Station



Fig8: Ambient Air Monitoring at Night time at Govt. College of Technology, Multan using Mobile Ambient Air Monitoring Station

 <p>ESPAK Environmental Services Pakistan</p>	<h2 style="margin: 0;">Environmental Services Pakistan (ESPAK)</h2> <p style="margin: 0;">PAK EPA & PUNJAB EPD CERTIFIED</p>
---	--



Fig9: Ambient Air Monitoring at Night time at Center for Agricultural Machinery Industries, Mian Channu/Khanewal using Mobile Ambient Air Monitoring Station



Fig10: Ambient Air Monitoring at Night time at Govt. Institute of Textile, Faisalabad using Mobile Ambient Air Monitoring Station







Fig11: Ambient Air Monitoring at Day time at Govt. Vocational Training Institute (Women), Kartarpura, Rawalpindi using Mobile Ambient Air Monitoring Station



Fig12: Ambient Air Monitoring at Day time at Govt. college of Technology Women, Faisalabad using Mobile Ambient Air Monitoring Station

	<h2 style="margin: 0;">Environmental Services Pakistan (ESPAK)</h2> <p style="margin: 0;">PAK EPA & PUNJAB EPD CERTIFIED</p>
---	--

9.2 Noise Level Monitoring

	
<p>Fig1: Noise Level Monitoring day time at Government Technical Training Institute (Women), Murree using Digital Sound Level Meter</p>	<p>Fig2: Noise Level Monitoring night time at Government College of Technology Boys, Faisalabad using Digital Sound Level Meter</p>
	
<p>Fig3: Noise Level Monitoring day time at Government College of Technology, Sialkot using Digital Sound Level Meter</p>	<p>Fig4: Noise Level Monitoring night time at Government Technical Training Institute, Bahawalpur using Digital Sound Level Meter</p>

 **Environmental Services Pakistan (ESPAK)**
PAK EPA & PUNJAB EPD CERTIFIED



Fig9: Noise Level Monitoring night time at Government College of Technology, Sahiwal using Digital Sound Level Meter



Fig10: Noise Level Monitoring day time at Government College of Technology, Gujranwala using Digital Sound Level Meter



Fig11: Noise Level Monitoring day time at Government College of Technology, Bahawalpur using Digital Sound Level Meter



Fig12: Noise Level Monitoring day time at Government College of Technology, Multan using Digital Sound Level Meter



9.3 Drinking/Sewerage Water Sampling



Fig1: Drinking Water Sampling at Center for Agricultural Machinery Industries Mian Channu



Fig2: Drinking Water Sampling at Vocational Training Institute, Rawalpindi



Fig3: Drinking Water Sampling at Govt. College of Technology, Sahiwal



Fig4: Drinking Water Sampling at Government College of Technology, Gujranwala



9.4 Drinking/Sewerage Water Sampling

<p>Fig1: Sewerage Water Sampling at Government Technical Training Institute, Bahawalpur</p>	<p>Fig2: Sewerage Water Sampling at Vocational Training Institute, Rawalpindi</p>
<p>Fig3: Sewerage Water Sampling at Vocational Training Institute, Multan</p>	<p>Fig4: Sewerage Water Sampling at Government College of Technology, Gujranwala</p>



Environmental Services Pakistan (ESPAK)

PAK EPA & PUNJAB EPD CERTIFIED



Fig5: Sewerage Water Sampling at Government College of Technology, Faisalabad



Fig6: Sewerage Water Sampling at Government Technical Training Institute Bahawalpur.

9.5 Testing at Laboratory



Fig1: Laboratory Staff



Fig2: COD in Sewerage Water Testing

ANNEX-VI Impact Assessment Matrix

Environmental Impacts	Project Activities																						
	Air Quality	Noise	Soil Contamination	Visual and Aesthetic Value	Hazardous waste	Ground or Drinking Water	Increase in Waste Water Generation	Flora	Fauna	Livestock	Fishery	Disturbance to Locals	Cultural Issues	Gender Issues	Health and Safety of Workers	Archeological/Historical Religious	Human Health	Safety Issues	Agriculture	Livelihood	Improvement in Overall Economy	Resettlement	
Design/Pre-Construction Stage																							
Consumables of lab equipment	- 2	0	- 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
Design of COEs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
Preparation of Contractor Site Specific Plans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction Stage																							
Clearing of Land, Digging and Excavation	- 2	- 2	- 2	- 1	- 1	- 1	- 1	- 1	- 1	0	0	- 1	- 1	- 1	- 2	0	- 1	- 1	- 1	2	2	0	0
Construction material, equipment	- 2	- 2	- 2	- 2	- 1	- 1	- 1	- 1	- 1	0	0	- 1	0	0	- 1	0	- 1	0	0	2	2	0	0
Disposal of spoil material	- 1	0	- 2	- 2	- 1	- 1	- 1	- 1	- 1	0	0	0	0	0	- 1	0	- 1	0	0	2	2	0	0
Construction Camps	- 1	- 2	- 2	- 2	0	0	- 2	0	0	0	0	- 1	0	- 1	- 1	0	- 1	0	- 1	2	2	0	0
Construction Works	- 2	- 2	- 2	- 2	- 1	- 1	- 2	- 1	0	0	0	- 1	- 1	- 1	- 2	0	- 1	0	- 1	2	2	0	0
Use of Heavy Machinery	- 2	- 2	- 1	- 2	- 1	- 1	- 1	0	0	0	0	- 1	0	- 1	- 1	0	- 1	0	0	2	2	0	0
Wastewater Disposal	0	0	- 1	- 1	- 1	- 1	- 1	0	0	0	0	0	0	0	- 1	0	- 1	0	0	2	2	0	0
Solid Waste Disposal	- 2	0	- 1	- 1	- 1	- 1	- 1	0	0	0	0	- 1	0	0	- 1	0	- 1	0	- 1	2	2	0	0

Leakage & Spillage of Oils and Chemicals	0	0	0	0	-1	-1	-1	0	0	0	0	0	0	0	0	-1	0	-1	0	0	2	2	0
Security Fencing and Lightning	0	0	0	-1	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	2	2	0
Operation Stage																							
Landscaping	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Institute Operations	0	0	0	0	0	-1	-1	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0

Key: -3: High negative impact, -2: Moderate negative impact, -1: Low negative impact; 0: insignificant/negligible impact; +1: low positive impact; +2: high positive impact;

NOTE: The above matrix shows the impact magnitude without any mitigation. With the application of mitigation, the magnitude of impacts will be either insignificant or low.

ANNEX-VII Government of Pakistan Guidelines for Construction amid COVID-19



Date: 11 April 2020
 Document Code: 11-01
 Version: 01

Guidelines

Health & Safety of Building & Construction Workers during COVID-19 Outbreak

Objective

To provide guidelines for the workers involved in building and construction work during the current epidemic of COVID-19.

Rationale

Construction processes are dynamic with significantly varying number of workers on a construction project site from day to day. The workers coming from diverse environments and working closely together increases the risk of exposure to COVID 19.

Building construction involves earth work, procurement of materials and supplies and their storage, construction work done by masons, blacksmiths, electricians, carpenters, plumbers, painters, supervisors, managers and security personnel. These guidelines provide the safety measure to be implemented at the construction site having a dusty environment, continuous flow of different materials and make-shift type of arrangements for storage, food and sanitation calls for implementation of safety precautions at the very basic level of personal hygiene only.

Advice for Site Managers:

Without prejudice to the following, all possible and prescribed actions shall be taken at the project site, as should facilitate the health of all life present at the site.

- Every construction project shall make proper arrangements for uninterrupted building services including but not restricted to, electricity, fuel, water supply, water disposal and sanitation, communication links, washrooms with hand hygiene and shower facility and with proper and adequate supply of soaps and disinfectants.
- Workers should not use biometric attendance machines or crowd during attendance, entry or exit to the premises of the construction site
- Ensure the availability of the thermal gun at the entry and exit of the construction site and no worker should be allowed without getting his/her temperature checked.
- Site manager must maintain a register of all contact details with NID number and addresses of all present at the site in case a follow up or tracing and tracking of contacts is required at a later stage.
- Develop the employee roaster to decrease the number of people on the site very day. Split the shifts of the workers in morning and evening with limit of each shift to 8 working hours.



- Every worker must change into standard working attire at the time of commencement of duty and change back to their regular dress after taking shower when their duty hours end.
- In addition to all other internationally recognized safety precaution for construction workers and other staff, every individual must be provided with a face mask. It must be ensured that everyone during his or her presence at the site continues to wear the mask. Face mask shall be replaced as and when soiled or otherwise removed. Outer surface of face mask must not be touched with hands.
- Non-essential work trainings must be postponed avoiding gathering of people.
- Ensure the physical distance by creating more than one route of entry and exit to the site.
- Instruct the workers to inform the construction manager (or authorities) if
 - They develop any symptoms of cough, flu or fever.
 - They have been exposed to someone suspected or confirmed with COVID 19.
 - They have met someone who has a travel history of COVID 19 endemic country
 - They have travelled in last couple of days or plan to travel soon
- All incidences of appearance of the symptoms of COVID-19 shall be immediately documented and maintained at the site and information regarding which shall be immediately communicated through e-mail or else, to the designated health facility, and the sick worker shall be transported to the health facility for further advice and action. The site manager must establish a link with a nearby healthcare facility with arrangements for quick transportation of workers in case of an emergency.
- Persuade the workers to inform the authorities for their safety and of other if they observe any signs and symptoms in a colleague
- Do not allow any worker at the construction site who has the symptoms
- Display the awareness banners about hand hygiene and physical distancing, where you can, around the work site.
- Everyone on the construction site must observe sneezing and coughing etiquettes.
- Workers shall be requested and required to wash their hands as frequently as practicable and shall also be advised not to touch their face with their hands during work.
- Workers must maintain no less than two arm lengths between them before, during after work at all the times. They shall not make physical contact and shall be required to maintain separate personal gears and assets which must be clearly labelled and stored without intermix.
- Only sanitize-able dinning surfaces shall be used, which must be cleaned before each service. Food must be heated to a temperature to no less than 70° C before consumption and shall preferably be served in disposable utensils. If reusable utensils are used, these must be washed with soap and water immediately after use and stored at a safe place.
- The lunch breaks and stretch breaks of the workers must be staggered to avoid the clustering of workers. Workers must not sit at less than 2 meters distance while having meals and while any other activity requiring interpersonal communications.
- In the wake of current restrictions on transportations site mangers will ensure safe transport arrangements for worker which should not be crowded and should have social distancing in place during the entire process from pickups till drops at destination



- In case of workers sleeping in at the site of construction, a safe distance of 2 meters must be ensured in the sleeping rooms
- A supply of safe drinking water must be made available at the project site and maintained.

Advice for Construction Workers:

- All possible and prescribed measures shall be taken to ensure your and others health
- Enter your contact details in the register maintained at the site, in case a follow up or tracing and tracking of contacts is required at a later stage.
- Follow hygiene practices at washrooms and shower facility with proper and adequate use of soaps and disinfectants.
- Every worker must change into standard working attire at the time of commencement of duty and change back to their regular dress after taking shower when their duty hours end.
- In addition to all other internationally recognized safety precaution for construction workers and other staff, every individual must use face mask. Face mask shall be replaced as and when soiled or otherwise removed. Outer surface of face mask must not be touched with hands.
- Workers should wash their hands as frequently as practicable and shall not to touch their face with their hands during work.
- Everyone on the construction site must observe sneezing and coughing etiquettes.
- Workers must maintain no less than two arm lengths between them before, during after work at all the times, They shall not make physical contact and shall be required to maintain separate personal gears and assets which must be clearly labelled and stored without intermix.
- Sick worker should immediately inform the site manager and must get medical advice from nearby health centre.
- Only sanitize able dinning surfaces shall be used. Food must be heated to a temperature to no less than 70° C before consumption and shall preferably be in disposable utensils. If reusable utensils are used, these must be washed with soap and water immediately after use and stored at a safe place.
- Do not sit at less than 2 meters distance while having meals and while any other activity requiring interpersonal communications.
- Do not use biometric attendance machines or crowd during attendance, entry or exit to the premises of the construction site.
- Use safe transport arrangements which should not be crowded and should have social distancing in place during the entire process from pickups till drops at destination.
- In case sleeping in at the site of construction, a safe distance of 2 meters must be ensured in the sleeping rooms.

Deliveries or Other Contractors Visiting the Site

- Non-essential visits to the construction sites should be cancelled or postponed.



Government of Pakistan
Ministry of National Health Services,
Regulations & Coordination

- Delivery workers or other contractors who need to visit the construction site must go through temperature check before entering and should be given clear instructions for precautions to be taken while on site.
- Designate the workers, with protective gears or at least gloved and mask, to attend to the deliveries and contractors.
- Make alcohol-based hand sanitizer (at least 70%) available for the workers handling deliveries.
- Instruct the visiting truck drivers to remain in their vehicles and whenever possible make use of contactless methods, such as mobile phones, to communicate with your workers.

Note: The above recommendations are being regularly reviewed by the Ministry of National Health Services, Regulations & Coordination and will be updated based on the international & national recommendations and best practices.

The Ministry acknowledges the contribution of Irfan Mirza, Syeda Shehribano Akhtar and HSA/ HPSIU/ NIH team to compile these guidelines.

For more information, please contact:

HSA/ HPSIU/ NIH, PM National Health Complex, Islamabad

<http://covid.gov.pk/>

<http://nhsrc.gov.pk/>

<https://www.facebook.com/NHSRCoOfficial>

<http://www.hsa.edu.pk/>

<https://twitter.com/nhsrcoofficial>

<https://www.nih.org.pk/>

https://www.youtube.com/channel/UCdYuzeSP4Ug1f_ZZK1

ANNEX-VIII: Proposed National and International Guidelines on Environmental Parameters

- (i) Punjab Environmental Protection Act 2012
- (ii) Factories Act
- (iii) ADB Safeguards Policy Statement, 2009
- (iv) ADB Accountability Mechanism

ANNEX-IX: Latest Picture Profile of COEs visited during May-June 2022

GOVERNMENT STAFF TRAINING COLLEGE, MURREE



Photo 74: Proposed Construction Site (where numerous no. of trees need to be cut)



Photo 75: A View of the Flora of Project Area



Photo 76: Another Proposal of Construction Site



Photo 77: Water Bore might be Impacted during Construction



Photo 78: Water Storage Tanks



Photo 79: Meeting with Officials of GSTC

GOVERNMENT TECHNICAL TRAINING INSTITUTE (W), MURREE



Photo 80: A View of the College Building



Photo 81: Another View of the College Building



Photo 82: Water Storage Tanks



Photo 83: An Aerial of the GTTI(W), Murree



Photo 84: Visit of College with Staff



Photo 85: Site Visit with College Staff

**ANNEX-X: DULY FILLED FORMS
RECORD of
RAPID ENVIRONMENTAL ASSESSMENT EXERCISE
RAPID ENVIRONMENTAL ASSESSMENT**

Sr. No. _____ Date: _____

Name of Institution: Govt. Staff Training College District: Rawalpindi
Murree

Tehsil: Murree Town/Village: _____

Teaching Staff: 05 Sanctioned posted only 01 filled Support Staff: 09

Resident Staff: _____ Resident Trainees: _____

Literacy Rate: _____ Employment Rate: _____

Students: _____

1. PHYSICAL ENVIRONMENT

- 1.1. Is the area densely/moderately/scarcely populated?
scarcely populated
- 1.2. How the Project Site can be accessed (name the major road)?
Muzaffarabad Road
- 1.3. Describe the source and distribution system (Municipal/Tube Well – Overhead Tank – Drinking water Treatment Plant – Pipe Network) of drinking water in the institution?
Institute has its own boring system and this water is used for drinking and other needs of water. However, this water will not be sufficient for construction
- 1.4. In case of ground water, what is the ground water level in the Project Area?
Boring depth is around 400 feet and water level at the depth of 300 feet.
- 1.5. How is the drinking water quality (good/poor)?
Good
- 1.6. How the wastewater is collected, treated at site and safely disposed (separate sewage system e.g. storm/toilet waste /septic tank/soakage pit/ treatment plant/mode of final disposal from the site to outer system)?
septic tank
- 1.7. Any impacts on natural waters (river) due to wastewater discharge (if any)?
No
- 1.8. Describe the solid waste segregation / collection / safe disposal system (separate bins for wastes – segregated collection – mode of safe disposal of solid waste)
Municipal vehicle collect solid waste from garbage bin after 03 days
- 1.9. What are the major air and noise pollution sources in the Project Area?
No
- 1.10. Is the Project Area prone to natural hazards (e.g. flooding, earthquake, heatwave, urban flooding, drought, etc.)?
Earthquake, Snow Storms

ADB funded – Improving Workforce Readiness Project Punjab
(Technical and Vocational Centers)

- 1.11. Is there any historical/culturally sensitive site(s) nearby which could be impacted due to project interventions?

NO

2. ECOLOGICAL ENVIRONMENT

- 2.1. Which type of trees/flora are present in the Project Area?
chir pine, blue pine, deodar and spruce
- 2.2. How many trees (along with tree species) are being affected/cut due to project interventions?
50 trees will be affected due to project interventions
- 2.3. What is the major fauna of the Project Area?
Wild dogs and boars outside the boundary
- 2.4. Is there any environmentally sensitive/protected area nearby the Project Area?
NO
- 2.5. Is there any threatened/protected species present in the Project Area?
NO

3. SOCIOECONOMIC ENVIRONMENT

- 3.1. What are the languages being spoken in the Project Area?
Potohari
- 3.2. What are major diseases in the Project Area?
NO specific
- 3.3. What is the mode of transportation (public/private) in the Project Area?
private
- 3.4. Is there any religiously sensitive site nearby which could be impacted due to project interventions?
NO
- 3.5. Educational facilities available in the neighborhood:

SR. NO	FACILITIES	YES	NO	IF YES THEN REPLY				
				GOVT.	PRIVAT E	BOYS (M)	GIRL S (F)	CO-EDUCATION
1.	PRIMARY SCHOOL	√		√		√	√	
2.	MIDDLE SCHOOL	√		√		√	√	
3.	HIGH SCHOOL	√		√		√	√	
4.	COLLEGE	√		√		√	√	
5.	VOCATIONAL TRAINING CENTERS	√		√		√	√	
6.	DEENI MADRASSA	√			√	√		
7.	OTHERS							

3.6. Institutional facilities available in the neighborhood:

SR. NO	FACILITIES	YES	NO	IF YES THEN REPLY		NAME
				GOVT.	PRIVAT E	
1.	HOSPITAL	√		√		THQ MURREE
2.	DISPENSARY					
3.	BASIC HEALTH UNIT					
4.	POST OFFICE	√				PAKISTAN POST MURREE
5.	MOSQUE	√				
6.	BANKS	√				
7.	OTHERS					

3.7. Civic facilities available in the neighborhood:

SR. NO	FACILITIES	YES	NO	REMARKS IF ANY
1.	LINED DRAINAGE SYSTEM	√		
2.	STREET LIGHTS		√	
3.	GROCERY SHOPS		√	
4.	RECREATIONAL / GAMES FACILITIES (PARKS, ETC.)		√	
5.	MEDICAL STORES	√		
6.	GRAVEYARDS			
7.	ELECTRICITY	√		
8.	TELEPHONE	√		
9.	PUBLIC WATER SUPPLY, SEWERAGE NETWORK		√	
10.	OTHERS			

4. Description of immediate neighborhood all across boundary line of the institution:
GSTC Murree and GTTI (w) are situated within same boundary. This boundary wall is adjacent with Forest department office and rest house.

5. Concerns/ Apprehensions Raised by COE staff/students/neighbors:
Proposed site from GSTC Murree is not suitable as it will affect many trees and proposed site of GTTI (w) Murree will affect GSTC boring system. Therefore, it is our serious concern that location of proposed site must be changed.

ADB funded – Improving Workforce Readiness Project Punjab
(Technical and Vocational Centers)

6. Suggestions:

7. List of Individuals Consulted on Site and Immediate Neighborhood:

Sr. No.	Name	Designation
1.	Dr. Ahmad Mustafa	Director
2.	Ms. Shazia Fazil	Chief Instructor
3.	Mr. Rehman Ali	Hostel Clerk
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		
14.		
15.		
16.		

DETAILS OF THE PERSON CONDUCTING SURVEY:

Name/Designation	Signature/Date
------------------	----------------

A Checklist for Preliminary Climate Risk Screening

Institute Name: _____ District: _____ Tehsil: _____

Screening Questions		Score	Remarks ¹¹¹
Location and Design of Project	Is siting and/or orientation of the project (or its components) likely to be affected by climate conditions including extreme weather related e.g. floods, droughts, precipitation, snow storms, heatwaves, storms, landslides?		
	Would the project design (e.g. orientation, ceiling height, window opening, thermal insulation) need to consider any hydro-meteorological parameters (e.g., flood, heatwave, cold wave, peak river flow, precipitation pattern, snow storms, reliable water level, peak wind speed, etc)?		
Materials and Maintenance	Would weather, current and likely future climate conditions (e.g. prevailing humidity level, temperature contrast between hot summer days and cold winter days, exposure to wind and humidity hydro-meteorological parameters likely affect the selection of project inputs over the life of project outputs (e.g. construction material)?		
	Would weather, current and likely future climate conditions, and related extreme events likely affect the maintenance (scheduling and cost) of project output(s)?		
Performance of Project Outputs	Would weather/climate conditions, and related extreme events likely affect the performance (e.g. annual power production) of project output(s) (e.g. hydro-power generation facilities) throughout their design life time?		

Options for answers and corresponding score are provided below:

Response	Score
Not Likely	0
Likely	1
Very Likely	2

Responses when added that provide a score of 0 will be considered low risk project. If adding all responses will result to a score of 1-4 and that no score of 2 was given to any single response, the project will be assigned a medium risk category. A total score of 5 or more (which include providing a score of 1 in all responses) or a 2 in any single response, will be categorized as high risk project.

Result of Initial Screening (Low, Medium, High): _____

Other Comments (if any):

¹¹¹ If possible, provide details on the sensitivity of project components to climate conditions, such as how climate parameters are considered in design standards for infrastructure components, how changes in key climate parameters and sea level might affect the siting/routing of project, the selection of construction material and/or scheduling, performances and/or the maintenance cost/scheduling of project outputs.

RAPID ENVIRONMENTAL ASSESSMENT

Sr. No. _____	Date: 24-06-2022
Name of Institution: GTTI (W) Murree	District: Rawalpindi
Tehsil: Murree	Town/Village: Town
Teaching Staff: 10	Support Staff: 15
Resident Staff: 04	Resident Trainees: 0
Literacy Rate: _____	Employment Rate: _____
Students: 200	

1. PHYSICAL ENVIRONMENT

- 1.1. Is the area densely/moderately/scarcely populated?
Moderately populated.
- 1.2. How the Project Site can be accessed (name the major road)?
Rich Bell Road Kashmir Point, link road from Jhika Gali to Kashmir Point.
- 1.3. Describe the source and distribution system (Municipal/Tube Well – Overhead Tank – Drinking water Treatment Plant – Pipe Network) of drinking water in the institution?
TMA water supply and pipe network.
- 1.4. In case of ground water, what is the ground water level in the Project Area?
Estimated dept of water under ground is almost 300ft.
- 1.5. How is the drinking water quality (good/poor)?
Good.
- 1.6. How the wastewater is collected, treated at site and safely disposed (separate sewage system e.g. storm/toilet waste /septic tank/soakage pit/ treatment plant/mode of final disposal from the site to outer system)?
Separate sewerage system, septic tanks.
- 1.7. Any impacts on natural waters (river) due to wastewater discharge (if any)?
None.
- 1.8. Describe the solid waste segregation / collection / safe disposal system (separate bins for wastes – segregated collection – mode of safe disposal of solid waste)
Separate bins, Managed by TMA.
- 1.9. What are the major air and noise pollution sources in the Project Area?
None.
- 1.10. Is the Project Area prone to natural hazards (e.g. flooding, earthquake, heatwave, urban flooding, drought, etc.)?
Earthquake, Snow Storms.
- 1.11. Is there any historical/culturally sensitive site(s) nearby which could be impacted due to project interventions?

ADB funded – Improving Workforce Readiness Project Punjab
(Technical and Vocational Centers)

No.

2. ECOLOGICAL ENVIRONMENT

- 2.1. Which type of trees/flora are present in the Project Area?
Gymnosperms, Angeosperms.
- 2.2. How many trees (along with tree species) are being affected/cut due to project interventions?
Mostly pinetrees and shrubs.
- 2.3. What is the major fauna of the Project Area?
Wild dogs and boars outside the boundary.
- 2.4. Is there any environmentally sensitive/protected area nearby the Project Area?
No
- 2.5. Is there any threatened/protected species present in the Project Area?
No

3. SOCIOECONOMIC ENVIRONMENT

- 3.1. What are the languages being spoken in the Project Area?
Urdu, English, Potohari
- 3.2. What are major diseases in the Project Area?
Not Specific
- 3.3. What is the mode of transportation (public/private) in the Project Area?
Private, Institute based only for Students.
- 3.4. Is there any religiously sensitive site nearby which could be impacted due to project interventions?
No.
- 3.5. Educational facilities available in the neighborhood:

SR. NO	FACILITIES	YES	NO	IF YES THEN REPLY				
				GOVT.	PRIVATE	BOYS (M)	GIRLS (F)	CO-EDUCATION
8.	PRIMARY SCHOOL	✓		✓				✓
9.	MIDDLE SCHOOL		✓					
10.	HIGH SCHOOL				✓			✓
11.	COLLEGE	✓		✓	✓	✓	✓	
12.	VOCATIONAL TRAINING CENTERS		✓					
13.	DEENI MADRASSA		✓					
14.	OTHERS							

3.6. Institutional facilities available in the neighborhood:

SR. NO	FACILITIES	YES	NO	IF YES THEN REPLY		NAME
				GOVT.	PRIVAT E	
8.	HOSPITAL			✓		
9.	DISPENSARY		✓			
10	BASIC HEALTH UNIT					
11	POST OFFICE	✓				
12	MOSQUE	✓				
13	BANKS	✓			✓	
14	OTHERS					

4. Description of immediate neighborhood all across boundary line of the institution:
Govt. Staff Training Institute, Forest Rest House, Government House, Chief Secretary House & Hotels.
5. Concerns/ Apprehensions Raised by COE staff/students/neighbors:
None.
6. Suggestions:
Bore well required
Slope of snow dumping
Wall raising to make the residential area separate
Replacement of pipelines with PPR.
7. List of Individuals Consulted on Site and Immediate Neighborhood:

Sr. No.	Name	Designation
1.	Principal GTTI (W) Murree	
2.	Principal GSTC, Murree	
3.	Teaching Staff	
4.	Students	

A Checklist for Preliminary Climate Risk Screening

Institute Name: GOVT. TECHNICAL TRAINING INSTITUTE (W) MURREE

District: RAWALPINDI Tehsil: MURREE

Screening Questions		Score	Remarks ¹¹²
Location and Design of Project	Is siting and/or orientation of the project (or its components) likely to be affected by climate conditions including extreme weather related e.g. floods, droughts, precipitation, snow storms, heatwaves, storms, landslides?	Snow Storm 8/10	
	Would the project design (e.g. orientation, ceiling height, window opening, thermal insulation) need to consider any hydro-meteorological parameters (e.g., flood, heatwave, cold wave, peak river flow, precipitation pattern, snow storms, reliable water level, peak wind speed, etc)?	0/10	
Materials and Maintenance	Would weather, current and likely future climate conditions (e.g. prevailing humidity level, temperature contrast between hot summer days and cold winter days, exposure to wind and humidity hydro-meteorological parameters likely affect the selection of project inputs over the life of project outputs (e.g. construction material)?	8/10	
	Would weather, current and likely future climate conditions, and related extreme events likely affect the maintenance (scheduling and cost) of project output(s)?	9/10	
Performance of Project Outputs	Would weather/climate conditions, and related extreme events likely affect the performance (e.g. annual power production) of project output(s) (e.g. hydro-power generation facilities) throughout their design life time?	8/10	

Options for answers and corresponding score are provided below:

Response	Score
Not Likely	0
Likely	1
Very Likely	2

Responses when added that provide a score of 0 will be considered low risk project. If adding all responses will result to a score of 1-4 and that no score of 2 was given to any single response, the project

¹¹² If possible, provide details on the sensitivity of project components to climate conditions, such as how climate parameters are considered in design standards for infrastructure components, how changes in key climate parameters and sea level might affect the siting/routing of project, the selection of construction material and/or scheduling, performances and/or the maintenance cost/scheduling of project outputs.

will be assigned a medium risk category. A total score of 5 or more (which include providing a score of 1 in all responses) or a 2 in any single response, will be categorized as high risk project.

Result of Initial Screening (Low, Medium, High): Medium

Other Comments (if any):

Prepared by: **Rehana Abbasi, Principal** Signature: _____ Date: **24-06-2022**