ESTABLISHMENT OF MEDICAL AND NURSING COLLEGE AT GILGIT

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) REPORT

HEALTH DEPARTMENT OF GILGIT-BALTISTAN

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LIST OF ABBREVIATIONS

AOI	Area of Influence
ASTM	American Society for Testing and Materials
BAP	Best Available Techniques
BEP	Best Environmental Practices
BCP	Building Code of Pakistan
CAMS	Copernicus Atmosphere Monitoring Service
CBO	Community-Based Organization
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPA	Environmental Protection Agency
ERS	Electrical Resistivity Survey
ESCA	Ecologically Sensitive and Critical Areas
ESMP	Environmental and Social Management Plan
FDT	Field Density Test
GB	Gilgit-Baltistan
GB-EPA	Gilgit-Baltistan Environmental Protection Agency
GBV	Gender-Based Violence
GHG	Greenhouse Gases
GIS	Geographic Information System
GRM	Grievance Redress Mechanism
GSP	Geological Survey of Pakistan
HSE	Health, Safety, and Environment

HVAC	Heating, Ventilation, and Air Conditioning
HWMP	Hospital Waste Management Plan
IEE	Initial Environmental Examination
MoCC	Ministry of Climate Change
MRI	Magnetic Resonance Imaging
MSDS	Material Safety Data Sheet
NCCP	National Climate Change Policy
NCS	National Conservation Strategy
NEQS	National Environmental Quality Standards
NGO	Non-Governmental Organization
NOC	No Objection Certificate
NRM	National Reference Manual
O.H.R	Overhead Reservoir
OHWT	Over Head Water Tank
OPD	Outpatient Department
PCU	Passenger Car Unit
PD	Project Director
PEPA	Pakistan Environmental Protection Act
PGRC	Project Grievance Redress Committee
PMU	Project Management Unit
PPE	Personal Protective Equipment
RTK	Real-Time Kinematic
SFT	Square Feet
SPT	Standard Penetration Test
UNIDO	United Nations Industrial Development Organization

VES	Vertical Electrical Sounding
VRF	Variable Refrigerant Flow

EXECUTIVE SUMMARY

The proposed Medical and Nursing College in Minawar, Gilgit represents a landmark initiative by the Government of Gilgit-Baltistan (GB) to transform the healthcare and education landscape of the region. This project, announced by the then Prime Minister of Pakistan in 2019, is being developed in two major phases. In Phase I, the focus is on the construction of a state-of-the-art Medical and Nursing College along with residential and administrative facilities. Phase II will include the development of a fully integrated 150 bedded teaching hospital. The total estimated cost of the project is PKR 23,576.604 million.

Spanning 500 kanal (over 62 acres) of government-owned, uninhabited land in Minawar, on the outskirts of Gilgit city, the site has been strategically selected due to its accessibility, environmental suitability, and lack of resettlement or land acquisition issues. The College is located at Latitude 35.859490° N and Longitude 74.512332° E, strategically positioned along the Karakoram Highway (N-35) for optimal connectivity. The site lies between the settlements of Jalalabad to the northwest and Chamugar to the southeast, both of which are located on the opposite (northeastern) side of the Gilgit River. This positioning places the project site on the southwestern river terrace of the Gilgit River, with the watercourse forming a natural boundary to the northeast, while maintaining direct access to the major transportation corridor of the KKH. The project aims to address several critical challenges:

- Acute shortage of healthcare professionals, with less than 5% of aspiring students from GB gaining admission to medical colleges annually.
- High outmigration of trained doctors and nurses due to limited local employment and professional development opportunities.
- Overreliance on medical facilities in urban centers like Islamabad, Rawalpindi, Lahore and Peshawar, leading to high costs and delayed treatment for residents.
- Alarming health indicators, including high maternal and infant mortality rates, a rising burden of non-communicable diseases, and limited response capacity to emergencies.

The envisioned campus will include:

- A Medical College with advanced lecture halls, labs, dissection rooms, libraries, and demonstration areas.
- A Nursing College with modern training infrastructure.
- Residential hostels for over 600 students, apartments for staff, a sports complex, bank, shopping mart, cafeteria, and mosque.
- Supporting infrastructure such as incinerators, mortuary, fire-fighting systems, green zones, and parking for over 750 vehicles.

To ensure environmental compliance and sustainable development, this Environmental Impact Assessment (EIA) has been prepared in accordance with the Gilgit-Baltistan Environmental Protection Agency (GB-EPA) IEE/EIA Regulations, 2024, falling under Schedule I for urban development and construction projects.

The EIA covers a comprehensive range of environmental and social considerations:

Topographic and geotechnical surveys confirmed the site's stability and structural suitability.

Groundwater and resistivity studies identified safe, high-quality aquifers suitable for developing gravity-fed water supply systems or deep bore-based sources for domestic use. Hydrological analysis and flood risk mapping led to the design of concrete-lined sheet flow interceptor drains to manage flash flood events.

Although baseline air quality was not formally assessed through monitoring, it is assumed to be generally good at the project site due to its remote location, low The Government of Gilgit-Baltistan (GB), through the Health Department, has proposed the establishment of a Medical and Nursing College in Minawar, Gilgit, as a flagship initiative to address critical healthcare and education challenges in the region. The project, announced by the Prime Minister in 2019, aims to strengthen local health infrastructure, reduce dependency on urban centers, and provide quality education and healthcare services to the underserved populations of GB. Envisioned in two phases, the first phase includes the development of the college infrastructure, academic and residential blocks, and associated facilities, while the second phase will establish a fully functional 150-bed teaching hospital. The project is being executed by the Project Director under the Project Management Unit (PMU) of the Health Department GB.

The project site spans over 500 kanal (approximately 62 acres) of government-owned barren land in Minawar, Gilgit, located adjacent to the Karakoram Highway (KKH). The site is free from land disputes or encroachment and offers excellent road connectivity, making it highly suitable for institutional development. Technical and site feasibility studies—including topographic surveys, electrical resistivity, soil testing, and seismic analysis—confirmed the viability of the site, with no groundwater encountered up to 15 meters, strong soil stability, and sufficient aquifers identified for water extraction.

The Environmental Impact Assessment (EIA), conducted in accordance with the Gilgit-Baltistan Environmental Protection Act, 2014 and GB-EPA Review of IEE/EIA Regulations, 2024, provides a comprehensive evaluation of the project's potential environmental and social impacts. The project was initially categorized under IEE; however, based on its nature and the anticipated generation of hazardous medical waste, it has been upgraded to a full EIA under Schedule II, Urban Development and Healthcare Facilities category. The assessment includes the evaluation of land use, air quality, water availability and quality, noise environment, biodiversity, soil characteristics, and socio-economic aspects. Detailed field surveys, stakeholder consultations, and site investigations were carried out to inform this report.

The baseline environmental assessment confirmed that the project area is sparsely vegetated, with no ecologically sensitive species or habitats observed. Air quality is presumed to be within permissible limits due to the absence of industrial activity nearby, while background noise levels are considered negligible. Water quality analysis was conducted using two samples—one from borehole water and the other from a community supply scheme tank. Laboratory results confirmed that the borehole sample met all chemical and microbiological parameters, making it safe for use. However, the supply scheme sample showed microbial contamination (E. coli and Fecal Enterococci), indicating it is unfit for direct human consumption without treatment. Consequently, the project will rely primarily on borewell water for all uses during both construction and operational phases.

Socio-economic studies identified a strong public demand for a medical college, with over 1,200 students annually attempting medical entrance exams but only a small fraction securing seats in institutions outside GB. Stakeholders, including local residents, healthcare workers, and officials from the Gilgit-Baltistan Waste Management Company (GBWMC), expressed strong support for the project, emphasizing the need for modern waste handling systems, employment for local youth, and proper sanitation mechanisms within hospital design.

The project is expected to generate temporary and permanent employment, reduce patient referrals to other cities, and contribute to local economic growth. Key concerns raised during consultations—such as the absence of dedicated drainage systems in OTs, lack of proper waste chutes in multi-story buildings, and risk of improper infectious waste handling—have been addressed through design improvements. These include the integration of centralized drainage infrastructure, sealed gravity-fed waste chutes per floor, and the use of a hook-arm garbage collection system for internal waste movement.

A robust Hospital Waste Management Plan (HWMP) has been prepared in compliance with the Hospital Waste Management Rules, 2005, National Hazardous Waste Management Policy 2022, and relevant international treaties including the Basel and Stockholm Conventions. The plan includes color-coded waste segregation, vertical chute systems, dedicated placenta and ash pits, and a 100 kg/hour dual-chamber incinerator equipped with emission controls. The Yellow Room is recommended for the temporary storage of infectious waste, while non-risk waste will be stored in a designated area behind the incinerator and transported by GBWMC to the municipal landfill. GBWMC has formally confirmed its role in waste handling post-commissioning, and an MoU will be finalized prior to operation.

Anticipated environmental impacts are mostly localized and reversible, with appropriate mitigation strategies outlined in the Environmental and Social Management Plan (ESMP). These include dust suppression during construction, proper wastewater disposal, control of noise emissions, occupational safety protocols, and continuous community engagement. Monitoring indicators, reporting timelines, and grievance redressal mechanisms have also been defined.

The EIA concludes that the Medical and Nursing College project is technically sound, environmentally sustainable, and socially beneficial. Its implementation will not only reduce the human resource gap in healthcare within GB but also offer long-term improvements in regional health outcomes, education, and economic development. Subject to the implementation of the ESMP and continued oversight by GB-EPA and the project's Environmental and Social Safeguards Officers, the project is recommended for environmental approval and immediate execution.

1. INTRODUCTION

1.1. Background

Healthcare education is a fundamental pillar in improving the quality of medical services and addressing the growing healthcare needs of a population. The proposed establishment of a Medical and Nursing College in Gilgit is a significant step towards enhancing healthcare education, strengthening healthcare delivery, and building local capacity. This initiative is especially crucial for remote and underdeveloped regions like Gilgit-Baltistan, where there is a persistent shortage of trained healthcare professionals.

The project aims to contribute meaningfully to the healthcare sector by producing qualified medical personnel, including doctors, nurses, and allied health professionals, who are essential for improving service delivery and healthcare outcomes. The idea of establishing the college was first announced in 2019 by the then Prime Minister of Pakistan, with the objective of providing advanced medical education, specialized training, and accessible healthcare facilities for the people of Gilgit-Baltistan.

The project site is located in Gilgit at Latitude 35.859490° N and Longitude 74.512332° E. The land identified for the development is government-owned, uninhabited, and flat, which is ideal for construction. Importantly, there are no resettlement or displacement issues associated with the site, which helps avoid one of the most sensitive aspects typically encountered in infrastructure development projects in Pakistan.

The total estimated cost of the project is PKR 23,576.604 million, which includes the construction of both the Medical and Nursing College and an associated hospital. The project will be implemented in a phased manner to ensure efficient allocation of resources and timely completion.

Due to its unique geographic and socio-economic conditions, Gilgit-Baltistan faces multiple healthcare challenges, such as limited access to quality medical services, a lack of specialized facilities, and an inadequate healthcare workforce. The establishment of a dedicated Medical and Nursing College will play a key role in bridging these gaps, reducing the region's dependency on external healthcare institutions, and encouraging trained medical professionals to stay and serve within the region. This project also aligns with the broader government vision of improving healthcare accessibility and strengthening human resources in the medical sector.

1.2. Location

The proposed site for the establishment of the Medical and Dental College is located at coordinates 35.859490° N, 74.512332° E within the jurisdiction of Gilgit District, Gilgit-Baltistan. Geographically, the site is situated on a flat river terrace along the Gilgit River, offering a strategic and environmentally suitable setting for institutional development. The area falls between the settlements of Jalalabad to the north and Chamugar to the south and southeast. The surrounding terrain comprises a combination of cultivated fields, built-up villages, and barren mountainous landforms, creating a diverse natural and human landscape.

To the north of the project site lies the populated locality of Jalalabad, characterized by agricultural activity and residential clusters. The eastern side of the site is bordered by rugged mountain slopes that act as a natural buffer zone, reducing exposure to urban sprawl and providing scenic and environmental value. The southern boundary is in proximity to Chamugar village, where existing community infrastructure such as shops, dispensaries, and local roads are present, facilitating access and integration. To the west, the Karakoram Highway (N-35) runs parallel to the Gilgit River, offering direct regional connectivity and ease of transportation for construction materials, students, staff, and future patients.

The Figure 1 illustrates the site's central position within the local setting, its access routes, and surrounding land uses. The area provides ample space for planned academic infrastructure, green spaces, parking, and potential future expansion. The natural boundary created by the river on three sides also supports site security and controlled development. Overall, the location is considered environmentally suitable and socio-economically beneficial for the establishment of a medical and dental institution.

Figure 1: Project Site for the construction of Medical and Nursing College

1.3. Existing Healthcare Facilities and Challenges

The healthcare system in Gilgit-Baltistan is currently managed by the Department of Health (DoH), which oversees 379 healthcare facilities catering to a population of approximately 1.4 million across an expansive 72,496 square kilometers[1]. Despite the presence of these facilities, the healthcare infrastructure remains inadequate to meet the

[1] Department of Health, Gilgit-Baltistan

rising demands of the region's residents. Several challenges hinder the efficient delivery of medical services, including:

- A critical shortage of trained healthcare professionals and medical specialists.
- The absence of modern diagnostic and treatment facilities.
- Limited opportunities for medical education and training within the region.
- Overburdened hospitals that frequently need to refer patients to other provinces for specialized treatment.

As a result, many residents of Gilgit-Baltistan are compelled to travel long distances within or outside the region to seek quality medical care. This not only imposes a significant financial burden on patients but also puts additional pressure on the already strained healthcare system. The establishment of a fully equipped Medical and Nursing College will play a crucial role in addressing these gaps by training skilled medical professionals, reducing dependency on external healthcare institutions, and enhancing the overall healthcare capacity of the region.

1.4. Environmental Impact Assessment (EIA) Study

The Environmental Impact Assessment (EIA) study provides a comprehensive framework for identifying, evaluating, and mitigating the potential environmental and social impacts associated with the establishment of the Medical and Nursing College in Gilgit. This detailed assessment examines air quality, land use, solid and hazardous waste management, noise levels, ecological effects, socio-economic factors, and public health implications. The EIA process ensures compliance with local, national, and international environmental regulations and guides sustainable development practices.

As per the Gilgit-Baltistan Environmental Protection Agency Review of Initial Environmental Examination and Environmental Impact Assessment Regulations, 2024, the proposed project falls under Section I of Schedule II: "Urban Development, Construction & Tourism." Specifically, the project involves the creation of a medical college and hospital facility generating hazardous healthcare waste, which qualifies it for a full Environmental Impact Assessment (EIA) under Clause 4: "Pathological laboratories, sample collection units, BHU, RHC, and any other facility creating hazardous waste.

1.5. Screening and Scoping

As part of the EIA process, a screening and scoping exercise was undertaken in compliance with the GB-EPA Regulations, 2024. The screening confirmed that the project falls under Schedule II, warranting a full EIA due to its generation of hazardous healthcare waste and classification under Urban Development and Health Infrastructure.

The scoping process identified the following key environmental and social components that require detailed evaluation:

- Land use and site planning impacts

- Healthcare and hazardous waste management
- Air and noise pollution during construction
- Demand for water and other utilities
- Impact on nearby ecological features, if any
- Traffic generation and access
- Socio-economic and cultural impacts

1.6. Study Objectives

The main objective of this Environmental Impact Assessment (EIA) is to evaluate the potential environmental and social impacts of the proposed Medical and Nursing College and to develop appropriate mitigation strategies to minimize adverse effects. The specific goals include:

- Identifying and analyzing environmental risks and opportunities related to project implementation.
- Ensuring full compliance with Gilgit-Baltistan EPA's EIA Regulations, 2024, and relevant national and international standards.
- Promoting inclusive engagement with local communities, relevant authorities, and health professionals.
- Formulating an Environmental and Social Management Plan (ESMP) to facilitate the mitigation, monitoring, and management of impacts across the project lifecycle.

1.7. Justification

The establishment of a Medical and Nursing College in Gilgit-Baltistan addresses a critical regional need for healthcare education and service delivery. Annually, more than 3,000 students graduate with Higher Secondary School (F.Sc) qualifications, with around 1,200 attempting to gain admission to medical colleges. Unfortunately, only about 70 students secure places in public sector medical colleges, and a mere 10-15 return to serve in Gilgit-Baltistan. This underscores the urgent requirement for local medical education facilities.

The region also struggles to retain skilled medical professionals due to limited opportunities for education, inadequate salaries, and a shortage of advanced healthcare facilities. A locally established medical college will provide educational advancement, professional growth, and a stable career path, encouraging healthcare personnel to remain in the area.

Residents frequently travel to cities like Islamabad, Rawalpindi, and Peshawar for advanced medical care, placing a financial and emotional burden on families. A regional medical college and associated teaching hospital will significantly enhance local healthcare delivery.

Gilgit-Baltistan faces unique health concerns, including elevated maternal and infant mortality rates, infectious diseases, and rising non-communicable conditions. The proposed institution will train medical professionals equipped to address these regional challenges, support medical research, and facilitate preventive care programs.

Furthermore, the project will generate extensive employment opportunities—ranging from faculty to technical and administrative support staff—stimulating the local economy. Endorsed by various stakeholders, including international supporters like Princess Zahra Aga Khan, the initiative aligns with broader policy goals of healthcare access and long-term educational infrastructure development in remote regions like Gilgit-Baltistan.

1.8. EIA Methodology

The Environmental Impact Assessment (EIA) for the proposed Medical and Nursing College was conducted using an integrated approach combining both qualitative and quantitative techniques. The following methods were employed:

- **Desk-based Review:** Analysis of relevant national environmental regulations, international guidelines (e.g., WHO, Basel and Stockholm Conventions), and previously published environmental and social data.
- **Field Investigations**: Site reconnaissance and primary data collection for baseline environmental parameters including land use, air quality observations, ecological conditions, and socio-economic context.
- **Stakeholder Consultations**: Engagements with relevant stakeholders such as local communities, municipal authorities, healthcare workers, and regulatory bodies to gather input and understand concerns.
- **Impact Assessment**: Systematic identification, prediction, and evaluation of potential environmental and social impacts arising from construction and operation phases of the project.
- **Development of Mitigation Measures**: Based on the impact analysis, detailed mitigation strategies and alternatives were proposed.
- **Preparation of Environmental and Social Management Plan (ESMP)**: A comprehensive ESMP was formulated to outline responsibilities, monitoring requirements, and institutional arrangements for effective implementation.
- **Reporting and Documentation**: Compilation of all findings, methodologies, and recommendations in a structured and regulatory-compliant EIA report.

1.9. EIA Process

The Environmental Impact Assessment process for the project follows a systematic and structured approach, as outlined below:

1. **Screening**: Determining the need for an EIA based on project type, size, and location in accordance with GB-EPA IEE/EIA Regulations, 2024.
2. **Scoping**: Identifying key environmental and social issues that require detailed assessment.
3. **Baseline Study**: Collecting and analyzing data on existing environmental and socio-economic conditions in the project area.
4. **Impact Assessment**: Evaluating the magnitude and significance of potential impacts and identifying mitigation measures.
5. **Mitigation and ESMP Development**: Designing practical and effective measures to avoid, reduce, or offset adverse impacts, compiled into an Environmental and Social Management Plan (ESMP).
6. **Reporting**: Compiling the EIA findings, methodologies, and recommendations into a report.
7. **Review and Approval**: Submitting the EIA report to the Gilgit-Baltistan EPA for review, public consultation, and formal approval.

This process ensures a transparent, participatory, and environmentally responsible approach to project planning and implementation.

1.10. Proponent

The project is being undertaken by the **Health Department, Government of Gilgit-Baltistan**, which is responsible for its overall planning, funding, and implementation.

Mr. Shahid Hussain

Project Director (PD)

Project Management Unit (PMU),

Near National Bank, Jutial, Gilgit

1.11. Study Team

The EIA study is conducted by a multidisciplinary team of experts specializing in:

The main study team for this EIA study includes:

Table 1: Study team of the Project

S.No	Name	Position
1.	Dr. Yawar Abbas	PhD (Environmental Sciences) EIA Project Lead
2.	Eng. Hannan Hafeez	Director HA Consulting

3.	Mr. Suhaib Malik	Environmentalist (ESMP Expert)
4.	Mr. Adnan Ullah	Environmentalist
5.	Mr. Umair Uddin	Environmentalist

1.12. Report Structure

The report is structured as follows:

- **Chapter 1:** Introduction (Background, Location, Study Objectives, Methodology, and Process)
- **Chapter 2:** Policy, Legal Framework and Relevant laws
- **Chapter 3:** The Site Investigation Studies and Project Description
- **Chapter 4:** Analysis of Project Alternatives
- **Chapter 5:** Baseline Environmental and Social Conditions
- **Chapter 6:** Stakeholder Consultations
- **Chapter 7:** Anticipated Impacts and Mitigation Measures
- **Chapter 8:** Environmental and Social Management Plan (ESMP)
- **Chapter 9:** Conclusion and Recomendation

This EIA aims to provide a comprehensive environmental and social impact assessment, ensuring that the establishment of the Medical and Nursing College in Gilgit aligns with national development goals and contributes positively to the healthcare and education sectors in the region.

2. POLICIES, LEGAL FRAMEWORK AND RELEVANT LAWS

2.1. Introduction

This section outlines the current environmental policy, legal framework, and administrative requirements governing the Environmental Impact Assessment (EIA) for the proposed establishment of a Medical and Nursing College in Gilgit. It provides a comprehensive discussion of the relevant provisions from the Gilgit-Baltistan Environmental Protection Agency (GB-EPA), the Pakistan Environmental Protection Agency (Pak-EPA), and associated environmental policies and guidelines.

The proposed project falls under the jurisdiction of the GB Environmental Protection Act, 2014, and the IEE/EIA Regulations, 2014, which mandate the preparation of an EIA. Following a detailed review of these legal frameworks, the project has been classified under Schedule II of the Gilgit-Baltistan Environmental Protection Agency Review of Initial Environmental Examination and Environmental Impact Assessment Regulations, 2024. As such, an Environmental Impact Assessment (EIA) study is required to ensure compliance with environmental standards for the establishment of the Medical and Nursing College in Gilgit.

2.2. National Policies, Laws, Regulations and Guidelines Relevant to the Project

The Pakistan Environmental Protection Ordinance (PEPO) was enacted in 1983, laying the groundwork for environmental regulation in the country. This was followed by the Pakistan Environmental Protection Act (PEPA) of 1997, legislated by Parliament, which led to the establishment of Environmental Protection Agencies (EPAs) at both federal and provincial levels. Following the 18th Amendment in 2010, environmental protection was devolved to the provinces, granting provincial EPAs full autonomy to develop their own legislation, laws, and guidelines tailored to environmental conservation. Consequently, the Federal EPA's authority was restricted to the jurisdiction of the capital, Islamabad.

2.2.1. Pakistan Environmental Protection Act, 1997

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 broad range of issues and extends to air, water, industrial liquid effluent, soil, marine, and noise pollution, as well as to the handling of hazardous wastes. As defined in the Act "environment" means: "(a) air, water and land; (b) all layers of the atmosphere; (c) all organic and inorganic matter and living organisms; (d) the ecosystem and ecological relationships; (e) buildings, structures, roads, facilities and works; (f) all social and economic conditions affecting community life; and (g) the inter-relationships between any of the factors in sub-clauses (a) to (f).

2.2.2. The National Environmental Policy, 2005

The National Environmental Policy (NEP) emphasizes the incorporation of environmental considerations into development planning by mandating the use of Initial Environmental Examinations (IEE) and Environmental Impact Assessments (EIA) at the project level. Serving as the primary framework, the NEP seeks to safeguard, conserve, and rehabilitate Pakistan's environment, with the ultimate goal of enhancing citizens' quality of life through sustainable development. The policy provides guidance for federal, provincial, and local governments, organized under the following key areas:

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

2.2.3. National Conservation Strategy (NCS), 1992

The Pakistan National Conservation Strategy (NCS), adopted and endorsed by the Government of Pakistan in March 1992, serves as the country's primary policy document addressing environmental challenges. Operating on a ten-year planning and implementation cycle, the NCS focuses on fourteen key areas, outlined as follows:

- Preserving soil quality in agricultural lands
- Enhancing irrigation efficiency
- Safeguarding watersheds
- Promoting forestry and plantation initiatives
- Rehabilitating rangelands and improving livestock management
- Protecting water bodies and supporting sustainable fisheries
- Preserving biodiversity
- Improving energy efficiency
- Developing and utilizing renewable energy and material resources
- Preventing and mitigating pollution
- Managing urban waste effectively

- Strengthening institutions for the management of shared resources
- Integrating population and environmental initiatives
- Conserving cultural heritage

2.2.4. National Environmental Quality Standards (NEQS)

The National Environmental Quality Standards (NEQS) were first promulgated in 1993 and have been amended in 1995 and 2000. The following standards are specified therein:

- The maximum allowable concentration of pollutants (32 parameters) in municipal and liquid industrial effluents discharged to inland waters, sewage treatment facilities, and the sea (three separate sets of numbers);
- The maximum allowable concentration of pollutants (16 parameters) in gaseous emissions from industrial sources; and
- The maximum allowable concentration of pollutants (2 parameters) in gaseous emissions from vehicle exhaust and noise emission from vehicles.
- The standards apply to liquid effluents from construction sites, dam areas, powerhouse sites, plant and residential areas and wastewater discharges from workers and other construction camps, and project vehicles, especially heavy construction vehicles. The prevailing NEQS for liquid effluents discharged to inland surface waters and gaseous emission from industrial sources are provided. These standards will apply to the gaseous emissions and liquid effluents discharged into the environment from the project.

The environmental parameters and quality will be ensured as per NEQ's

2.2.5. National Climate Change Policy, 2012 (NCCP)

In September 2012 Government of Pakistan launched its National Climate Change Policy. Environmental assessment is integrated in the preamble of the policy. The policy commits for taking appropriate measures for mitigation and adaptation to climate change through tools of environmental assessment.

2.2.6. Land Acquisition Act

The Land Acquisition Act (LAA) of 1894 governs the acquisition of private property for public purposes, including development projects in Pakistan. It consists of 55 sections that address area notifications, surveys, acquisition processes, compensation, apportionment awards, dispute resolution, penalties, and exemptions. Development projects may necessitate government acquisition of privately owned land, potentially displacing land users. Land can be acquired through:

i. Expropriation (compulsory acquisition)

ii. Voluntary negotiations with landowners for the sale of their property

iii. Donations from landowners

In the case of constructing a Medical and Nursing College, the site is already **government-owned**, so no acquisition of privately owned land is required.

2.3. Provincial Policies, Laws, Regulations and Guidelines

2.3.1. Gilgit-Baltistan Environmental Protection Act, 2014

In 2010, through the 18th Amendment to the Constitution of the Islamic Republic of Pakistan, 1973, environment became a purely provincial subject, empowering each province to make its own law and the role of Federal EPA has been limited to the jurisdiction of Capital Islamabad. In 2015, Gilgit-Baltistan framed its own law and adopted the Federal Act with minor amendments, calling it The Gilgit-Baltistan Environmental Protection Act, 2014. Under Section 5(1) of the Act the Govt of Gilgit-Baltistan established the Gilgit-Baltistan Environmental Protection Agency, to exercise the powers and perform the functions assigned to it under the provisions of this Act and the rules and regulations. Similarly, the Act bound the Project Proponent(s) to submit relevant IEE and EIA report(s) of proposed project(s) falls within the provincial boundaries of Gilgit-Baltistan to GB-EPA for requisite review and approval.

Gilgit-Baltistan Legislative Assembly enacted “The Gilgit Baltistan Environmental Protection Act, 2014” to provide for the protection, conservation, rehabilitation and improvement of the environment, prevention and control of pollution, promotion of sustainable development, and for matters connected therewith and incidental thereto. The act comprises on twelve parts and is applicable and covers almost all environmental domains such as air, ecology, biodiversity, water and soil, etc. A framework for establishment of Gilgit-Baltistan Environmental Protection Council, Gilgit-Baltistan Environmental Protection Agency, Gilgit-Baltistan Sustainable Development Fund, Environmental Courts and Green Courts has been developed in the Act. Similarly, the Act also deals with environmental examinations, assessments, monitoring and auditing.

2.3.2. Northern Areas Strategy for Sustainable Development (2003)

The Northern Areas Strategy for Sustainable Development (2003) was the primary policy document of the Government of Pakistan (GoP) as far as sustainable development issues of Gilgit-Baltistan (formerly known as Northern Areas) are concerned. For socio-economic development and poverty alleviation this strategy focuses on environmental health, urban environment, energy, cultural heritage and sustainable tourism. Environmental assessment is included in implementation mechanisms of this sustainable development strategy.

2.3.3. Gilgit-Baltistan Climate Change Strategy and Action Plan 2017

Recognizing the need of the region and taking guidance from the National Climate Change Policy of Pakistan 2012, this strategy has been formulated to take measures to reduce risks and vulnerabilities from changing climate. This strategy focuses on infrastructure and built environment as the key sector that can be severely hit by potential climate change related disasters. Securing the infrastructure and enhancing its resilience is therefore important not only in reducing risk of human causalities but also in supporting the capacities of communities to reduce the overall damaging impacts of climate change. This strategy recognizes that special measures are needed to secure the built infrastructure from the climate change impacts at first and foremost. Secondly, there is need to amend the existing and/or make new building laws and codes for infrastructure.

The strategy also emphasizes that mountain glaciers and snow are main sources of water in GB, ice and snow melt water flows down through the streams and rivers, which is diverted for agriculture, power generation and domestic use. As hydropower is the major source of electricity in the region, hence efficient functioning of water and power sector is thus essential. The climate change may have damaging impacts on water and power infrastructure. Efficient functioning of water and power sector, effective management, conservation of water resources and wise use of hydropower potential is pivotal.

The strategy further press on water supply and sewerage as glaciers and snow deposits are vulnerable to the impacts of climate change. The melted water from glaciers and snow enters streams, which subsequently feed man-made channels that bring water into the settlement for agriculture use, domestic requirements and livestock. The strategy recognizes need to promote access to safe drinking water and sewage facilities and ensure proper maintenance involving the beneficiaries of these schemes, create awareness among communities particularly in disaster prone areas to conserve water as much as possible and also promote mechanisms for reuse and recycling of wastewater.

2.3.4. GB-EPA Review of IEE and EIA Assessment Regulations, 2024

The Gilgit-Baltistan Environmental Protection Agency Review of Initial Environmental Examination and Environmental Impact Assessment Regulations, 2024, enacted under the Gilgit-Baltistan Environmental Protection Act, 2014, governs environmental assessments for projects in the region. It mandates Initial Environmental Examinations (IEE) or Environmental Impact Assessments (EIA) to ensure sustainable development, reflecting Gilgit-Baltistan's autonomy post the 18th Amendment of 2010. The regulations outline submission, review, and approval processes by the GB-EPA, emphasizing environmental protection in this ecologically sensitive area.

Projects are classified under two schedules: Schedule I requires an IEE for moderate-impact projects, like a Medical and Nursing College in Gilgit, while Schedule II demands an EIA for high-impact projects. The regulations enforce mitigation measures for air, water, and biodiversity, ensuring compliance and transparency through public consultation where needed, balancing development with ecological preservation.

2.3.5. Establishment of Tourist Facilities and other Infrastructure at Ecologically Sensitive and Critical Areas (ESCA) Draft Rules, 2022

In exercise of the powers conferred by section 36 of the Gilgit-Baltistan Environmental Protection Act, 2014, the Government of Gilgit-Baltistan has framed Establishment of Tourist Facilities and other Infrastructure at Ecologically Sensitive and Critical Areas

(ESCA) Rules, 2022. The Section 6(a) of these Rules categorizes is about construction of Hotels under different activities or infrastructure development. These rules provide for environmental safeguards, social norms and protection of biodiversity

2.3.6. The Northern Areas Hotels and Restaurants Rules, 1982

The Pakistan Hotels and Restaurants Rules, 1977, made under Pakistan Hotels and Restaurants Act, 1976 as in force in Pakistan from time to time, and all notifications and orders which have been issued thereunder were adopted as far as practicable and applicable to the Northern Areas as The Northern Areas Hotels and Restaurants Rules, 1982 through a notification No. G-14 (100)/77 dated 4 July 1982 issued by Kashmir Affairs and Northern Affairs Division of Government of Pakistan. Such rules provide measures for controlling and regulating the standards of service and amenities for tourists in hotels and restaurants and for ancillary matters but without any provision for conservation and protection of the environment by the establishing and operating tourist facilities and other infrastructure.

2.3.7. Gilgit Baltistan (Northern Areas) Wildlife Preservation Act, 1975

This Act provides for the establishment of national parks, wildlife reserves and wildlife sanctuaries and the issuing of hunting licenses and certificates of lawful possession. It regulates hunting, prohibits the use of inhumane methods, and imposes certain other limitations, such as time of day, season and area in which hunting is permitted. The First Schedule of the Act contains a list of animals divided according to the categories of "small game" and "big game".

All activities at the project site will have to be carried out keeping in view the provisions of this act.

2.3.8. Gilgit Baltistan (Northern Areas) Fisheries Act, 1975

This act is related to the fisheries in Gilgit Baltistan. The act mainly describes the prohibition of the destruction of fish by explosives and the destruction of fish by poisoning water. The act also describes the fish size not to be killed and capture specified in the second column of the First Schedule. Moreover, the act also describes the separate penalties for the violation of sections 4, 5 or 9 and sections 6, 7, 8 or 10.

2.3.9. Gilgit Baltistan (Northern Areas) Forest Rules, 1983

The Gilgit Baltistan (Northern Areas) Forest Rules protect forests which are either the property of the government or have property rights to the whole or part of the forest produce. However local people may have some concessions and user rights. They may be able to use these forests for grazing and collection of fuel wood and other non-timber products.

2.3.10. The Gilgit-Baltistan Disaster Management Act, No. II of 2017

This Act has been enacted for the establishment of a Disaster Management System in Gilgit- Baltistan. The Act highlight roles and responsibilities of the concerned authorities and procedures for establishment of Disaster Management Commission, constitution of District Disaster Management Authority, measures to be adopted by the Government for Disaster Management, functions of the Local Authority, establishment of Gilgit-Baltistan Institute of Disaster Management, establishment of Gilgit-Baltistan Disaster Response Force and other requisite measures compulsory for Disaster Management matters.

2.4. Existing labour Laws in Gilgit-Baltistan

All the existing and applicable labor laws in the area will be applicable to the project developer. Some of the laws to be abided in wither case are as under.

2.4.1. Gilgit-Baltistan Minimum Wages Act 2020

As per the minimum wages Act GB for the financial year 2022 to 2023, RS 25,000 is fixed for unskilled labor. Any Employer who contravenes the provision of this act shall be punished with imprisonment for a term which may extend to six months or with a fine up to 20,000 rupees or both.

2.4.2. Gilgit-Baltistan Prohibition of Employment of Children Act 2019

As per the "Gilgit-Baltistan Prohibition of Employment of Children Act 2019" no child under the age of 14 years can be employed in any labor work or factory. In violation of this act, punished with imprisonment may extend to 15 days and the fine may extend to 30,000 rupees or both.

2.4.3. Force or Adulation of Bounded/forced System Act 2020

Under this act forced or bounded labor system is prohibited across Gilgit-Baltistan. Whoever is found guilty in law can be punished with 6 months imprisonment or a fine up to fifty thousand rupees or both.

2.5. Hospital Waste Management and International Environmental Commitments

2.5.1. Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal

The Basel Convention, to which Pakistan is a party, is the most comprehensive global treaty addressing the transboundary movement and environmentally sound management of hazardous wastes, including medical and healthcare waste. The Convention is legally binding and emphasizes:

- Minimizing the generation of hazardous waste.
- Ensuring its environmentally sound management.
- Prohibiting illegal international trade of hazardous substances.

According to the Convention, clinical waste from medical care in hospitals (Y1) and pharmaceutical waste (Y3) are recognized as hazardous categories. It also includes a specific hazard class (H6.2) for infectious substances, which directly applies to hospital waste from diagnostic and treatment activities.

The proposed college must ensure that any hazardous waste—especially pathological, infectious, and chemical waste—is managed locally and not exported or disposed of in violation of the Basel Convention's principles.

2.5.2. Stockholm Convention on Persistent Organic Pollutants (POPs)

The Stockholm Convention on Persistent Organic Pollutants (POPs) is a global treaty that seeks to protect human health and the environment from toxic chemicals that remain in the environment for long periods. Among these pollutants, dioxins and furans, typically generated by medical waste incinerators, are of significant concern.

Under Article 5 and Annex C of the Convention, signatory countries, including Pakistan, are obligated to:

- Reduce or eliminate the unintentional production of POPs.
- Use Best Available Techniques (BAT) and Best Environmental Practices (BEP) in incinerators and combustion systems.

The Medical and Nursing College in Gilgit, as part of its HWMP, must implement environmentally sound practices for the incineration of infectious waste, ensuring compliance with international standards. This includes adopting emission control systems, temperature regulation in incinerators, and strict protocols for operation and maintenance.

2.5.4. National Hazardous Waste Management Policy, 2022

The National Hazardous Waste Management Policy, 2022, developed by the Ministry of Climate Change, provides a national framework for the safe handling, storage, transportation, treatment, and disposal of hazardous waste, including healthcare waste. It emphasizes waste minimization at source, segregation of hazardous materials, and the adoption of Best Available Techniques (BAT) and Best Environmental Practices (BEP).

- For the proposed Medical and Nursing College in Gilgit, the policy mandates:
- Proper identification and segregation of hazardous healthcare waste.
- Use of environmentally sound technologies for incineration and disposal.
- Compliance with NEQS and alignment with international obligations under the Basel and Stockholm Conventions.

2.5.5 Hospital Waste Management Rules, 2005

The Hospital Waste Management (HWM) Rules, 2005, notified under the Pakistan Environmental Protection Act (PEPA), 1997, provide a comprehensive legal framework for the safe handling, segregation, collection, storage, transportation, and disposal of hospital waste. These rules apply to all public and private healthcare establishments and assign specific responsibilities to healthcare providers at all administrative levels.

In accordance with Rule 3, the hospital management is solely responsible for the safe handling and environmentally sound disposal of all categories of healthcare waste, including infectious, pathological, pharmaceutical, and sharps waste. The rules mandate the designation of a waste management officer, preparation of waste management plans, and training of healthcare staff to ensure compliance and prevent environmental and public health hazards.

For the proposed Medical and Nursing College in Gilgit, strict adherence to these rules is mandatory. A dedicated **Hospital Waste Management Plan (HWMP)** has been formulated in line with the HWM Rules, 2005, to guide waste segregation, storage, incineration, and final disposal at the proposed facility.

3. THE SITE INVESTIGATION STUDIES AND PROJECT DESCRIPTION

3.1. Background:

Gilgit-Baltistan, located in the northern region of Pakistan, is a mountainous area with a sparse population spread across remote valleys. Despite its unique geography and strategic significance, the region faces considerable challenges in terms of access to quality healthcare and medical education. The shortage of trained doctors, nurses, and healthcare technicians has long been a major concern for the government and local communities alike. These challenges are further intensified by the absence of local institutions that can provide specialized training in medicine and nursing, forcing students to seek admission in other parts of the country—often with limited success due to the highly competitive nature of medical admissions and restricted quota seats.

Every year, over 3,000 students in Gilgit-Baltistan graduate with pre-medical qualifications (F.Sc), but only a small percentage manage to secure seats in public sector medical colleges. Furthermore, even fewer return to the region to practice medicine, exacerbating the already critical shortage of healthcare professionals. As a result, the local population frequently has to travel to cities like Islamabad, Rawalpindi, and Peshawar for even basic medical services, placing a heavy financial and logistical burden on families.

In response to these longstanding issues, the idea of establishing a Medical and Nursing College in Gilgit was formally announced in 2019 by the then Prime Minister of Pakistan. The project aims to not only provide access to quality medical education within the region but also to strengthen the local healthcare infrastructure through a future teaching hospital. The initiative will help build a pool of qualified medical professionals, reduce dependence on external facilities, and improve healthcare delivery across Gilgit-Baltistan. This step is aligned with the national and provincial goals of equitable health access, local capacity development, and socio-economic upliftment of underdeveloped regions.

3.2. Location:

The proposed Medical and Nursing College is located in Minawar, a semi-urban area situated on the outskirts of Gilgit city, which serves as the administrative capital of Gilgit-Baltistan. The specific geographic coordinates of the project site are Latitude 35.859490° N and Longitude 74.512332° E. The site lies along the Gilgit-Skardu Road, approximately 10 kilometers from the city center, offering easy accessibility and connectivity to major transport routes, including the Karakoram Highway (KKH).

Minawar has been strategically selected due to its favourable topography, availability of government-owned land, and proximity to urban infrastructure while still being free from congestion and overdevelopment. The area provides a relatively peaceful and spacious environment, ideal for an academic institution. Its location on flat terrain reduces the need for significant land alteration, thereby minimizing environmental impact during construction.

The site is also advantageous from a planning perspective. It is well connected to the surrounding villages and towns, allowing students from different districts of Gilgit-Baltistan to commute easily or reside in hostels planned as part of the college infrastructure. The nearby availability of utilities such as electricity, water, and telecommunications further support the selection of this site for the establishment of a major educational and healthcare facility. Additionally, the uninhabited nature of the land ensures that no displacement or resettlement issues will arise during project implementation.

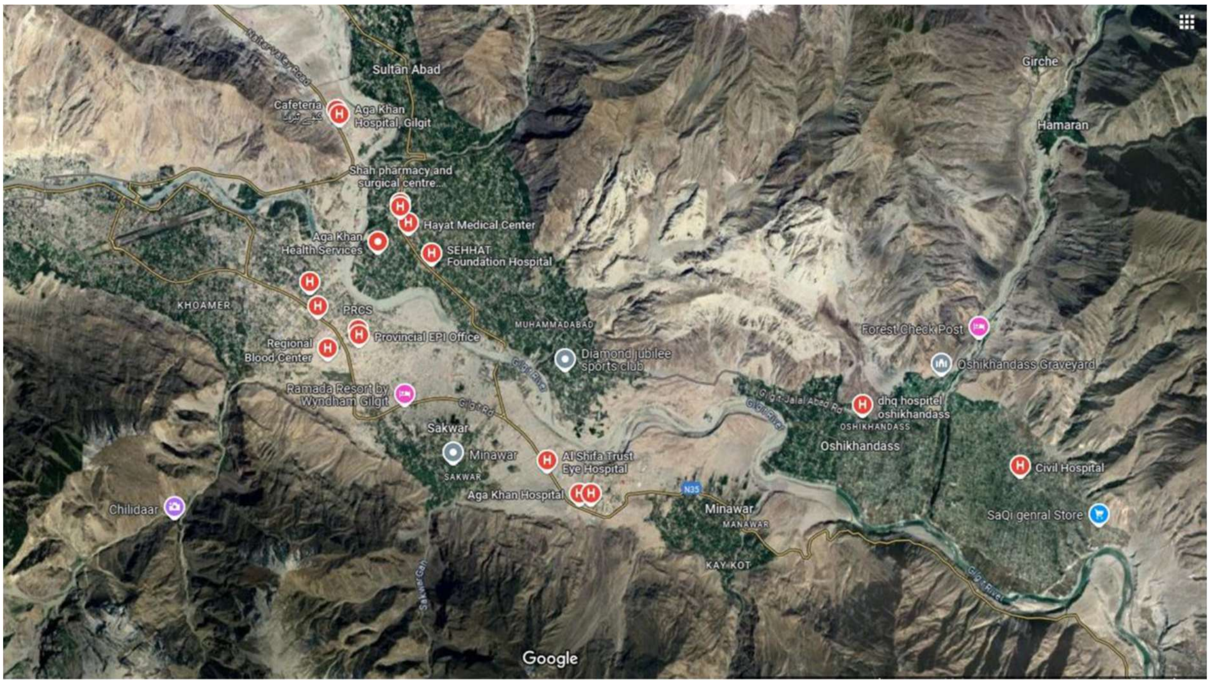


Figure 2: Project area location and its surrounding

3.3. STUDIES AND INVESTIGATIONS:

A number of studies and investigations have been carried out at site in order to assess technical
feasibility of the proposed site. These studies/investigations include:

i. Topographic Survey
ii. Geotechnical Investigations including Groundwater Study
iii. Electrical Resistivity Survey (ERS)
iv. Hydrology and Hydraulics

3.3.1. Topographic Survey

A detailed topographic survey was conducted to assess the physical characteristics of the proposed site for the Medical and Nursing College in Minawar, Gilgit. The survey provides essential data for planning, designing, and executing the construction activities with minimal environmental impact. The following sub-sections outline the site features, survey methodology, equipment used, and control point fixation approach.

3.3.1.a. Site Area and Terrain

The proposed project spans a total area of 500 Kanal of government-owned land. The terrain is hilly, with an elevation difference of approximately 120 feet across the site. This elevation variation was carefully captured and mapped to facilitate architectural planning and structural design. The site boundaries were accurately demarcated in collaboration with the local Patwari (land revenue official) to ensure no disputes or encroachments.

A drone-based topographic survey was carried out to generate high-resolution spatial data, which helped create accurate contour maps and surface profiles. This modern method ensured better accuracy and coverage compared to traditional surveying techniques.

The contour data has been illustrated in Figure 3 Contour Map, which reflects elevation lines at regular intervals, highlighting the site's slope, ridges, and depressions. This information will support sustainable site planning and construction grading.

3.3.1.b. Methodology

The topographic survey followed a systematic and technologically advanced approach. It included the following key steps:

- **Control Point Establishment**: Permanent survey control points were fixed across the site using an already existing control network to ensure positional accuracy and reference.
- **Data Acquisition**: Surveyors collected field data using advanced geospatial tools such as RTK-enabled GPS and Total Stations. These tools ensured precision in horizontal and vertical measurements.
- **Map Development**: Using the data, detailed 1:1000 scale topographic maps were developed. These maps included contour lines at 1-meter intervals, which provide essential elevation and terrain information required for design and construction.
- All survey maps and deliverables were developed in accordance with the prescribed scale and specifications required by regulatory authorities and engineering standards.

3.3.1.c. Survey Equipment

To ensure data accuracy and high-quality mapping, the following **modern survey equipment** was used during the topographic survey:

- **GPS FOIF L1 and L2 in RTK Mode**: Real-Time Kinematic GPS units were used for highly accurate positioning with centimeter-level precision.
- **Total Station Sokkia Set 650X and Nikon DTM 332**: These were used to collect angular and distance data across the site. These instruments are ideal for detailed site measurements and setting out ground features.

- **Level WILD NAK2**: This precision level instrument was used to verify elevations and ensure consistent vertical control across the project site.

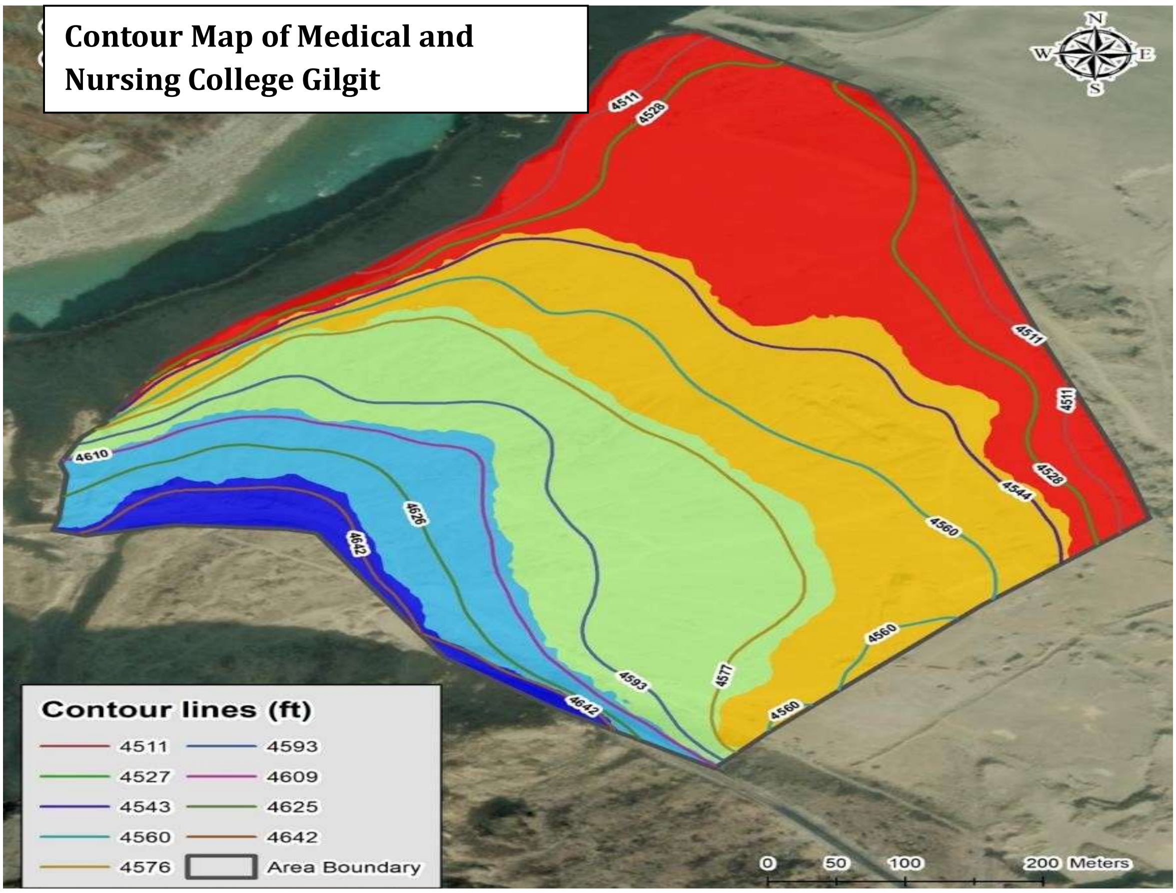


Figure 3: Contour map of the project site

3.3.2. Geotechnical Investigation

The Geotechnical Investigations were aimed at revealing the general subsurface soil type and classification at the proposed site area which would help to ensure a safe and economical preliminary design of various infrastructure facilities.

The following sections provide the work plan and methodology to be implemented for undertaking the conceived Geotechnical Investigations.

A geotechnical investigation was conducted for the Health Department of Gilgit Baltistan to inform the structural design of foundations for the proposed medical and nursing college at Gilgit, which will cover approximately 61 acres and include various buildings and infrastructure. The investigation involved boreholes, Standard Penetration Tests (SPT), test pit excavations, soil sample collection, groundwater table assessment, and laboratory testing to prepare a geotechnical investigation report based on field investigations and lab results. Such investigations are crucial for understanding soil characteristics and ensuring the stability of structures, especially in regions prone to seismic activity.Geotechnical investigations comprised execution of boreholes of depth up to 15 m, excavation of 1.5 m deep test pits, performance of field testing, collection of soil samples and laboratory testing on selected samples.

3.3.2.a. Objectives of Geotechnical Investigations

Geotechnical investigations have been conducted at site to achieve the following objectives:

i. To establish the presence and extents of various lithological units prevailing at the project site.
ii. To ascertain the presence and location of ground water from geotechnical point of view and to determine its quality from construction perspective.
iii. To explore the zones of soft / weak soil stratum within the project area.
iv. To determine the geotechnical parameters for carrying out the design of foundations to be constructed for the proposed buildings. Medical and Nursing College, Gilgit Geotechnical Investigation Report 2
v. To determine the geotechnical parameters for carrying out the design of road works.
vi. To furnish the considerations which are to be considered for the construction of foundations, road works and other geotechnical structures.

3.3.2.b. Scope of Geotechnical Investigations

The following geotechnical investigations were carried out to full-fill the above listed objectives and structural requirements:

i. Drilling of fifteen (15) boreholes up to a maximum depth of 15 m below EGL through straight rotary drilling method.
ii. Excavation of ten (10) test pits of 1.5 m depth below EGL.
iii. Performance of standard penetration test (SPT) in boreholes.
iv. Performance of field density test (FDT) in test pits.
v. Collection of necessary soil samples from boreholes & test pits.
vi. Obtaining necessary information about groundwater table in boreholes.
vii. Laboratory testing of selected soil samples.
viii. Preparation of detailed borehole & test pit logs as per field investigation and laboratory testing.
ix. Preparation of foundation design recommendations for different soil stratum encountered during geotechnical investigations.
x. Preparation of geotechnical recommendations for design of road works.
xi. Preparation of detailed geotechnical investigations report.

3.3.2.c. Field Investigations

This mainly deals with the activities performed in the field to acquire the subsurface information of existing soils present at the proposed project site. Field activities conducted during these investigations are summarized hereunder:

- Drilling of boreholes using straight rotary drilling method
- Excavation of test pits
- Performance of in-situ tests (i.e. SPTs & FDTs)
- Taking observation of groundwater table
- Soil sampling for subsequent laboratory testing

3.3.2.d. Groundwater Observation

Observations regarding the depth of groundwater table were taken immediately and 24 hour after the completion of boreholes. The observations indicated that groundwater table (GWT) was not encountered in any borehole up to 15 m depth during execution of field investigations.

3.3.2.e. Laboratory Testing

After completion of field investigations, a laboratory testing program for selected soil samples was prepared in the light of various types of sub-soils encountered at various depths. The laboratory testing program was prepared in such a way to acquire the maximum details required for soil classification and evaluation of index, strength, chemical and other engineering characteristics of sub-soils present at the project site.

The following laboratory testing was mainly carried out:

- Particle Size Distribution (ASTM D6913)
- Direct Shear (ASTM D3080)
- Modified AASHTO Compaction (ASTM D1557)
- 3-Point Soaked CBR (ASTM D1883)
- Chemical Analysis of Soil (BS 1377 part 3)

3.3.2.f. Site Geotechnics

Geotechnical investigations were planned in such a manner to effectively explore site geotechnics of the project area. This chapter mainly discusses our evaluations for subsoil stratigraphy, seismicity, soil seismic profile, liquefaction potential and other geotechnical characteristics of the soils prevailing at the project site.

3.3.2.g. Stratigraphy

At the time of these investigations, the maximum depth of drilled borehole was 15 m below NSL. General stratigraphy of the project area, as deduced from site investigations, indicates the presence of following stratigraphic units:

- Silty Sand with Gravel / Poorly graded Sand with Gravel, in medium dense to dense state, was generally present from top of the ground to a depth of 3 m below NSL.
- Silty Gravel with Sand / Poorly graded Gravel with Sand, in dense to very dense state, was generally present from 3 m to maximum drilled depth

of 15 m below NSL.

3.3.2.h. Seismicity of the Area

The project site lies in Zone 3 as per "Seismic Provisions 2007" of Building Code of Pakistan (BCP: SP, 2007). Keeping in view the seism tectonic set up of the Project Area and the degree of importance of the structures of the proposed project, it is recommended that the structures should be designed to withstand horizontal peak ground acceleration (PGA) of 0.24g to 0.32g. This PGA has 10% probability of exceedance in 50 years.

3.3.2.i. Seismic Soil Profile Characterization

The seismic profile of sub-soil present at site has been characterized by using the guidelines provided in "Seismic Provisions-2007" of Building Code of Pakistan (BCP: SP, 2007). Chapter – 4, of this code describes the procedure for determining the Soil Profile Types SA through SF in accordance with Table 4.1 (BCP: SP, 2007; Section 4.4). As per site conditions, soil profile type SC can be considered during structural design of foundation.

3.3.2.j. Liquefaction Potential

Loose state, water-submerged, cohesion less soils are generally susceptible to liquefaction under dynamic loads caused by earthquakes. Liquefaction results in total or partial loss of shear strength thereby leading to substantial subsidence, ground heave and/or uplifting of light weight structures.

Considering the subsurface stratum and groundwater conditions, chances of liquefaction are minimal for the project area.

3.3.2.k. Foundation and Road Design Considerations

Based on field investigations and subsequent laboratory testing, sub-surface strata at the project site have been established and the corresponding design of foundations has been carried out. The details of foundation design recommendations is provided in the following sections:

3.3.3. Electrical Resistivity Survey (ERS)

An electrical resistivity survey was conducted for the Health Department of Gilgit Baltistan's Medical and Nursing College project to determine suitable locations for tube well installation. The "Ground Water Study for establishment of Medical and Nursing College at Gilgit" aims to identify subsurface lithology and groundwater potential using Vertical Electrical Sounding (VES) to ensure better water quality and yield. Electrical Resistivity Survey is a geophysical technique that applies Ohm's law to study subsurface hydrological conditions. By injecting a commuted direct current into the ground through electrodes and measuring the potential difference, the apparent resistivity values can be calculated. These values help determine the type of water-bearing formation and differentiate between saline and fresh water aquifers. The method is cost-effective and less tedious compared to other methods.

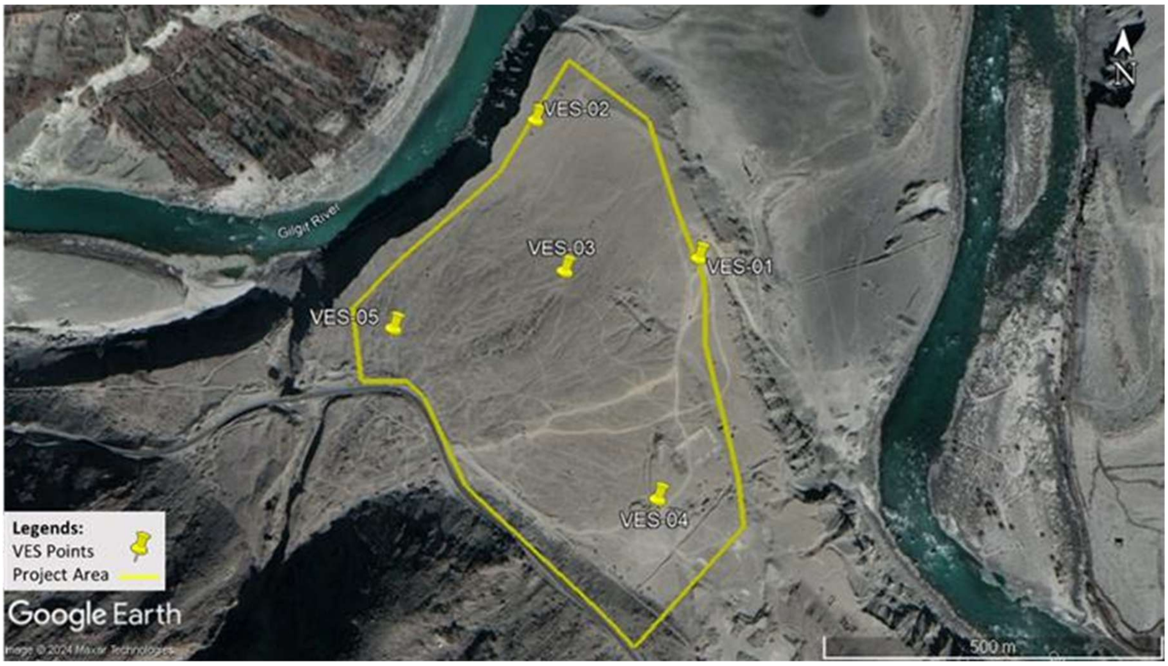


Figure 4 Electrical Resistivity Survey (ERS) Point

Source: Devised by Consultant

3.3.3.a. Objectives of ERS Studies

The objectives of the project are mentioned below;

- Determine the depth of the groundwater table.
- Evaluate the yield, sustainability of the groundwater aquifer, and the maximum capacity of the tubewell within the project area.
- Identify the optimal location for the tubewell strainer to access the potable water aquifer.
- Provide recommendations and designs for the tubewell, based on the data collected by the consultant.
- The consultants are executing the proposed scope of work at the project site as directed by the Client's Representative. The required study involves conducting Vertical Electrical Sounding (VES) using Electrical Resistivity Survey techniques, meeting the necessary criteria. A summary of the geophysical survey distribution is provided below.
- The resistivity tests were made at five (05) observation points down to a depth of maximum 200m, 180m, 200m, 180m, and 160m, for VES-01, VES-02, VES-03, VES-04 & VES-05 respectively within the project area. These electrical resistivity points are designated as VES-01, VES-02, VES-03, VES-04 & VES-05 and their locations are shown in Fig. 1. The resistivity measurements were made in accordance with ASTM Designation D6431 (2018).
- The results of soil resistivity testing along with the principle, field

procedure findings and recommendations are described in this report.

3.3.3.b. Scope of ERS

The Consultant has carried out the proposed scope of work at the project site as directed by the Client's Representative. This is to be accomplished by means of an electric resistivity survey. The following field works are executed: -

- Mobilization and demobilization of ERS equipment, along with all necessary tools and other related items
- Determining the true resistivity of various layers in terms of lithology, generating VES curves, producing colored strata charts of subsurface formations, identifying groundwater table levels, and determining the possible location for the tubewell strainer through an electrical resistivity survey.
- Conducting electrical resistivity surveys (ERS) at five (05) locations (recording northing and easting coordinates) within the project area to study groundwater conditions, interpret resistivity data, and describe groundwater behavior, including recharge and discharge characteristics.
- The final report includes, but not be limited to, conclusions and recommendations based on the interpretation of the electrical survey results and data collected from the site.

3.3.3.c. Results of Electrical Resistivity Survey

The field resistivity curves (Fig. 8-12) obtained at five (05) observation points within the project area shows an increasing trend overall with increase in electrode spacing and then dipping trend at large electrode spacing, representing variation of resistivity with depth.

The results of the electrical resistivity survey show that subsurface material down to the maximum exploration depth of 200 meters have five (05) resistivity layers with varying resistivity and thickness at the investigated locations. These resistivity layers also show variable vertical and lateral extension of the subsurface material in the project area.

Table 2 Coordinates of Vertical Electrical Soundings

Sr. No.	ERS No.	Latitude	Longitude
1	VES-01	35°51'36.50"N	74°30'46.50"E
2	VES-02	35°51'43.12"N	74°30'37.12"E
3	VES-03	35°51'35.86"N	74°30'38.85"E

4	VES-04	35°51'25.46"N	74°30'44.05"E
5	VES-05	35°51'33.13"N	74°30'29.33"E

I. VES-01

The interpretation of VES-01 reveals five (05) resistivity layers to a depth of 200m. A high resistivity layer near the surface at 1.2 meter is followed by a relatively less high resistivity layer extending down to 2.3 meters. Below this, two very high resistivity layers from 2.3m to 27.6meters and 27.6 to 57.4m representing the present of gravel, boulders with clay and sand layers. Medium resistivity layer from 57.4m to 200m is present shows the presence of moist sandy layer with gravel shows good quality of water. VES-01 is away from the river therefore the recharge may not adequate.

II. VES-02

VES-02 was conducted in the project area to a depth of 180 meters. The interpretation of VES- 02 reveals very high resistivity layers near the surface this may be the loose silty sand along with gravel and boulders present at the surface, followed by another very high resistivity layer extending down to 5.2 meters. Below this, the resistivity values increase to 24.2 meters. This represents the hard sand layer with gravel present in the subsurface. Another very high resistivity values up to 36.9m shows hard layer. From 36.9 to 180m high resistivity layer present shows the presence of fresh water. VES-02 is close to the river therefore recharge of water is adequate.

III. VES-03

VES-03 has been performed in the project area to the depth of 200 meters. The interpretation of VES-03 shows very high resistivity layers near the ground surface followed by a thick layer of another very high resistivity layer to the depth of 5.2m. Which is follow by two abnormal very high resistivity layers down to the depth of 36.9 meters. Change in lithology and water content which is represented by the presence of moist soil from 36.9m to 180m. Below 36.9m the moist sand with gravel are present with high resistivity values which shows the presence of fresh water. VES-03 is away from the river therefore the recharge may not be adequate.

IV. VES-04

The interpretation of VES-04 reveals six (06) resistivity layers to a depth of 180m. Very high resistivity five (05) layers are present up to depth of 155m High resistivity layer falling in the reasonable values from 155m to 180m representing the moist sandy layer with gravel shows good quality of water. VES-04 is away from the river therefore the recharge may not be adequate.

V. VES-05

The interpretation of VES-05 reveals six (06) resistivity layers to a depth of 160m. The first five (05) layers from the ground level up to the depth of 83m shows very high resistivity values representing the dry and compact layer of mix clay, sand, pebble and boulders deposited by the river. High resistivity layer falling in the reasonable values representing the moist sandy layer with gravel shows good quality of water from 83m to 160m. VES-05 is topographically higher than other VES points therefore drilling at VES-05 requires more drilling to reach the appropriate depth.

3.3.4. Hydrogeology of the Project Area

The principal source of domestic and household water in the GB is glacial and snowmelt runoff in the form of streams, rivers, lakes and springs. Supply of fresh and flowing water is abundant during summer especially from April to August and then gradually decreases from September to November. Later on there is snowfall during December to February which results in the shortage of drinking water in the rural areas. Villages at higher altitude use snowmelt, if no other water source is available. Snowmelt water is usually turbid, whereas spring water is clear and warm in winter and cold in summers therefore, spring water is preferred by inhabitants to be used for drinking either as piped or un-piped water.

Figure 7: Schematic diagram of Gilgit-Baltistan water supply system

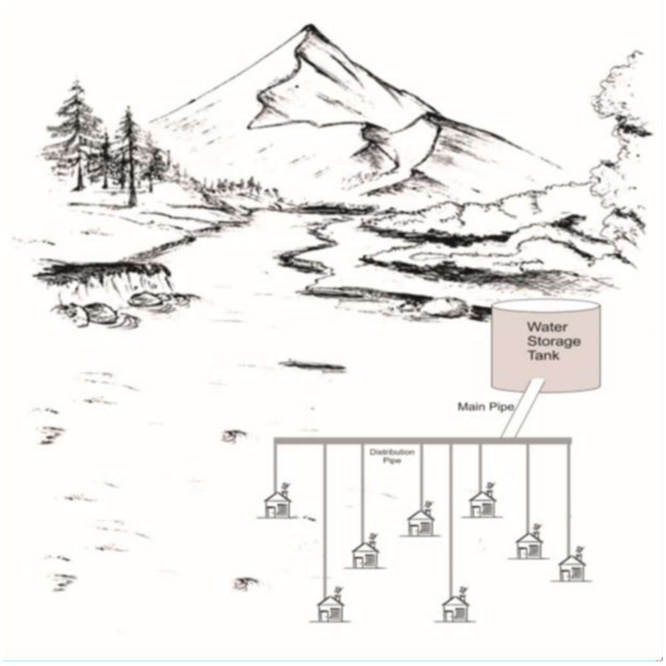


Figure 5 Schematic Diagram of water supply system in Gilgit-Baltistan

Source: Assessment of Water Quality Status in Gilgit Pakistan

3.3.4.a. Estimation of Flood

Two methods are available for the estimate of the flood for an ungauged streams/nullah, or a sheet flows as described below.

3.3.4.b. Flood Hydrograph Method

For the catchment areas greater than 1km^2, the US Soil Conservation Services Unit Hydrograph Method (SCS-UH) is used to estimate peak discharges. This method requires the following information about the catchment.

- Maximum 24-hour rainfall for the design return period
- Length of stream measured along the longest path travelled by storm water from head to the site
- Slope of stream from head to site
- Catchment area
- Antecedent soil moisture condition
- Soil group

$$T_c = \frac{(L)^{1.15}}{7700 \times (H)^{0.385}}$$

3.3.4.c. Rational Method

For the catchments having area less than 1km^2 rational method is used to compute the floods. Rational method technique is described as under:

Q = CIA

Where;

Q = Peak Discharge

(cusecs) C=

Coefficient of

discharge

I = Intensity of Rainfall

(inches/hour) A =

Catchment Area (acres)

i) **<u>Time of Concentration</u>**

Time of concentration (Tc) is the time required for runoff to travel from the hydraulically most distant point in the watershed to the outlet. Kirpich formula has been used for

Where;

T_c = Time of Concentration (hours)
L = Length of the longest

stream (feet) H = Fall in

length L (feet)

ii) **Rainfall Intensity**

Rainfall intensity is defined as the ratio of the total amount of rain (rainfall depth) falling during a given period to the duration of the period It is expressed in depth units per unit time, usually as mm/hour or inch/hour. Intensity-Duration-Frequency curves have been developed for Gilgit.

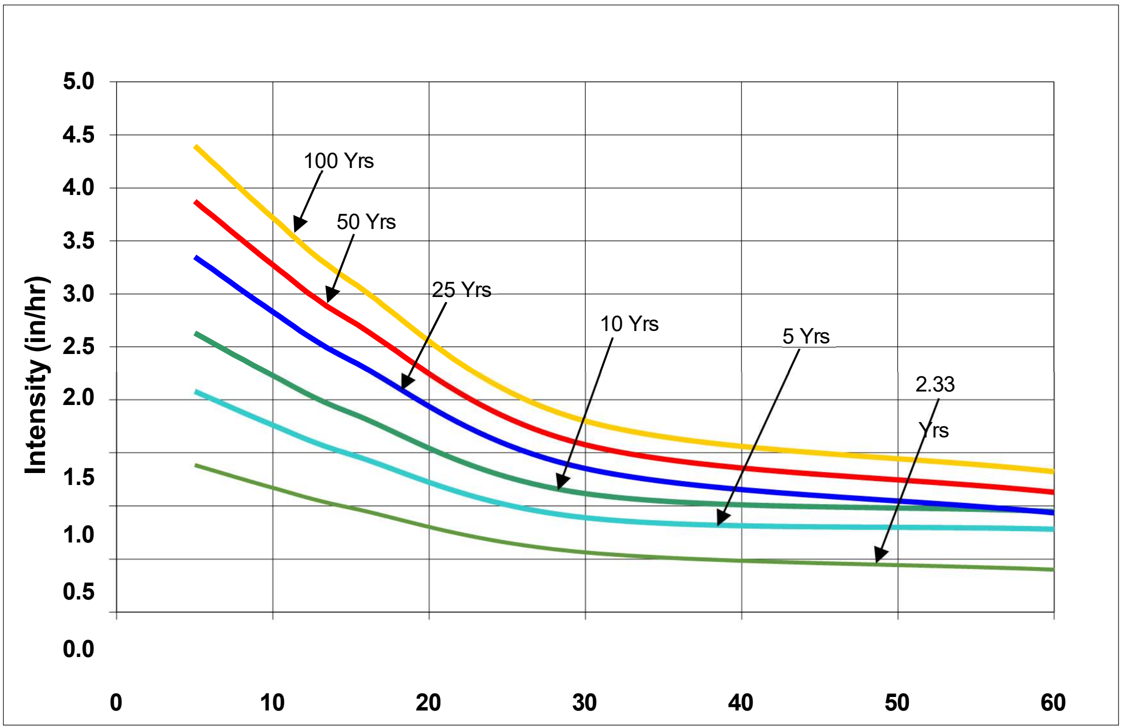


Figure 6 Intensity-Duration-Frequency Curve for Gilgit

3.3.4.d. Flood Discharges

For the project area, no concentrated stream is crossing or effecting the proposed hospital site. Some sheet flows will be affecting the project area which needs to be channelized. These sheet flows originate from the hillside from the southern side. As the catchment areas are less than 1km^2, therefore rational formula has been used for estimation of flood peaks. The floods estimated against various return periods are given in Table and extents of sheet flow catchments and the proposed alignment of sheet flow collector drain is given in Figure below;

Table 3 floods estimated against various return periods

Sr. No.	Coordinates of Catchment		Catchment Area	Design Discharge				
				5 yrs	10 yrs	25 yrs	50 yrs	100 yrs
	Latitude	Longitude	Km²	(ft³/sec)				
1	35°51'27.93"N	74°30'32.66"E	0.69	154	195	248	286	325
2	35°51'22.31"N	74°30'39.12"E	0.80	179	226	287	332	377

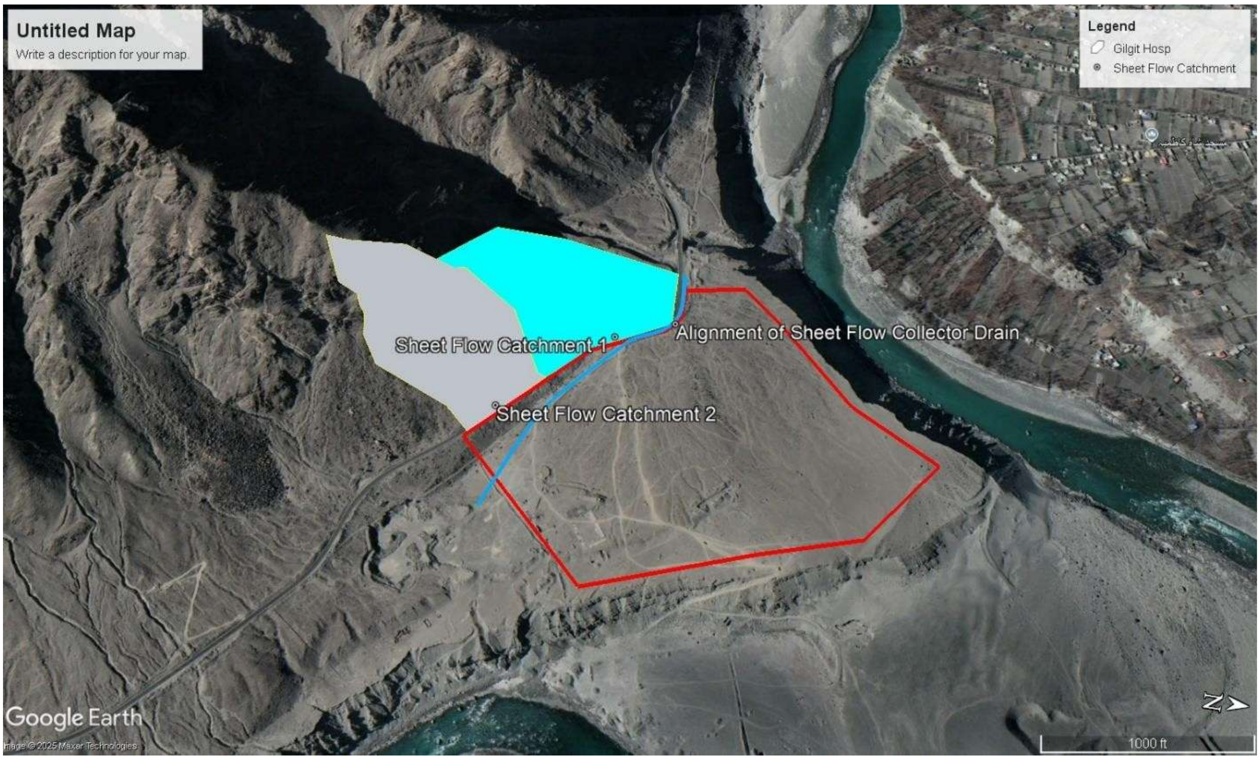


Figure 7 Extents of Sheet Flow Catchments and the proposed alignment of Sheet Flow Collector Drain

3.3.4.e. Design of Sheet Flow Interceptor Drain

The sheet flow interceptor drain is proposed in between the Karakoram highway and the proposed hospital building. The concrete lined drain is proposed below NSL to intercept the sheet flows from the right-side hills. The drain will run parallel to the Karakoram highway and eventually out falls in to the Gilgit River downstream of the proposed hospital building. The drain with excavated section has been designed using Manning equation with manning's roughness coefficient of 0.025 based on the large size boulder expected to come from the catchment due to very steep slopes of the catchment and weeds growth in the proposed drain. 100-year return period return period flood have been selected keeping in view the safety of proposed hospital and nature of flash floods.

Gradient of the channel has been adopted according to the natural topography of area. Curve radii used are not less than 7 times of the top water surface of channel. A free board of 2 ft is fixed for excavated section to accommodate exceptional floods and safety of the proposed intervention. Channel side slopes have been selected as 1.5H:1V conservatively to accommodate unexpected heavy rainfalls. The design parameters of proposed channel are given in table below.

The Design parameters of the proposed concrete lined drain are given below:

Table 4 Design Parameter of Proposed Sheet Flow Interceptor Drain

Sr. No.	From RD (ft)	To RD (ft)	100-year Discharge (cfs)	Natural Bed Slope	Bed Width (ft)	Flow Depth (ft)	Flow Velocity (ft/sec)
1	0+000	0+700	325	1 in 60	3	3.46	11.48
2	0+700	1+200	325	1 in 20	3	2.68	17.30
3	1+200	2+000	700	1 in 20	3	3.82	21.01

3.4. Traffic Impact Assessment

Trip Generation and Distribution

3.4.1. Trip Generation for the proposed Development

Trip generation was calculated with reference to the total covered area of hospital, medical college, nursing college, auditorium, admin, bank, café, shopping mart, doctor hostels, nursing hostels and apartments. The trip generations are expressed as passenger car units (PCU's) whereby each type of vehicle is expressed as an equivalent number of PCU's. Trip generation was done using the trip generation rates in the latest edition of the ITE Trip Generation Manual, 10th edition. The trips so generated are then calibrated keeping in view the local trend of traffic in such areas, especially for peak hours as all the traffic studies and analysis are done for the peak hour. So accordingly, generated trips for morning and evening peak hours were calculated and a maximum of these was selected.

The proposed development is a medical facility. the total covered area of the medical unit is 939,968 SFT which includes hospital building, medical college, nursing college, hostels, utilities, staff houses, staff apartments and parking for staff and visitors. It is expected that the highest number of trips will be generated in Pm peak hour based on the current land use pattern and the number of trips calculated by Trip generation rates in ITE Trip Generation Manual, 10th Edition.

The proposed development site is a medical facility which consist hospital building, medical college, nursing college, hostels for male and female, utilities, staff houses, staff apartments, admin building, bank, mosque, shopping mart, multiple parking and café. A description of each unit's usage and covered area of each unit is given in Table. The trips are calculated based on the total covered area of each building.

Table 5 Land use and Covered Area for each building in a development

Sr. No.	Coverage	ITE Land use	Covered Area (SFT)	Description
1	Hospital Building	Institutional (Healthcare)	376130	G+3 floors
2	Medical College & Nursing College	Institutional (Education)	185620	740 students (140 are day scholar)
3	Auditorium	Institutional / Public & Semi-Public	18420	G+1 Floor
4	Admin	Institutional (Administrative)	20853	G+1 Floor
5	Bank	Commercial	4720	Ground Floor Only
6	Mosque	Public & Semi-Public (Religious)	7863	G+1 Floor
7	Café	Commercial	11000	G+2 Floor
8	Incinerator	Utility	600	Ground Floor Only
9	Mortuary	Utility	2400	Ground Floor Only
10	Doctor Hostel (Male), Doctor Hostel (Female), Nursing Hostel (Male), Nursing Hostel (Female)	Residential (Hostel / Institutional)	188476	600 students
11	Apartment (1-10)	Residential (Low to Mid-Rise)	17682	24 apartments
12	Apartment (11-15)	Residential (Low to Mid-Rise)	15368	12 apartments
13	Apartment (16-18)	Residential (Low to Mid-Rise)	29487	20 apartments

14	Apartment (19)	Residential (Low to Mid-Rise)	39898	24 apartments
15	Shopping Mart	Commercial	2800	Ground Floor Only
16	Sports Club	Recreational	10000	Ground Floor Only
17	House for 21-22	Residential (Single-Family Housing)	8651	10 houses
19	Parking	Public & Semi-Public	N/A	500 car parking & 250 Bike parking

The trip generation rate and total generated trips for the selected land use against office, restaurant and hotel according to ITE Trip Generation Manual, 10th Edition, is given in table below:

Table 6 Peak Hour Trips Generation for each building in a development

Sr. No.	Description	Units	Total	Code	Trip per unit PM	Total Generated Trips (PM Peak Hour)	Incoming Trips	Outgoing Trips
1	Hospital	Covered area in KSF2	376.13	0.97	365	365	124	241
2	Medical College & Nursing College	Students	720	0.14	101	101	32	69
3	Auditorium	Covered area in KSF2	18.42	0.8	15	15	9	5
4	Admin	Covered area in KSF2	20.853	1.42	30	30	5	24
5	Bank	Covered area in KSF2	4.72	10	47	125	64	61
6	Mosque	Covered area in KSF2	7.863	10	79	145	72	72
7	Café	Covered area in KSF2	11	9	99	192	100	92
8	Incinerator	Covered area in KSF2	0.6	2.4	1	1	0	1
9	Mortuary	Covered area in KSF2	2.4	2.4	6	6	1	5

10	Doctor Hostel (Male), Doctor Hostel (Female), Nursing Hostel (Male), Nursing Hostel (Female)	Residents	600	0.3	180	180	90	90
11	Apartments (1-10), Apartments (11-15), Apartments (16-18), Apartments (19)	Dwelling units	78	0.67	52	52	31	21
12	Shopping Mart	Covered area in KSF2	2.8	4.21	12	12	6	6
13	Sports Club	Covered area in KSF2	10	3.36	34	34	21	12
14	House for 21-22	Dwelling units	10	1	10	10	6	4
Total						1030	441	588

The analysis is done for P.M. Peak hour. Total estimated trips generated are 1266. The percentages In and Out for the P.M. Peak are given as 44% and 56% respectively for all trips.

3.4.2. Trip Distribution

The total trips generated by the development consist of internal and external trips. Among these, 481 trips are classified as external trips, which include 185 incoming trips entering the hospital complex via N-35 and 296 outgoing trips exiting the medical complex to N-35. These external trips are primarily generated by the hospital, along with 20% of day scholars, as well as trips related to the bank, auditorium, and sports facility.

Additionally, 549 trips are categorized as internal trips, comprising 256 incoming trips and 292 outgoing trips that circulate within the medical complex. Internal trips also include shared movements between facilities; for instance, the incoming trip of one facility may serve as the exiting trip of another within the internal circulation network. This dynamic interaction between different facilities ensures efficient movement within the unit while minimizing unnecessary external congestion on N-35.

3.4.3. Parking

Parking plays a crucial role in urban planning and infrastructure development, ensuring smooth traffic flow, accessibility, and convenience for users. Adequate parking facilities reduce congestion on roads, enhance safety, and improve overall mobility within a development. In healthcare and institutional settings, proper parking management is essential for accommodating staff, patients, visitors, and emergency vehicles, minimizing disruptions and ensuring efficient operations. Well-planned parking also contributes to environmental sustainability by reducing the time spent searching for spaces, thereby lowering vehicle emissions and fuel consumption.

To meet the parking needs of the proposed development, 500 car parking spaces and 250 motorcycle parking spaces have been allocated. These designated parking areas will ensure that staff, patients, students, and visitors have convenient and organized parking facilities, reducing on-street congestion.

3.5. Layout Plans

The master plan is divided into functional zones, ensuring a well-structured and organized layout that includes:

3.5.1. BUILDING COMPONENTS: -

3.5.1a. Main Building

- Total Covered Area: 376130 SFT

ACCIDENT & EMERGENCY & IPD

- Stories: G+3
- Total Plinth Area: 43,430 SFT
- Total Building Height: 74′–0″

Ground Floor includes accident & emergency wards with minor OT's and Admin block. First Floor has Gynecology & Pediatrics ward along with private rooms and Gynecology Delivery Section. Second Floor has OT's, ICU, CCU & HDU Wards along with private rooms and Third floor has General wards that includes Medical, Surgical, Orthopedic and Cardiac ward for Male & Female.

DIAGNOSTICS & STORAGE

- Stories: G+2

- Total Plinth Area: 29,965 SFT
- Total Building Height: 58′–0″

Ground Floor is of Radiology department that includes X-Ray, MRI, CT-Scan & Ultrasound section along with storage area that has gases storage & medical equipment storage area. First floor is of pathology department includes Blood Bank, histopathology, hematology and microbiology labs.

Second Floor has Radiologist and Pathologist offices along with Staff Lounges.

OPD & Technical Block

- Stories: G+1
- Total Plinth Area: 30,484 SFT
- Total Building Height: 42′–0″

Ground Floor is of Consultant Doctors along with waiting areas while first floor has biomedical engineers' offices and support staff offices.

a) MEDICAL COLLEGE

- Stories: G+1
- Total Covered Area: 139866 SFT
- Total Plinth Area: 51220 SFT
- Total Building Height: 50′–0″

Ground floor has 4 lecture halls along with Forensic Museum, Anatomy Museum, Pathology Museum & Dissection Hall along with labs Forensic, Skill development, Histology & Pathology Lab along with demonstration rooms. First floor includes a lecture hall along with 5 labs Physiology, Pharmacology, Bio Chemistry, Community Medicine & Medical Education Lab along with Library, Common rooms and Cafeteria for faculty and staff.

b) NURSING COLLEGE

- Stories: G+1
- Total Covered Area: 46214 SFT

- Total Plinth Area: 22503 SFT
- Total Building Height: 50′–0″

Ground Floor includes Admin block, 2 Lecture Halls, Demonstration room, Skill Lab, and Anatomy lab and museum while first floor has 2 lecture halls and a demonstration room along with library and science lab. It also has cafeteria and common rooms.

c) AUDITORIUM

- Stories: G+1
- Total Covered Area: 18760 SFT
- Total Plinth Area: 9200 SFT
- Total Building Height: 43′–0″

Auditorium includes a hall with a capacity of 530 persons along with control, green room and a lounge for VIP's.

d) ADMINISTRATION

- Stories: G+1
- Total Covered Area: 23212 SFT
- Total Plinth Area: 4778 SFT
- Total Building Height: 37′–0″

Amin building will have a VC office along with all the directors and other administrative staff.

e) STUDENT SERVICE CENTRE & BANK

- Stories: Ground only
- Total Covered Area: 4720 SFT
- Total Building Height: 15′–0″

f) MOSQUE

- Stories: G+1
- Total Covered Area: 7863 SFT
- Total Plinth Area: 14862 SFT
- Total Building Height: 70′–0″

g) CAFE

- Stories: G+1
- Total Covered Area: 8300 SFT
- Total Plinth Area: 2996 SFT
- Total Building Height: 50′–0″

The Cafe has been provided for the Hospital that includes an indoor and outdoor space with a capacity of 200 people.

h) INCINERATOR

- Stories: Ground only
- Total Covered Area: 600 SFT
- Total Building Height: 15′–0″

i) MORTUARY

- Stories: Ground only
- Total Covered Area: 2400 SFT
- Total Building Height: 15′–0″

j) DOCTOR HOSTEL (MALE)

- Stories: G+3
- Total Covered Area: 62154 SFT
- Total Plinth Area: 15259 SFT

- Total Building Height: 63′–0″

The ground floor of the hostel has Ward room, Dining Hall & Common room for Students along single bedded rooms. First floor has single bedded rooms, second floor has double bedded rooms while 3rd floor has triple bedded rooms.

k) DOCTOR HOSTEL (FEMALE)

- Stories: G+3
- Total Covered Area: 62154 SFT
- Total Plinth Area: 15259 SFT
- Total Building Height: 63′–0″

The ground floor of the hostel has Ward room, Dining Hall & Common room for Students along with single bedded rooms. First floor has single bedded rooms, second floor has double bedded rooms while 3rd floor has triple bedded rooms.

l) NURSING HOSTEL (MALE)

- Stories: G+1
- Total Covered Area: 33234 SFT
- Total Plinth Area: 15259 SFT
- Total Building Height: 63′–0″

The ground floor of the hostel has Ward room, Dining Hall & Common room for Students along Single bedded rooms. First floor has Double bedded rooms.

m) NURSING HOSTEL (FEMALE)

- Stories: G+1
- Total Covered Area: 33234 SFT
- Total Plinth Area: 15259 SFT
- Total Building Height: 63′–0″

The ground floor of the hostel has Ward room, Dining Hall & Common room for Students along Single bedded rooms. First floor has Double bedded rooms.

n) APARTMENT (Level 1–10)

- Stories: G+2
- Total Covered Area: 18007 SFT
- Total Plinth Area: 5075 SFT
- Total Building Height: 50′–0″

This Building contains single bedded apartments.

- **APARTMENT (Level 11–15)**Stories: G+2
- Total Covered Area: 15733 SFT
- Total Plinth Area: 4226 SFT
- Total Building Height: 50′–0″

This Building contains double bedded apartments.

o) APARTMENT (Level 16–18)

- Stories: G+2
- Total Covered Area: 30294 SFT
- Total Plinth Area: 6476 SFT
- Total Building Height: 50′–0″

This Building contains triple bedded apartments.

p) APARTMENT (Level 19)

- Stories: G+2
- Total Covered Area: 39928 SFT
- Total Plinth Area: 6141 SFT
- Total Building Height: 50′–0″

This Building contains triple bedded apartments.

q) RESIDENCE (Level 20–21)

- Stories: G+1
- Total Covered Area: 3568 SFT
- Total Building Height: 36′–6″

r) RESIDENCE (Level 22)

- Stories: G+1
- Total Covered Area: 4876 SFT
- Total Building Height: 33′–9″

s) SHOPPING MART

- Stories: Ground only
- Total Covered Area: 2800 SFT
- Total Building Height: 15′–0″

t) SPORTS CLUB

- Stories: Ground only
- Total Covered Area: 10000 SFT
- Total Building Height: 15′–0″

Sports club has Gym, badminton arena, Snooker Lounge & Board games room along with allied facilities.

u) PLANT ROOM

- Stories: Ground only
- Total Covered Area: 5980 SFT
- Total Building Height: 15′–0″

v) PLANT ROOM (Along with Main Building)

- Stories: Ground only
- Total Covered Area: 3568 SFT

w) OHWT

- Stories: Ground only
- Total Covered Area: 3000 SFT

x) TUBE WELL ROOM

- Stories: Ground only
- Total Covered Area: 600 SFT

y) HEATED PUMP PAD

o Stories: Ground only

o Total Covered Area: 600 SFT

aa) FIRE FIGHTING PLANT

o Stories: Ground only

o Total Covered Area: 3569 SFT

bb) Bio-Medical Workshop

o Total Covered Area = 2400 SFT

3.5.1b. Equipment and Machinery

- Anesthesia
- Ventilation
- Imaging
- Laboratory
- Medical OPD & Other Equipment
- Monitoring
- Neonatology
- Operation Theater
- Refrigeration
- Sterilization

- Medical Gases
- Hospital Laundry
- Waste Management
- Endoscopy
- Maintenance Workshop
- Mortuary
- Transport
- Cleaning/Washing
- Storage
- Office/IT Equipment
- Wooden Furniture for Hospital (if referring to equipment-related wooden items like furniture in clinics)
- Miscellaneous (if it includes equipment items)

3.5.1c. Furniture and Fixtures

- Nursing Hostel Furniture
- Medical Hostel Furniture
- Student Service Center Furniture
- Admin Building Furniture
- Auditorium Furniture
- Medical College Furniture
- Nursing College Furniture

DISTRIBUTION OF BEDS

Table 7 Distribution of Beds

Sr. No.	Description	Nos
1	Medical Emergency	10
2	Surgical Emergency	10
3	Medical Ward	24
4	Ortho Ward	14
5	Surgical Ward	24
6	Neurosciences Ward	14
7	ICU	10
8	CCU	10
9	HDU	10
10	Gynecology	14
11	Pediatrics	16
12	Private Rooms	20
Total =		**150**

3.5.2. Architectural Details

The architectural design of the Main Hospital Building, Medical and Nursing College is carried out by the standards and requirement of the medical buildings. Details of the covered area used for different components of the project is as under

Total Project Area = 2,722,448 SFT. (500

Kanal) Total Covered Area of the

buildings = 966,064 SFT Total Road Area

= 225,400 SFT

Total Parking Area =

135,387 SFT Total Green

Area = 1,900,000 SFT

3.5.3. Land Use Distribution

Table 8 Land use distribution of the project site

Sr. No.	Building Name	Total Covered Area (SFT)
1	Main Building	376,130
2	Medical College	139,866
3	Nursing College	46,214
4	Auditorium	18,760
5	Admin	23,212
6	Bank	4,720
7	Mosque	7,863
8	Cafe	8,300
9	Incinerator	600
10	Mortuary	2,400
11	Doctor Hostel (Male)	62,154
12	Doctor Hostel (Female)	62,154
13	Nursing Hostel (Male)	33,234
14	Nursing Hostel (Female)	33,234
15	Apartment (Level 1–10)	18,007
16	Apartment (Level 11–15)	15,733
17	Apartment (Level 16–18)	30,294
18	Apartment (Level 19)	39,928
19	Residence (Level 20–21) 08 Nos.	28,544
20	Residence (Level–22)	4,876
21	Shopping Mart	2,800
22	Sports Club	10,000
23	Plant Room	5,980

24	Plant Room (Along w/ Main Bldg.)	3,568
25	Tube Well Room	600
26	Heated Pump Pad	600
27	OHWT	5,000
28	Fire Fighting Plant	3,569

This project addresses nearly all the essential requirements based on the needs of the area. Some of the key works contributing to technical parameters are as follow:

Table 9 Key works contributing to technical parameters

Sr. No.	**Description**	**Nos**
1	Medical Emergency	10
2	Surgical Emergency	10
4	Medical Ward	24
6	Ortho Ward	14
7	Surgical Ward	24
7	Neurosciences Ward	14
8	ICU	10
9	CCU	10
10	HDU	10
14	Gynecology Ward	14
15	Pediatrics	16
16	Private Rooms	20
Total =		150

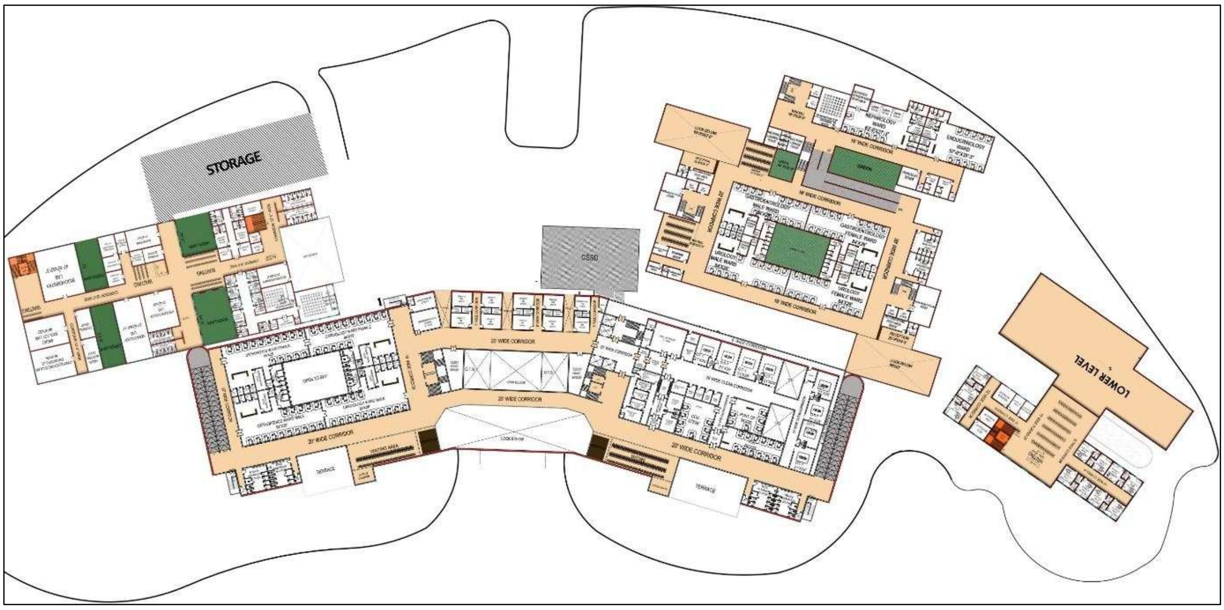


Figure 8 Proposed Design for Building

3.6. Building Design

3.6.1. Architectural Style

The architectural design prioritized functionality, sustainability, and cultural integration while adhering to modern healthcare and educational standards. The design embodied a contemporary institutional style, focusing on both functionality and aesthetic appeal. Symmetry and modular planning fostered organization and easy navigation. Wide corridors, open courtyards, and natural ventilation enhanced comfort, and the façade blended traditional and modern elements, using stone cladding to reflect the region's architecture alongside glass and steel for a sophisticated appearance.

The campus layout featured landscaped green spaces to foster a healing and learning-friendly environment. Pedestrian pathways, shaded seating areas, and courtyards created relaxing spaces for students, staff, and patients. The college and hospital were visually distinct yet harmonized, ensuring clarity in navigation and usability. Energy-efficient lighting and glass panels maximized natural daylight while reducing power consumption.

3.6.2. Structural Design Methodology

Once the architectural plans are finalized, the structural design will be carried out to ensure the stability and durability of the buildings, including the medical college, hospital, and residential blocks. Structural engineers will assess the load-bearing requirements, propose optimal beam and column arrangements, and determine foundation design based on the site's soil conditions and seismic considerations.

Advanced computer-aided design tools will be used for structural analysis, including:

- STAAD-Pro for structural analysis and design
- SAP-2000 for finite element analysis of static and dynamic loads
- ETABS for multi-story building design and lateral load analysis

The design, fabrication, and construction will comply with the latest codes and standards, including:

- Building Code of Pakistan (BCP)
- ACI 318-05 – Building Code Requirements for Reinforced Concrete
- UBC-97 – Uniform Building Code (Seismic Design Considerations)
- AISC – Steel Construction Standards
- ASCE 7-98 – Minimum Design Loads for Buildings
- ACI 350.3R – Seismic Design Guide for Liquid Containing Structures

Seismic Considerations

Given the region's location in a seismically active zone, the structural design strictly adhered to the Pakistan Building Codes (PBC) to ensure seismic safety. Flexible joints and expansion gaps were strategically included to allow for minor shifts during tremors, thereby preventing structural damage. To stabilize buildings on variable terrain, foundation reinforcement involved the use of deep piles or raft foundations. Additionally, shock-absorbing materials and dampers were implemented in critical areas such as hospital wards and surgical rooms to minimize the impact of earthquakes.

Load-Bearing Capacity

The structural design meticulously accounted for the weight of medical equipment, heavy machinery, and high foot traffic. Comprehensive live load and dead load calculations were conducted to guarantee durability while optimizing material usage. Furthermore, ceiling heights and ventilation shafts were optimized to enhance airflow and lighting throughout the facility.

3.6.3. Electricity Methodology

An electrical system was crucial for ensuring uninterrupted operations in medical and academic environments, given the high stakes involved with human life. Key aspects of the electrical design included power supply, lighting systems, wiring and distribution, and medical equipment power backup.

3.6.3.a. Power Supply

The facility connected to the national grid to ensure a stable electricity supply, supplemented by backup diesel/gas-based generators to prevent outages from affecting critical operations. Dedicated electrical substations and transformers efficiently managed power distribution, and solar power systems further supported energy needs, particularly in classrooms, administrative offices, and basic hospital services.

3.6.3.b. Lighting System

LED lighting was used throughout the facility to minimize energy consumption. Task-specific lighting was installed in different zones, such as shadow-free, high-intensity LED lights in surgeries and labs, adjustable brightness in lecture halls to reduce eye strain, and sensor-based outdoor and emergency lighting for automatic activation in low-light conditions.

3.6.3.c. Wiring and Distribution

Fire-resistant and concealed wiring was used for safety and aesthetic reasons. Separate circuits for high-voltage and low-voltage systems prevented overloads, and emergency shut-off systems allowed for quick power cut-off in case of faults. Essential electrical systems were independent, with identical conduits, cabinets, and boxes.

3.6.3.d. Medical Equipment Power Backup

UPS (Uninterruptible Power Supply) systems were installed for critical areas like ICUs, operation theaters, and diagnostic labs. Dedicated circuits for equipment such as MRI, CT scans, and X-ray machines prevented voltage fluctuations. Proper grounding and isolation of electrical systems were vital to protect patients and staff against electrical hazards, and ground fault circuit interrupters (GFCIs) were used to detect and interrupt abnormal electrical flows, reducing the risk of electrical shocks.

3.6.4. HVAC / Components

An efficient HVAC (Heating, Ventilation, and Air Conditioning) system is essential for maintaining a comfortable and hygienic indoor environment in medical facilities, going beyond mere temperature and humidity control to ensure a clean, germ-free environment that supports the well-being of patients and prevents the spread of disease.

3.6.4.a. Heating System

Centralized heating systems with energy-efficient boilers were used, and radiant floor heating was installed in key areas to improve energy efficiency.

3.6.4.b. Ventilation

Natural ventilation was prioritized through large operable windows and ventilated courtyards. Mechanical ventilation with high-efficiency air exchange was installed in hospital areas to prevent contamination. Special attention was given to air filtration, minimum air-change requirements, and exhaust systems.

3.6.4.c. Air Conditioning

Split AC and VRF (Variable Refrigerant Flow) systems ensured temperature control in administrative and academic buildings. Humidity-controlled air conditioning was used in operation theaters, pathology labs, and intensive care units. Maintaining humidity was especially important in areas such as MRI spaces, which may require supplemental systems. Temperatures in areas such as pharmacies and operating rooms needed to be as low as 62°F to

keep staff comfortable, requiring delivery of supply air as low as 48°F to prevent the space from becoming too humid.

3.6.4.d. Infection Control

HEPA filtration and UV sterilization systems were installed to minimize airborne pathogens. Negative pressure isolation rooms were built to contain infectious diseases. In critical care spaces such as operating rooms, a ceiling supply type system using non-aspirating "low velocity" diffusers was used to isolate the air over the operating or treatment area. The HVAC system for anesthetizing locations was designed in accordance with NFPA 99 to prevent recirculation of smoke within the surgical suite and prevent the circulation of smoke entering the system intake.

3.6.5. Fire Fighting

A comprehensive fire protection system was essential to ensure the safety of all occupants in a medical and educational facility. The system included robust fire detection and alarm systems, effective fire suppression systems, and well-planned emergency exits and evacuation plans.

3.6.5.a. Fire Detection and Alarm Systems

Automated fire alarm systems with smoke and heat detectors were installed throughout the facility to provide early warning of fire incidents. Manual alarm buttons were strategically placed in key locations to allow occupants to manually trigger alarms in case of emergencies. These systems complied with local and international fire safety standards.

3.6.5.b. Fire Suppression Systems

Automatic sprinkler systems were installed in all buildings to quickly suppress fires and minimize damage. CO_2 and gas suppression systems were used in IT and medical labs where water-based systems could damage sensitive equipment or pose electrical hazards. Fire hydrants and hose reels were strategically placed at various points to provide readily available water sources for firefighting.

3.6.5.c. Emergency Exits and Evacuation Plan

Wide staircases, illuminated exit signs, and fire-resistant doors were incorporated to facilitate safe and efficient evacuation. Regular fire drills and staff training were conducted to ensure preparedness and familiarity with evacuation procedures. Clear evacuation plans and assembly points were established and communicated to all occupants.

3.6.6. Public Health

Effective sanitation and waste management were critical for maintaining hygiene and preventing healthcare-acquired infections. Key components of these systems included waste disposal, water supply, hygiene, infection control, and accessibility.

3.6.6.a. Sanitation and Waste Management

Separate drainage and sewerage systems were implemented to ensure proper waste disposal. Biomedical waste incinerators handled medical waste. Healthcare waste management (HCWM) was essential for maintaining hospital hygiene and the safety of healthcare workers and communities. A robust HCWM plan considered waste minimization, segregation, labeling, collection, transportation, storage, treatment, and disposal. Waste was safely segregated into clearly labeled bins, and sharps and infectious waste were treated and disposed of safely.

3.6.6.b. Water Supply and Hygiene

Reverse osmosis (RO) water purification provided clean drinking water. Handwashing stations and sanitization areas were placed throughout the facility. Access to water, sanitation, and hygiene were integral to healthcare waste management and were necessary for safe, dignified, and quality healthcare. Functional hand hygiene facilities with water and soap or alcohol-based hand-rub were available at points of care and within five meters of toilets.

3.6.6.c. Infection Control Measures

Antimicrobial wall coatings and touch-free dispensers were used in critical areas. Negative pressure rooms were available in isolation wards for disease containment. HEPA filtration and UV sterilization systems were installed to minimize airborne pathogens.

Universal design principles ensured wheelchair access, elevators, and Braille signages. Improved sanitation facilities were usable, with at least one toilet dedicated for staff, at least one sex-segregated toilet with menstrual hygiene facilities, and at least one toilet accessible for users with limited mobility

3.7. INFRASTRUCTURE DESIGN

3.7.1. ROADS NETWORK

A well-planned road network is essential for ensuring efficient access and mobility within the Medical and Nursing College and 150-Bedded Hospital in Gilgit. The transportation network is designed to facilitate smooth movement for students, faculty, medical staff, patients, and visitors while ensuring emergency vehicle access. The layout includes arterial roads, internal circulation routes, and designated pathways, considering the site's topography and connectivity with the existing road infrastructure in Gilgit.

3.7.1.a. Design Criteria

The road network design follows national and international engineering standards while adapting to the specific terrain and climatic conditions of Gilgit. The design criteria prioritize accessibility, durability, and cost-effectiveness, ensuring the infrastructure remains functional in all seasons. Engineering decisions balance performance objectives with economic constraints, allowing for necessary modifications without compromising road quality.

3.7.1.b. Geometric Design

The geometric design of the road network adheres to AASHTO standards, commonly used for road planning in Pakistan, ensuring consistency and reliability.

3.7.1.c. Design Speed

- Primary access roads (connecting the site to the main highway): 50 KPH
- Internal roads within the medical campus: 30 KPH
- Service lanes and parking circulation roads: 20 KPH

3.7.1.d. Design Parameters

The key design parameters for the road network are presented in the table below;

Table 10 Geometric Design Parameters for Roads

Sr. No.	Description	Access Roads	Internal Roads
1	Design Speed (KPH)	50	30
2	Stopping Sight Distance (m)	75	40
3	Minimum Curve Radius (m)	120	40
4	Maximum Super Elevation Rate	3%	3%
5	Maximum Gradient	4%	3%
6	Minimum K (at Crest)	10	3
7	Minimum K (at Sag)	15	7

3.7.1.e. Cross-Section Elements

Lane Width:

- Primary access roads: 3.5 m per lane
- Internal roads: 3.0 m per lane
- Service lanes and parking

circulation: 2.5 Cross Slopes:

- Main carriageway: 2%
- Paved shoulders: 2%
- Foot

paths: 2%

Turning

Radius:

- Intersections:

Minimum 12 m Sidewalks:

- Width: 1.8 m (both sides where applicable)
- Kerb height: 0.3 m (non-mountable type)

3.7.1.f. Typical Cross-Sections

The table below presents the cross-sectional dimensions of the roads.

Table 11 Cross-Sectional Details of Roads

Road Type	R.O.W (m)	Carriageway Width (m)	Lane Width (m)	Shoulder Width (m)	Median Widt h (m)	Footpath Width (m)
Access Roads	30	7.0	3.5	1.5	3.0	1.8
Internal Roads	20	6.0	3.0	1.0	-	1.5
Service Lanes	12	5.0	2.5	1.0	-	1.5

3.7.1.g. Geometric Design Software

- **Civil 3D**: Used for horizontal and vertical alignment design.
- **AutoCAD**: Used for preparing layout plans and cross-sections.

3.7.1.h. Pavement Design

The pavement structure has been designed to withstand the projected traffic load, including ambulances, supply trucks, and daily vehicular movement within the campus.

3.7.1.i. Design Methodology

The pavement design follows AASHTO (1993) guidelines and considers the following parameters:

- **Equivalent Axle Loads**: Traffic composition includes light vehicles, emergency ambulances, and service trucks, with calculations based on Equivalent Single Axle Loads (ESALs).
- **Design Life**: The road network is designed for a 15-year lifespan before major rehabilitation is required.
- **Design CBR**: The pavement structure is designed based on a soaked CBR of 7% at 95% Modified AASHTO compaction.

Table 12 Pavement Layer Thickness

Sr. No.	Layer	Access Roads (cm)	Internal Roads (cm)	Service Lanes (cm)
1	Asphaltic Wearing Course	5	5	4

2	Asphaltic Base Course	15	12	10
3	Aggregate Base Course	25	25	20
4	Sub-Base Course	20	20	15
5	Sub-Grade CBR	7%	7%	7%

Table 13 Layer Thickness and Compaction

Material Type	Maximum Compacted Layer Thickness (cm)	Recommended Modified AASHTO Compaction (%)
Base Course	15	100
Sub-Base	15	98
Sub-Grade (Upper 30 cm)	15	95
General Fill (30-70 cm)	15	93
General Fill (Below 70 cm)	15	90

The transportation network has been designed to ensure seamless movement within the Medical and Nursing College and 150-Bedded Hospital in Gilgit, optimizing connectivity, safety, and efficiency for all users.

3.8. Water Supply System

Access to clean and potable water is fundamental to daily life and essential for sustaining human health, particularly in healthcare facilities. Beyond domestic consumption, water plays a crucial role in medical services, sanitation, and hospital operations. A reliable and uninterrupted water supply is imperative for the smooth functioning of healthcare institutions, ensuring adequate availability for patient care, medical procedures, sterilization, and general facility maintenance.

The water supply system for the Medical and Nursing College in Gilgit is designed to meet the demands of both the 150-bed hospital and the educational facilities, while also catering to ancillary infrastructure, including staff residences, hostels, and research centers. Additionally, the system accounts for landscaping requirements and emergency firefighting needs.

Total estimated demand of potable water is **150,000 imp Gal for 1.5 day approximately**. The building has 3 blocks. Each block will have 1 underground tank in basement or ground floor and 2 overhead tanks on roof. Water from underground tanks will be transferred via transfer pumps to overhead tanks on roof. Water will be distributed to all wet areas through PPR pipe network. Hot

Water Supply will be achieved through electric instant water heaters in respective area.

3.8.1. Source of Water

The water supply system for the hospital has been designed to keep in view the available water sources of the area. The prime source of water for the project is the underground. The water will be treated at the source through sedimentation, coagulation, flocculation, clarifiers, and chlorination. The treated water will be supplied to the hospital through an independent feeder line. The technical parameters of the water supply component of the project are as under

3.8.2. Components of Water Supply System

The water supply system includes essential components that ensure efficient distribution and management of water. These components are:

Overhead Reservoir (O.H.R.) – A storage facility designed to maintain water pressure and ensure a steady supply.

Pipe Distribution System – A network of pipelines responsible for transporting water to various locations.

Miscellaneous Fittings and Appurtenances – Additional components such as booster pumps, meters, control valves, and hydrants that regulate and support water distribution.

3.8.2.a. Over Head Reservoir (O.H.R)

The Over Head Reservoir (OHR) are elevated storage tanks which Store water for supply during maintenance works or electrical shortfall. Furthermore, they can be used for balancing flow and pressure during peak hours. The height of the Tube well is such that the terminal pressure requirement are fulfilled.

An Overhead Reservoir of 50,000 Gallons of storage capacity is proposed for the continuous supply of water.

Water Source

The water can be pumped directly to overhead reservoirs proposed within the site of the project through the proposed tube well and there is also provision of uplifting of water from Gilgit River through water pumps. The water source is developed based on maximum day demand.

3.8.2.b. Pipe Distribution System

Providing the proper materials in a water system will ensure long service life, minimal service interruptions and high reliability. The distribution system consists of pipes for conveyance and supply of water to the consumers. The material for pipes to be used in service connection, distribution network and transmission / pumping mains will be selected with due consideration to technical as well as cost aspects ensuring a balance between reliability and cost. While selecting the pipe material, past experience in water distribution system has also been considered.

The following pipe materials, which are commonly used in service connection, distribution system and pumping mains are commonly available in Pakistan.

1) Galvanized Iron (GI)
2) High Density Polyethylene (HDPE)
3) Unplasticized Polyvinyl Chloride (uPVC)
4) Asbestos Cement (AC)
5) Ductile Iron (DI)
6) Mild Steel (MS)
7) Glass Reinforced Plastic (GRP)

For PSEZ, HDPE pipe with diameter ranging from 110 mm (O.D) to 315 mm (O.D) complying with PN-10 rating have been used.

3.8.2.c. Miscellaneous Fitting and Appurtenances

Types of Valves and their Application in Water Distribution Systems:

Table 14 Types of Valves and their Application in Water Distribution Systems

MISCELLANEOUS FITTING AND APPURTENANCES			
Type	**Application**	**Size**	**AWWA Standard**
Gate	Isolating parts of the water distribution and transmission system.	3” up	C500 3” – 48”
Butterfly	Water mains typically larger than 8”. Used for	3” up	C504 Rubber Seated
	Isolating parts of the water transmission system		Butterfly Valves
Ball	Applications where throttling or frequent use is required. Water service lines.	6”and below	C507 6” – 48” and for pressures to 300 psi
Plug	Applications where throttling or frequent use is required. Water service lines.	6”and below	

Globe	Throttling operations and water service lines.	2"and below	

3.8.3. Water Quality

Water quality in the economic zone should be according to international criteria the physio- chemical and bacteriological quality of the water, to be supplied for potable purposes, to meet the guidelines as established in National Standards for Drinking Water Quality (NSDWQ) and WHO standards.

3.8.4. Water Demand

The design of the water supply and distribution system for the proposed Medical and Nursing College in Gilgit is a critical component, ensuring an uninterrupted water supply for academic, residential, and hospital facilities. Water demand varies based on institutional activities, hospital operations, student accommodation, and support facilities. The criteria for determining water requirements are established based on national and international standards, literature review, and data gathered from similar institutions. Consultations with healthcare professionals and facility managers provided insights into water usage patterns in medical colleges and hospitals. Additionally, various technical manuals and research materials were referenced to ensure a comprehensive assessment.

3.8.4.a. National Reference Manual (NRM)

According to the National Reference Manual (NRM), institutional and hospital water demand varies based on facility size and operations. For healthcare facilities, the average water consumption is estimated to be 50 gallons per bed per day, whereas academic institutions require 15–25 gallons per student per day, depending on the facilities available.

3.8.4.b. United Nations Industrial Development Organization (UNIDO) and International Guidelines

The United Nations Industrial Development Organization (UNIDO) and other global standards suggest that hospitals require 75–150 gallons per bed per day, considering general patient care, hygiene, laundry, and other medical operations. Similarly, WHO guidelines recommend a minimum 50 liters per patient per day for inpatient hospital care, ensuring sufficient water for sanitation, food preparation, and medical services.

3.8.4.c. Literature Review and Internet Resources

Various national and international resources were consulted to determine institutional water demand, including:

8) Handbook for Water Supply, Sanitation, and Hygiene Promotion (WASH) – International standards for water consumption in health and education facilities.
9) American Water Works Association (AWWA) – Best practices in water distribution for medical and institutional setups.

3.8.5. Actual Water Requirements for the Medical and Nursing College in Gilgit

As there are a lot of different departments in the proposed hospital, therefore, the water demand for each department is different and depends upon the usage and criteria of the service. The below table shows the water demand in the Hospital.

A detailed calculation of water requirements is based on the anticipated infrastructure:

Table 15 Water Requirements for the Medical and Nursing College

S N	Description	No of Persons	Per GPCD	Average Demand
1	House for 22	10	27	270
2	House for 21	10	27	270
3	Apartment 19	150	27	4,050
4	Apartment 16-18	120	27	3,240
5	Apartment 11-15	60	27	1,620
6	Apartment 1-10	120	27	3,240
7	Nursing Hostel Male	150	27	4,050
8	Nursing Hostel Female	150	27	4,050
9	Doctor Hospital Male	300	27	8,100
10	Doctor Hospital Female	300	27	8,100
11	Sports Club	10	5	50
12	Main Building	1,000	5	5,000
13	Nursing College	400	5	2,000
14	Medical College	1,200	5	6,000
15	Sports Club	10	5	50
16	Shopping Mart	10	5	50

17	Mortuary	5	5	25
18	Incinerator	5	5	25
19	Cafe	100	5	500
20	Mosque	300	10	3,000
21	Bank	50	5	250
22	Admin	100	5	500
23	Auditorium	500	5	2,500
Grand total of the scheme	**1,370**	-	**56,940**	

3.9. Design of Sewerage System

The design of various components of the sewerage system are based on the following considerations:

a) Possibility of dividing the area into various sewerage zones;

b) Design population;

c) Design period and design flows for various components of sewerage system;

d) Topography of the area;

e) Soil characteristics;

f) Climatic condition;

g) Availability of pipes, required sizes and materials;

h) Type of pipe material; and

i) Type of bedding material.

The water supply demands examined to estimate the sewage flow.

The output of design of sewerage network is as under:

a) Sewer Size (diameter); and

b) Slope and Invert level of sewer

3.9.1. Sanitary Drainage System

- Drainage system is designed as a two-pipe system (Waste and Soil Waste) with separate two vent stacks.
- Special waste (Chemical waste) such as labs and any other Special requirement from medical planer shall have a separate waste stack.
- Soil, waste, and vent water from plumbing fixtures and drains on all the floors, shall be collected into a system of drainage stacks which will run vertically through the building and connected to the main drainage system.
- Drainage from all buildings is taken by gravity to septic tanks provided with each building separately and then after septic tank will be drained to soakage pits.

3.10. Design of Storm Water Drainage System

The following steps are involved in the design of comprehensive storm water drainage scheme:

3.10.1. Establishment of Design Criteria

Criteria for storm water drainage scheme is established;

a) Analysis of rainfall data and development of Intensity-Duration-Frequency (IDF) Curves is performed by the hydrologist for the design of storm water drainage network and its appurtenances;

b) Layout plan of Storm sewers / drain network for the collection of storm water taking into account the sub-drainage areas are prepared on the basis of topographic survey and master plan approved by the Client;

c) Hydraulic Design / computation sheets indicating drain / stem sewer notation, time of concentration, co-efficient of surface run-off, quantity of storm water, pipe diameter/drain size, velocity of flow, gradient of drain / pipe, road levels and invert levels etc. are prepared;

d) Generally, the pumping stations are required to dispose off the storm water into water body in the flat terrain however, all attempts are made to design the entire storm water scheme on gravity system up to disposal point (nearby water body); and

e) Pumping station is provided where the gravity-based system is not workable.

3.10.2. Storm Water Drainage System

The design criteria for storm water drainage system is as under:

I. Design Return Period

The drainage systems in the city are designed to handle storm runoffs having return periods ranging from nearly two (2) years to five (5) years depending on the value of the properties in the drainage area and the damages due to floods. However, storm water drainage system of the City is designed based on five (5) years return period.

II. Estimation of Runoff

There are several methods of estimating the runoff. The choice of the method is based on the size of catchments being considered.

Rational Formula has been found simple to apply and accurate when used on small evenly shaped catchments. Rational Method is suitable for areas up to 3 km^2.

a) Rational Method

In this method peak runoff is related to the average rainfall intensity over the duration of the storm:

Q = 0.278 CIA

Where

Q	=	Peak runoff (m^3/sec)
C	=	Weighted runoff coefficient
I	=	Average rainfall intensity (mm/hr)
A	=	Drainage Area (km^2)

b) Rainfall Intensity

The determination of the average rainfall intensity "I" to be used in the formula involves the following factors:

a) Frequency of occurrence (Return period); and
b) Intensity duration characteristics of rainfall of design storm frequency

The rainfall intensity is used in the Rational Method obtained from "Rainfall Intensity- Duration-Frequency Curve (IDFC) for the city" for the corresponding design storm return period.

c) Time of Concentration

Time of concentration is the time required for the maximum runoff to develop during a continuous uniform rain. Time of concentration consists of an inlet time or overland flow plus the travel time in the storm channel from the most remote inlet to the point under consideration. The travel time is estimated from hydraulic properties of the storm pipe or channel.

Therefore, the time of concentration T_c is defined by $T_c= T_i+$

T_t (minutes) Where

T_c = Time of concentration (minutes)

T_t = Time of flow in the storm pipe or channel (minutes)

T_i = Overland Flow time (minutes)

Taking into consideration small watershed area, design of pipes and storm channels is carried out by using Kerby's method.

The Kerby equation is as under:

$$T_i = K\frac{[LxN]^{0.467}}{[S]^{0.235}}$$

Where

T_i = Inlet time or overland flow time (minutes)

K = 1.44 for SI units

L = Overland flow length (m)

N = A dimensionless retardation co-efficient and = 0.2 for poor grass, cultivated row crops or moderately bare surfaces

S = Dimensionless slope

For application of Rational Method, Taxas Department of Transportation recommends that Tc be less than 300 minutes (5 hours) and greater than 10 minutes. Other agencies require Tc to be greater than 5 minutes. The reason is that estimates become unacceptably large for durations less than 5 or 10 minutes. For long durations (such as greater than 300 minutes), the assumption of a relatively steady rainfall rate is less valid. For rural environments, Kerby (1959) and Kirpich (1940) methods are useful for calculation of overland flow and channel flow respectively.

Keeping in view the above-mentioned factors, the minimum time of concentration for pipes and channels is adopted as 10 minutes.

3.11. Structural Design

The structural design of different parts of the building has been carried out by following standard codes of practice, software and specifications. Codes followed during design of building are as followed.

- BCP-SP-2007 "Building Code of Pakistan: Seismic Provisions- 2007"
- ACI-318-08 "Building Code Requirements for Reinforced Concrete"
- ASCE 7-10 "Minimum Design Loads for Buildings and Other Structures"
- UBC-97 "Uniform Building Code"
- ACI 224R-01 "Control of Cracking in Concrete Structures"
- ACI 350-06 "Code Requirements for Environmental

Engineering Concrete Structures”

- ACI 209R-92 “American concrete institute, Prediction of Creep, Shrinkage, and Temperature Effects in Concrete Structures”
- AISC 360, Specification for Structural Steel Building.

Following software are used in order to analyze and design different structural members of the structures.

- ETABSV21.0.0
- SAFEV16.0.0
- SAP200015.1.0

STAAD PRO Connect Edition V23

Concrete

Strength factor of concrete in deemed important during the design of Reinforced structural elements. Following is the cylindrical strength detail used for different structural element of the building.

For RCC Walls/ Columns & Foundations 4000 PSI, Beams, Slabs 4,000 PSI, and for Blinding Concrete 2,175 PSI, as 28 days’ compressive strength of concrete.

Structural Reinforcement

All structural reinforcement shall be high-strength deformed steel Grade 60 with a minimum yield strength of 60,000 psi and shall conform to the requirements of ASTM 615.

Seismic Load

The project site Gilgit is in seismic zone 3 as per the Building Code of Pakistan, Seismic Provisions –2007. Seismic loads are computed according to BCP-SP-2007.

Block Masonry

Block Masonry is used for all masonry works and partition walls.

3.12. Electrical Design

The Design has been based on the Electrical Load Criterion and System Description consisting of but not limited to the following: -

i. 11kV Trunk/Primary feeder network from existing 132/11.5kV Grid station to the premises.
ii. 11kV Underground Network including 11kV Ring Main Units (3 & 4 way), 11/0.415 kV Pad-Mounted Transformers/ Kiosk Substations, 8.7/15kV Medium Voltage Cables as per Electrical loading requirements as per NEPRA standard specifications.
iii. Low Voltage network including Distribution Boxes, 600/1000V Low Voltage Cables.

iv. Road/Street Lighting Network

The underground power distribution system mainly comprises of the following:

i. 11kV Overhead Feeder from Existing Grid Station to the site (DISCOs)
ii. 11kV Underground Medium Voltage (M.V) Cable Network
iii. Low Voltage Distribution system
iv. Road/ street lighting network based on lights.

The brief description of the above systems is as follows:

The basic design parameters of WAPDA for residential and commercial developments have been enhanced for the increased electrical power requirement which are below:

The following design parameters for electrical power estimation for residential, commercial, and other areas of project have been adopted: -

In general, the development factor 0.85, diversity factor 1.25 and power factor of 0.90 have been taken in electrical power estimation for the project. 100kVA, 200kVA, 400kVA and 630 kVA rated distribution transformers for areas have been proposed. The distribution transformers shall be utilized upto 80% of its rated capacity. MV (8.7/15kV) and LV (0.6/1kV) power cables shall be utilized within 60% to 70% of its normal ampere ratings considering cable laying installation factors as per site requirement. The rating of switches shall be 630A as per applicable WAPDA/IESCO standard rules and regulations. The maximum short-circuits level of 25/31.5 kA for Medium Voltage Switchgear installation, permissible limits of 5% for voltage drop and 3% for energy losses has been taken. Based upon the electrical power demand parameters, the total estimated power requirement is 3439 kW/ 4880MVA. The total estimated power shall be fulfilled from one independent 11kV feeders, from the Existing Grid Station's. The Energy Efficient LED Street light fixtures as suitable wattages to achieve lighting outputs in accordance with latest applicable international standards. 10/ 12 single & double arm and 15 Meters poles shall be used as per requirement. The road lights shall be fed through light control panels are provided electric connections with the help of street light control panels, fed from nearest PAD Mounted Distribution transformers. Pole arm extension shall be 1.0 - 1.5 meter with average luminance of 1.0- 1.5 cd/sqm. 4 core 35 sq. mm Cu./PVC/PVC cables are used from transformer to LCP & 4 core 16sq. mm. Cu./PVC/PVC cables shall be used & between poles along-with 1 core cable shall be used for earthing purpose.

3.13. Integration of HVAC System in Hospitals

A central HVAC plant is proposed to serve in the Main Hospital building while the medical & nursing college serve with the VRF System & Remaining all building are served with single split system.

The following components shall be part of the Central HVAC plant;

- Water Cooled Electric Chiller (Centrifugal Type),

- Air Cooled Chiller with Heat Pump,
- Cooling Towers,
- Air Handling Units,
- Fan Coil Units,
- Chilled/Hot and Condensing Water Pumps,
- Piping/Ducting, etc.
- HVAC Controls

The cooling towers will be installed at the roof top of proposed HVAC plant.

Air handling units (AHU), fan coil units (FCUs) and exhaust fans (EF) will be appropriately distributed for areas of the main hospital building to be served. Designated AHU rooms are located at each floor of the building.

Considering that the Central Plant Room is located outside the main hospital building, chilled water and condenser water circulation pump scheme is adopted.

a) Small Enclosures

Ceiling mounted cassette type fan coil units with independent operative and temperature controls will be installed in rooms wherever applicable.

b) Circulation Area

Circulation area such as lobbies and corridors of the building is to be served through Air Handling Units depending upon the load variation pattern.

c) Fresh air

Fresh air intakes for AHUs will be through exterior walls of AHU rooms, whereas fresh air for fan coil units will be provided through AHUs placed floor wise in the building.

Toilets, kitchen, stores and parking etc. will be exhausted directly to atmosphere as per ASHRAE Standards.

Based on the data and architectural layout available at this stage, the building cooling load estimated for proposed buildings is mentioned below:

i. Estimated Cooling Load of Main Hospital Building = 1650 TR
ii. Estimated Cooling Load of Nursing College = 167 TR
iii. Estimated Cooling Load of Medical College = 485.5 TR
iv. Estimated Cooling Load of Auditorium = 184 TR

Based on the above load main hospital building served by Central Plant located outside the main hospital building, Medical & Nursing College served by VRF system and Auditorium building served by Floor standing split units, major equipment will be selected with following capacities and duties:

1650 TR Estimated Cooling Requirement

3 x 550 TR Water Cooled Electric Type

Centrifugal Chiller 2 x 275 TR Air-cooled Chiller with

Heat Pump

Centrifugal Chiller (electrical type) will serve for cooling purpose. Heating requirement will be fulfilled with the help of Air-cooled chiller with heat pump.

3 x 2310 GPM For total requirement of Centrifugal Chiller. However, AHUs and FCUs capacities shall be finalized depending upon the requirement of the respective area. Primary pumping system shall be adopted keeping in view building blocks operational hours.

During mild weather if heating or cooling is not desired, the central plant may be shut-down to curtail operating energy bill. However, the air handling equipment may be operated to provide minimum outdoor air (fresh air). Biomedical technical specification**.**

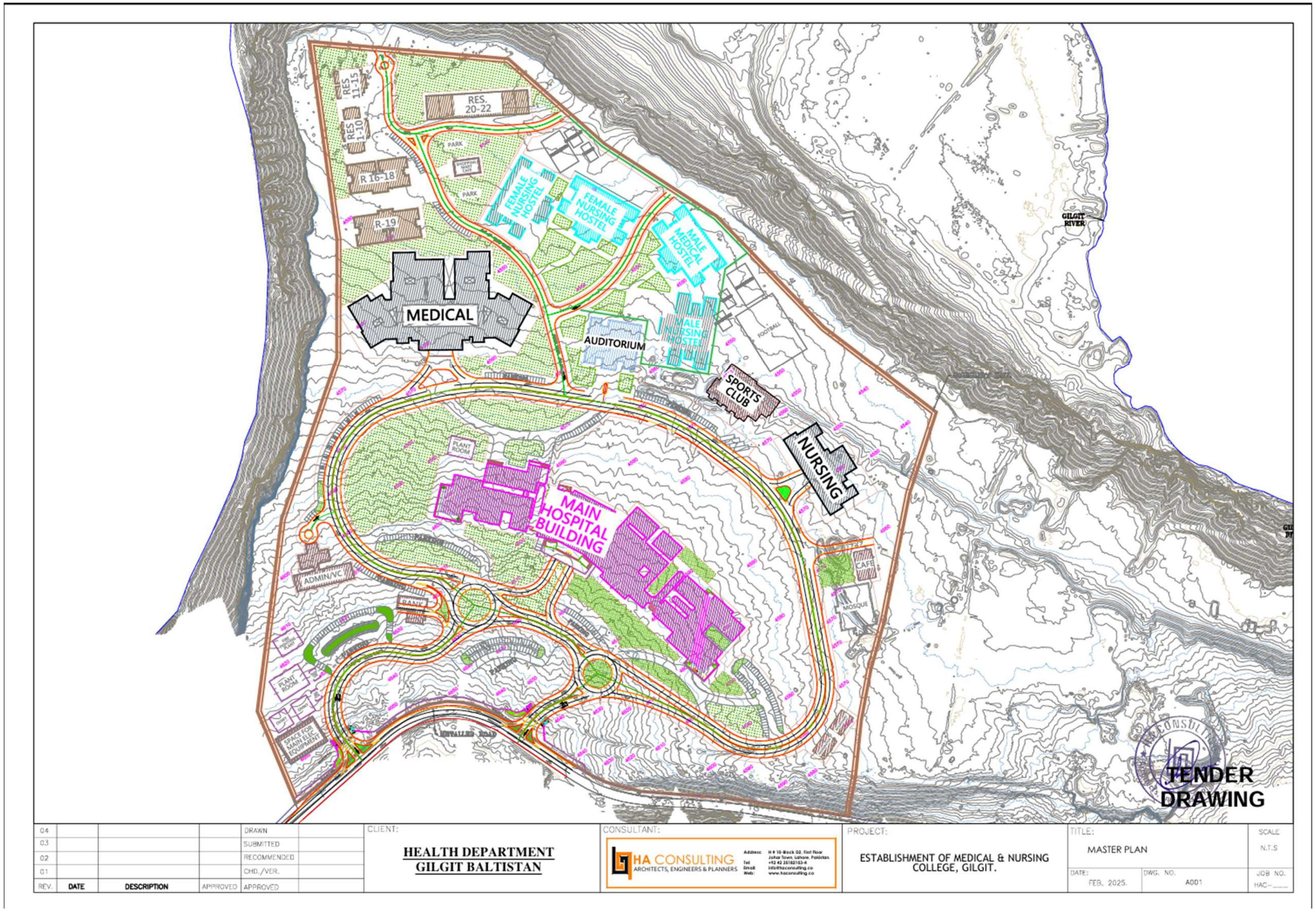


Figure 9 Design of the Project

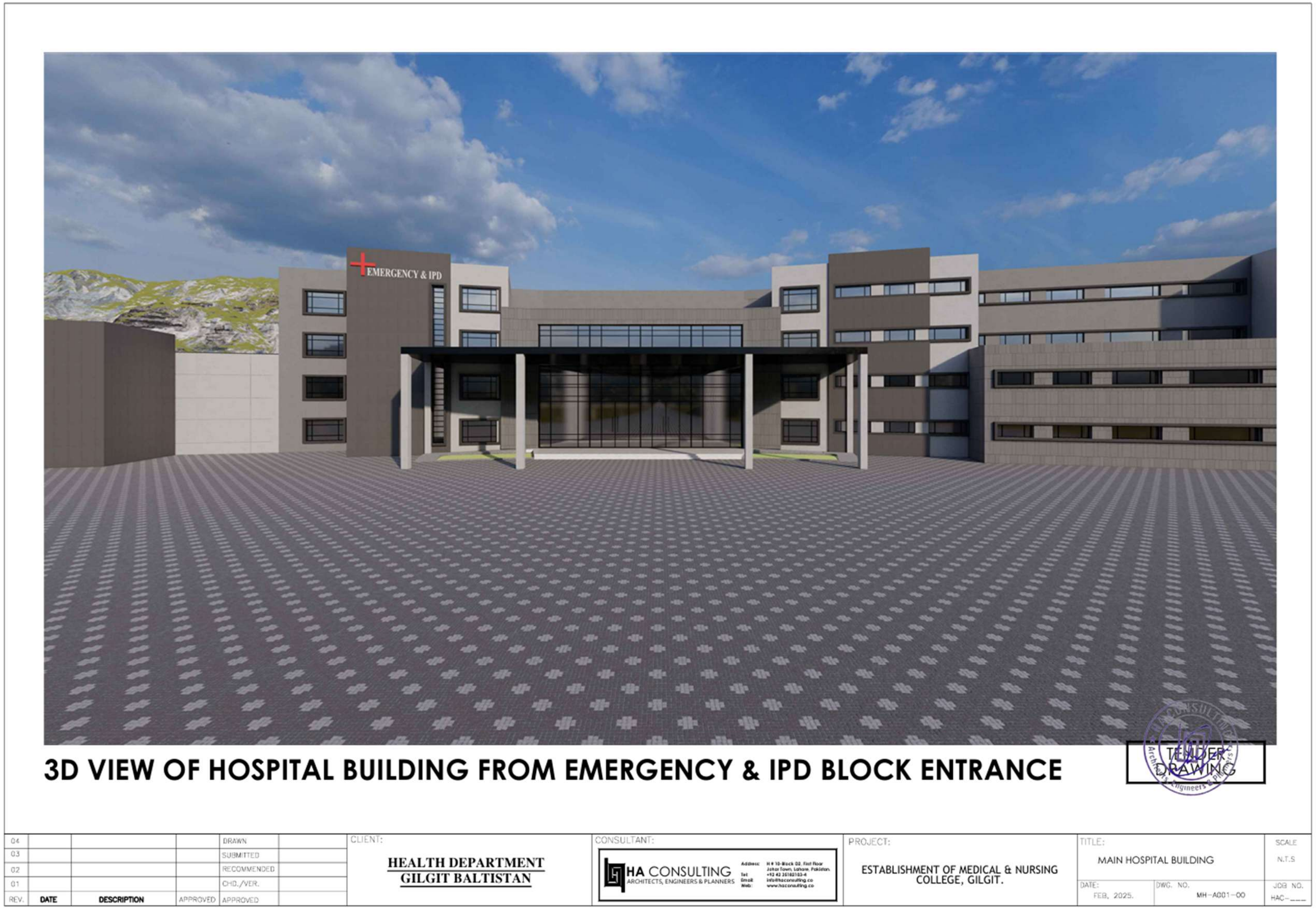


Figure 10 3D View of Hospital Building from Emergency and IPD block Entrance

4. Analysis of Project Alternatives

4.1. Introduction

An essential component of the Environmental Impact Assessment (EIA) process is the Analysis of Alternatives, which ensures that all reasonable options are explored before selecting the preferred project design and site. This chapter presents a comparative evaluation of the project alternatives considered during the planning phase of the Medical and Nursing College in Gilgit, including site selection, design layout, and waste management systems. It also justifies the choice of the final site and design from environmental, social, and technical perspectives.

4.2. No Development Option

The No Development Option implies that the proposed Medical and Nursing College project would not be implemented at all. While this alternative would result in no environmental disturbance, it would also mean forgoing a critical and much-needed investment in the region's health and education infrastructure.

If the project does not proceed:

- The local community would continue to suffer from a lack of accessible and affordable medical education and services.
- Healthcare facilities would remain overstretched, and patients would continue traveling to cities such as Islamabad and Peshawar for treatment.
- The opportunity to generate employment across skilled, semi-skilled, and unskilled sectors would be lost.
- There would be no economic boost from construction activities, procurement, or institutional development.
- The existing challenges of maternal mortality, non-communicable diseases, and a shortage of medical professionals would persist or worsen.

The project has strong public support and is aligned with regional and national development goals. Not pursuing this development would deny the local population basic healthcare and professional education opportunities, which are essential for long-term socio-economic growth.

Conclusion: The No Development Option is not considered viable, as it contradicts the region’s pressing health, education, and employment needs. Proceeding with the project, therefore, offers significantly more long-term benefits than environmental concerns arising from project implementation.

4.3. Site Alternatives

4.3.1. Option 1: Chilmish Daas (Initially Conceived Site)

Chilmish Daas was the first site considered for the establishment of the Medical and Nursing College. Although it offered a large area with open terrain:

- Environmental concerns included risks of seasonal flooding and poor soil stability.
- Accessibility issues were flagged due to its distance from the main highway and limited road infrastructure.
- Land ownership and utility mapping complexities delayed preliminary clearances.

Due to these cumulative challenges, the site was dropped after initial review.

4.3.2 Option 2: Sultanabad

Sultanabad was the second proposed site. It is situated closer to Gilgit city and offered relatively better connectivity. However:

- Land disputes emerged during the early planning phase. Multiple parties laid claim to portions of the land, making legal clearance uncertain.
- Community concerns about displacement and land rights created social tensions.
- These issues introduced the risk of significant project delays, legal challenges, and increased costs.

Therefore, Sultanabad was also excluded from consideration.

4.3.3 Option 3: Minawar (Selected Site)

Minawar was selected as the final and preferred site due to the following advantages:

- Government-owned land, free from encroachments and disputes, simplifying acquisition.
- Located directly along the Karakoram Highway (KKH) with excellent connectivity.
- Safe distance from the Gilgit River, reducing the risk of flood hazards.
- Relatively flat and stable terrain, confirmed suitable for construction through geotechnical and topographical investigations.
- Away from dense settlements, minimizing social and noise-related conflicts.
- Sufficient land availability (500 kanal) for future expansion, including the development of a full-fledged teaching hospital in Phase II.

Conclusion: Minawar emerged as the most environmentally, socially, and technically feasible option for long-term development.

4.4. Design and Layout Alternatives

Two primary design concepts were considered:

Option A: Vertical Compact Design

- Features multi story academic blocks and vertically stacked facilities.
- Pros: Smaller physical footprint, possibly lower infrastructure costs.
- Cons: Increased seismic vulnerability, higher operational complexity, less accessible for patients and students.

Option B: Horizontal Zoning (Preferred)

- Spreads facilities over multiple blocks in a zoned layout: academic, residential, utilities, green space.
- Pros: Safer in seismic conditions, easier access, allows phased construction, better traffic and service flow.
- Cons: Larger land requirement and extended utility network.

Conclusion: Horizontal zoning was selected for its operational benefits and alignment with local terrain, safety considerations, and long-term campus vision.

4.5. Hospital Waste Management Alternatives

Option 1: Municipal Collection and Disposal

- Relied on local municipal services for hospital waste management.
- Not viable due to lack of specialized infrastructure, low capacity, and environmental risks.

Option 2: On-Site Segregation, Incineration, and Sanitary Landfill (Preferred)

- Aligns with WHO guidelines and Hospital Waste Management Rules 2005.
- Includes color-coded segregation, dedicated incinerator, and separate transfer of non-risk waste.
- Minimizes public health risks and fulfills Stockholm and Basel Convention obligations.

Conclusion: On-site waste handling with controlled incineration and local landfill disposal was selected as the environmentally safest and most compliant method.

4.6. Environmentally and Socially Preferred Alternative

After evaluating multiple options across site selection, design, and waste management, the current plan—construction at Minawar with horizontal layout and sustainable waste management infrastructure—is the most appropriate choice. It reflects an integrated balance between environmental protection, operational feasibility, and regional healthcare needs.

5. BASELINE ENVIRONMENTAL AND SOCIAL CONDITIONS

5.1. General

This section outlines the baseline conditions of the Study Area, covering the existing physical, ecological, and socio-economic aspects of the environment. The information presented has been obtained through a combination of desk-based reviews of existing data and the collection of primary data during field visits to the Study Area and consultations with relevant offices.

5.2. Study Area

The Study Area for the proposed Medical and Nursing College project refers to the land and surrounding vicinity that may experience environmental or social changes during the project's construction and operation.

The primary area of concern is the 500 Kanal site located in Minawar, Gilgit, which has been officially allocated for the development of the college. This land is government-owned, uninhabited, and relatively flat, making it suitable for construction without the need for any resettlement. The site lies adjacent to the Gilgit-Skardu Road, providing convenient access for construction and future institutional activities.

In addition to the project site, the immediate surroundings form part of the study area. These include nearby settlements, existing infrastructure such as access roads, and any local utilities or services that may be directly or indirectly influenced by project activities. While the project does not involve any displacement or acquisition of inhabited areas, it is important to understand how the project may interact with the nearby community in terms of traffic, noise, and resource usage.

This study area has been identified based on the nature and scale of the project and is used to assess baseline environmental and social conditions such as topography, climate, land use, and socioeconomic context. It helps ensure that any potential impacts are properly identified and addressed through appropriate mitigation measures.

5.3. Physical Environment

Understanding the physical environment of the project site is essential for assessing potential environmental impacts during the construction and operational phases of the Medical and Nursing College in Minawar, Gilgit. The physical environment includes topography, geology, and seismic conditions, which influence the feasibility, safety, and sustainability of the proposed development.

5.3.1. Topography

The proposed site is located in Minawar, a locality on the outskirts of Gilgit city, along the Gilgit-Skardu Road. The topography of the area is characterized by a gently undulating to slightly hilly terrain, with an elevation difference of approximately 120 feet across the site.

The total land area spans 500 Kanal, offering ample space for institutional buildings and future expansion, including a teaching hospital.

The site is relatively flat and uninhabited, which makes it suitable for large-scale construction activities without the need for major earthwork or land modification. Drainage patterns are natural, with no major water bodies or streams intersecting the core site, reducing the risk of waterlogging or flooding. The location offers scenic views of the surrounding hills and mountains, which also enhances its suitability for a serene academic and medical environment.

5.3.2. Regional Geology

Gilgit-Baltistan lies within the complex geological setting of the Himalayan orogenic belt, which is known for its dynamic tectonic history. The region is composed of various geological formations that include metamorphic rocks, sedimentary units, and igneous intrusions. In the broader regional context, the area comprises formations such as the Kohistan-Ladakh arc, the Indian Plate sediments, and melange zones associated with the collision of the Indian and Eurasian plates.

This geologically active region is characterized by rugged terrain, steep valleys, and high mountains. The presence of diverse rock types, including schist, quartzite, granite, and limestone, defines the regional lithology. These geological features are also responsible for shaping the landforms and influencing soil properties and stability in the Gilgit region.

5.3.3. Site Geology

At the project site level in Minawar, the geology is relatively stable and suitable for structural development. The surface geology predominantly comprises alluvial deposits, gravel, and coarse sand, which are common in river terrace and valley floor areas near Gilgit. These deposits are generally well-drained and offer moderate to good bearing capacity for construction.

Subsurface investigations and topographic surveys indicate no major geological constraints such as active fault lines, landslides, or sinkholes within the project boundary. However, standard geotechnical investigations are recommended prior to foundation design to confirm the depth of bedrock, water table levels, and soil compaction needs.

5.3.4. Seismicity of the Area

The project site lies in Zone 3 as per "Seismic Provisions 2007" of Building Code of Pakistan (BCP: SP, 2007). Keeping in view the seism tectonic set up of the Project Area and the degree of importance of the structures of the proposed project, it is recommended that the structures should be designed to withstand horizontal peak ground acceleration (PGA) of 0.24g to 0.32g.

This PGA has 10% probability of exceedance in 50 years.

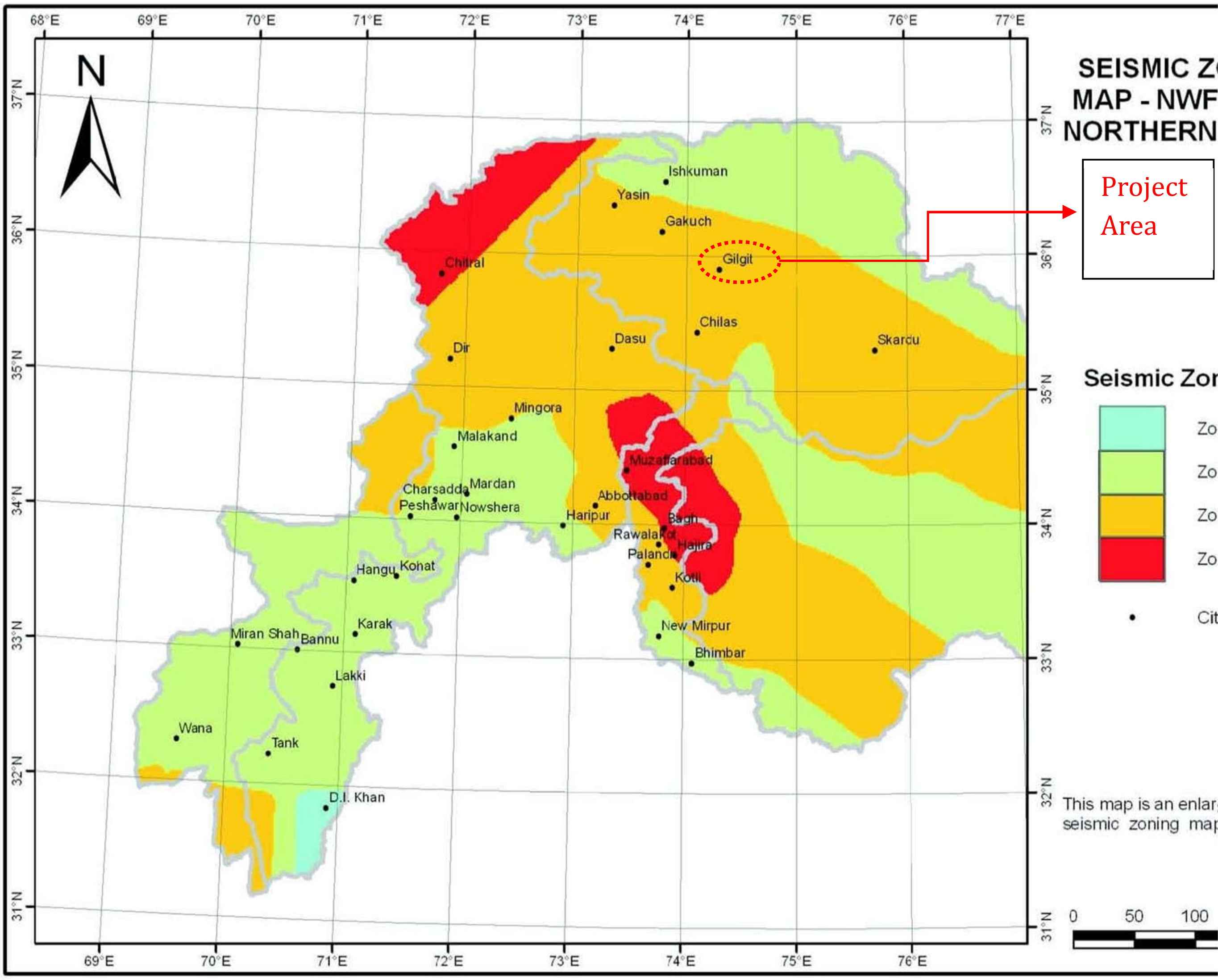


Figure 11 Seismicity of the Area

The climate of Gilgit is predominantly cold, with winter lasting for about eight to nine months of the year. This extended winter season significantly influences the region's overall weather patterns and environmental conditions. Gilgit District is surrounded by glaciers, and a large portion of the river flow in the region originates from glacial melt, which makes water availability highly seasonal and sensitive to temperature variations. As a result, river discharge levels can fluctuate drastically, potentially affecting the stability of nearby landscapes, especially in areas close to water channels.

According to future projections by Global Climate Models (GCMs), temperatures in Gilgit could rise by up to 7°C by the end of the 21st century. This anticipated increase in temperature poses serious implications for glacial melt rates, water resources, and ecological stability in the region.

The nearest meteorological station is located in Gilgit, and relevant climatic data has been collected from the Gilgit-Baltistan Environmental Protection Agency (GB-EPA). The region experiences cold winters and warm, dry summers. In lower valleys, summer temperatures can become quite high, while higher altitudes remain comparatively pleasant during this season. Detailed climate parameters including temperature, rainfall, and humidity are discussed in the following subsections.

5.3.5.a. *Temperature:*

The region experiences significant temperature variations between seasons. December is typically the coldest month, with the lowest recorded mean minimum temperature of -6.8°C, observed in 1999. In contrast, July is the hottest month, during which the mean maximum temperature reached 39.7°C, recorded in 1990.

Historical climate records from 1984 to 2013 provide a comprehensive overview of the region's temperature trends. Detailed mean monthly temperature data for this period is included in Annex-2, while annual temperature summaries are presented in Table 16. This datasets help illustrate the seasonal patterns and long-term climate behavior of Gilgit.

Table 16 Mean Annual Temperature of Gilgit since 1984-2013

S. No	Year	Annual
1	1984	23.5
2	1985	24.2
3	1986	22.7
4	1987	23.3
5	1988	24.6
6	1989	22.6
7	1990	24.9
8	1991	23.3
9	1992	23.3
10	1993	24.2
11	1994	24
12	1995	23.7
13	1996	23.5
14	1997	24.8
15	1998	25
16	1999	24.8
17	2000	25.3
18	2001	25.9
19	2002	25
20	2003	24.3
21	2004	24.8
22	1005	24
23	2006	24.5
24	2007	25

25	2008	25
26	2009	23.9
27	2010	24.2
28	2011	24.8
29	2012	23.6
30	2013	25

Source: Gilgit-Baltistan Environmental Protection Agency

5.3.5.b. Rainfall

Rainfall in the region primarily occurs during the monsoon season, with July and August receiving the highest precipitation levels. These months typically contribute the bulk of the annual rainfall due to seasonal monsoon patterns.

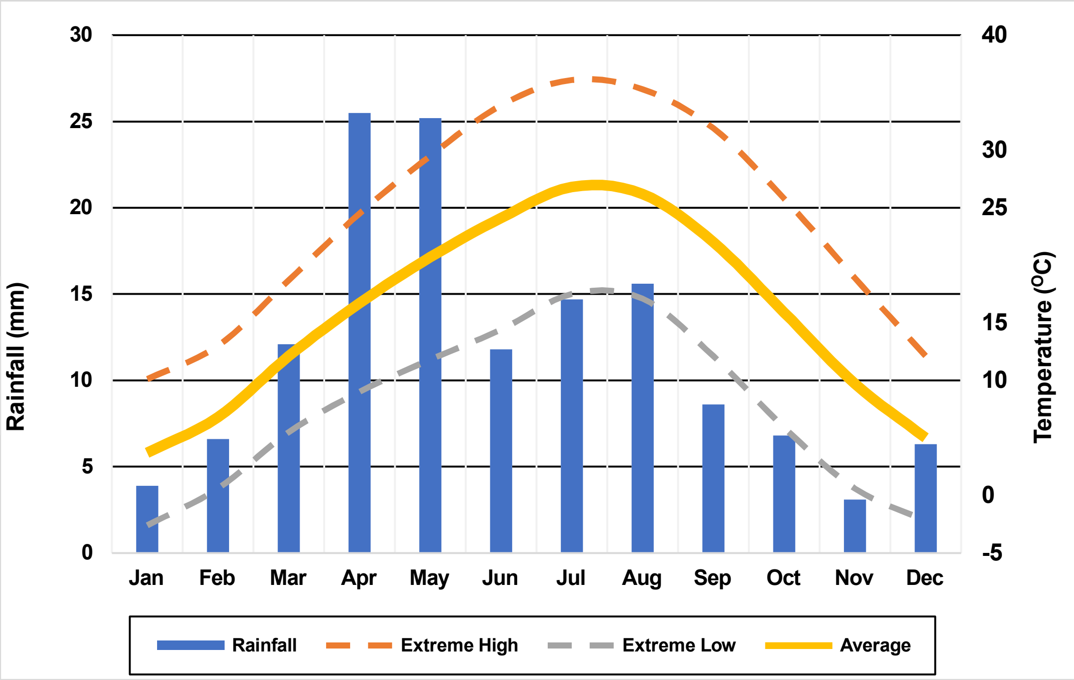
The monthly rainfall variations for the years 1984 and 2013 are provided in Annex-2 for reference. Additionally, the annual mean rainfall data is summarized in Table 17, offering a clearer understanding of long-term precipitation trends in the area.

Table 17 Mean Annual Rainfall in Gilgit since 1984-2013

S. No	Year	Annual
1	1984	104.7
2	1985	101
3	1986	133.6
4	1987	199.4
5	1988	136.2
6	1989	159.6
7	1990	89.3
8	1991	118.4
9	1992	94.3
10	1993	94.6
11	1994	119.2
12	1995	108.3
13	1996	251.7
14	1997	128.7
15	1998	167.9
16	1999	206.8
17	2000	97.2
18	2001	88
19	2002	112.4
20	2003	225.6
21	2004	147.1
22	1005	149.8
23	2006	132.6
24	2007	84.3
25	2008	170.7
26	2009	141.1
27	2010	267.5

28	2011	158.7
29	2012	147.4
30	2013	153.5

Source: Gilgit-Baltistan Environmental Protection Agency



Source: Gilgit-Baltistan Environmental Protection Agency

Figure 12 Monthly mean Temperature and Rainfall Trends at Gilgit

Wind speed and direction data for the region are recorded daily at 1200 and 0000 UTC. Based on these recordings, monthly mean wind speeds have been calculated for the years 1984 to 2013, and the data is provided in Annex-3, with measurements expressed in knots.

To give a broader picture, the annual mean wind speeds for the same period are presented in Table 4-6 to Table 4-8. This information is useful in assessing the potential environmental impacts related to air movement, dust dispersion, and construction-related emissions in the project area.

S. No	Year	Annual
1	1984	1.8
2	1985	1.7
3	1986	2
4	1987	2.1
5	1988	1.6
6	1989	2
7	1990	1.5
8	19912	118.4
9	1992	1.6
10	1993	1.7

11	1994	1.9
12	1995	1.5
13	1996	1.3
14	1997	1.6
15	1998	1.5
16	1999	1.9
17	2000	2.5
18	2001	2.3
19	2002	1.9
20	2003	2
21	2004	2.2
22	1005	2.1
23	2006	2.6
24	2007	2.4
25	2008	2.6
26	2009	2.3
27	2010	1.4
28	2011	2.4
29	2012	3.3
30	2013	2.3

Source: Gilgit-Baltistan Environmental Protection Agency

Mean Wind Direction at Synoptic Hours (0000 UTC)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1984	S23E	S45E	S67E	W	N77W	S6E	S40E	S23W	S45E	W	W	W
1985	S67W	N72W	S31W	E	S34E	W	S56E	S37W	E	S67W	S18W	S45W
1986	S66W	S73W	N10W	W	S83W	S	S45W	N	S45W	CALM	S	N23E
1987	S73W	W	S38E	S45E	S75E	W	S45W	W	N45E	W	S38W	S73W
1988	N87W	N80W	N56W	S68W	S70W	CALM	S52W	N84W	S62W	S74W	S66W	N23W
1989	S45W	W	N87W	S70W	N74W	S29E	S63W	W	W	S18E	W	N82W
1990	S28W	S45W	N45W	S45E	S45W	S76W	S56E	S20E	S68E	N	S45W	S67E
1991	S75W	N82W	N78W	N45E	W	S18E	N75E	S45W	S60W	S23W	CALM	S23W
1992	S3E	N85W	S45W	S69W	N67W	S64W	S78E	S9E	S66W	S45W	CALM	CALM
1993	S58W	N15E	S66W	S12W	N75W	N38W	S55W	S18W	S45W	S60W	S23W	S34W
1994	S74W	S82W	S68W	S23W	S11W	S45W	S45W	S23E	S45E	W	W	N76E
1995	CALM	S	W	S45W	N23W	N45W	S45W	S	S23E	N45W	CALM	S28W
1996	W	N50W	S41E	S27E	S5E	S45W	W	N23E	E	N77W	CALM	N45W
1997	W	S72E	N36E	S45E	S45W	N45W	S45E	S	S45W	CALM	E	CALM
1998	E	W	N66W	W	S41E	S57W	S45E	CALM	S27W	S66W	CALM	CALM
1999	W	W	N24W	W	S23W	S45E	S41E	S56E	W	W	W	W
2000	W	S85W	S71W	S45W	E	S38W	S45W	CALM	S38W	CALM	W	W
2001	S	S75W	N	N45E	E	W	CALM	E	E	W	CALM	CALM
2002	CALM	CALM	S	E	N45E	W	W	CALM	S60W	CALM	W	CALM
2003	CALM	N45E	S	W	CALM	N60E	CALM	S66W	W	N45W	CALM	CALM
2004	W	S76W	S77W	W	S45W	E	S45E	CALM	S23E	S45W	CALM	W
2005	W	CALM	S	N45W	E	W	CALM	S60W	CALM	W	CALM	CALM
2006	CALM	CALM	N14E	CALM	W	CALM	S80W	N45W	S75W	W	CALM	N45E

2007	CALM	W	CALM	N82W	S65W	N45W	W	S55W	N45W	S45E	CALM	CALM
2008	S68W	S68W	N63W	S16E	CALM	CALM	S75E	CALM	CALM	W	S45E	S57W
2009	S83W	W	S72W	CALM	E	S75E	N62E	E	S67W	W	CALM	S82W
2010	W	CALM	E	N45W	E	CALM	CALM	CALM	S62W	CALM	CALM	CALM
2011	CALM	CALM	W	S45E	W	N68E	E	S62E	N79W	CALM	W	CALM
2012	W	S45W	W	S45W	E	S23E	S45E	W	W	W	W	S63W
2013	S	S45E	S45W	E	E	E	CALM	CALM	CALM	CALM	CALM	CALM

Source: Gilgit-Baltistan Environmental Protection Agency

5.3.5.d. Relative Humidity

Relative humidity data for the project area is recorded daily at 0000 UTC to capture atmospheric moisture conditions during early hours. This consistent monitoring supports the assessment of seasonal and annual humidity trends.

The collected data is compiled in Annex-2 for reference. Furthermore, the annual mean relative humidity recorded at 0000 UTC for the years 1984 to 2013 is presented in Table 18, providing valuable insight into the region's typical moisture levels and their relevance for construction activities and human comfort.

Table 18 Mean Annual Relative Humidity at 0000 UTC (%)

Sr. No	Year	Annual
1	1984	----
2	1985	70.4
3	1986	76.9
4	1987	81.6
5	1988	80.4
6	1989	78.6
7	1990	77.3
8	1991	80.4
9	1992	77.9
10	1993	78.3
11	1994	80.8
12	1995	78.4
13	1996	79.7
14	1997	76.4
15	1998	77.3
16	1999	76.4
17	2000	73.3
18	2001	73.2
19	2002	78
20	2003	80.5
21	2004	78.1
22	2005	80.9
23	2006	78.9
24	2007	76.3
25	2008	76.7

26	2009	76.1
27	2010	80.8
28	2011	77.9
29	2012	73.9
30	2013	75.6

Source: Gilgit-Baltistan Environmental Protection Agency

5.3.5. Water Resource

5.3.2.a. Water Demand

Water is one of the most critical resources in the construction and operational phases of a medical and nursing college, especially when it includes a 150-bedded hospital. The importance of water in this project spans across multiple dimensions, including construction processes, operational sustainability, hygiene, and environmental protection.

5.3.2.b. Surface Water

There is no surface water flowing through the project site.

5.3.2.c. Ground Water:

The primary source of water in the project area is groundwater, typically available at depths of up to 15 meters. It has been observed that deeper boreholes tend to yield higher-quality water, especially in terms of potability. In alignment with this finding, the proposed Medical and Nursing College in Gilgit will install deep bore wells to extract groundwater for use during both the construction and operational phases. To evaluate the safety and suitability of local water resources, three water samples were collected and analyzed in accordance with World Health Organization (WHO) and National Environmental Quality Standards (NEQS): (i) groundwater drawn from a borehole near the project site, (ii) water collected from a nearby community supply scheme tank, and (iii) river water collected from the Gilgit River.

S. No	Sample	Coordinates
1	Groundwater sample (Boring)	Lat: 35.8687 Long: 74.4538
2	Community supply scheme tank	Lat: 35.8704 Long: 74.4324
3	River Sample (Near Project site)	Lat: 35.8586 Long: 74.5162

The bore well sample, extracted from a location in close proximity to the Area of Influence (AOI), demonstrated excellent quality. It met all WHO and NEQS guidelines for both physicochemical and microbiological parameters. The sample showed a neutral pH of 7.2, low Total Dissolved Solids (TDS) at 130 ppm, and minimal salinity (131 mg/L). Importantly, no E. coli or Fecal Enterococci were detected, confirming its microbiological safety. These results establish the bore well as a fit and dependable source of water for all intended hospital uses, including drinking, sterilization, patient care, and general hygiene.

The river water sample also conformed to acceptable chemical limits, with a pH of 7.5 and TDS of 199 ppm. However, the turbidity was extremely high (401 NTU), and microbiological contamination was severe, with both E. coli and Fecal Enterococci found in quantities Too Numerous To Count (TNTC). Despite this, the project design includes a provision to uplift river water for domestic non-potable purposes such as toilet flushing, cleaning, and landscaping. To safely utilize this resource, the project must incorporate appropriate treatment infrastructure, including sedimentation tanks, filtration units, and disinfection mechanisms, prior to use.

The water sample from the community supply scheme tank, while chemically compliant (pH 7.4 and TDS 182 ppm), also exhibited excessive microbial contamination. Both E. coli and Fecal Enterococci were detected at TNTC levels, rendering the water unsafe for any use without proper treatment. However, since the current project does not include any provisions for utilizing the supply scheme water, it is excluded from the planned water management strategy for the college.

In conclusion, based on current analytical evidence, deep bore well water located near the AOI will serve as the primary and reliable source for potable and clinical applications. River water may be used for non-potable functions only after appropriate treatment. The supply scheme water is not intended for use under the project scope due to both its current microbiological condition and lack of infrastructure provision. (Report Annex 5)

Table 19: Water Quality Testing Report

S. No.	Parameter	Bore Sample	Supply Scheme Sample	River Sample	WHO/NEQS Limits
1	pH	7.2	7.4	7.5	6.5 – 8.5
2	Electrical Conductivity (µS/cm)	254	364	401	≤ 1000 µS/cm
3	Total Dissolved Solids (TDS) (ppm)	130	182	199	< 400 ppm
4	Salinity (mg/L)	131	178	196	< 600 mg/L
5	Turbidity (NTU)	0.91	0.53	401	< 5 NTU

6	Total Hardness (mg/L)	23 (Soft)	45 (Soft)	60	0 – <60 mg/L (Soft)
7	Calcium Hardness (mg/L)	9 (Soft)	27 (Soft)	34	0 – <60 mg/L (Soft)
8	Chlorides (mg/L)	1.4	2.1	4.3	< 250 mg/L
9	Nitrite (mg/L)	0.1	0.1	3.5	< 1 mg/L
10	Sulphate (mg/L)	0.9	1.8	2.9	< 250 mg/L
11	*E. coli* (CFU/100 mL)	0	TNTC	TNTC	0 CFU/100 mL
12	Fecal Enterococci (CFU/100 mL)	0	TNTC	TNTC	0 CFU/100 mL

5.3.6. Ambient Air Quality:

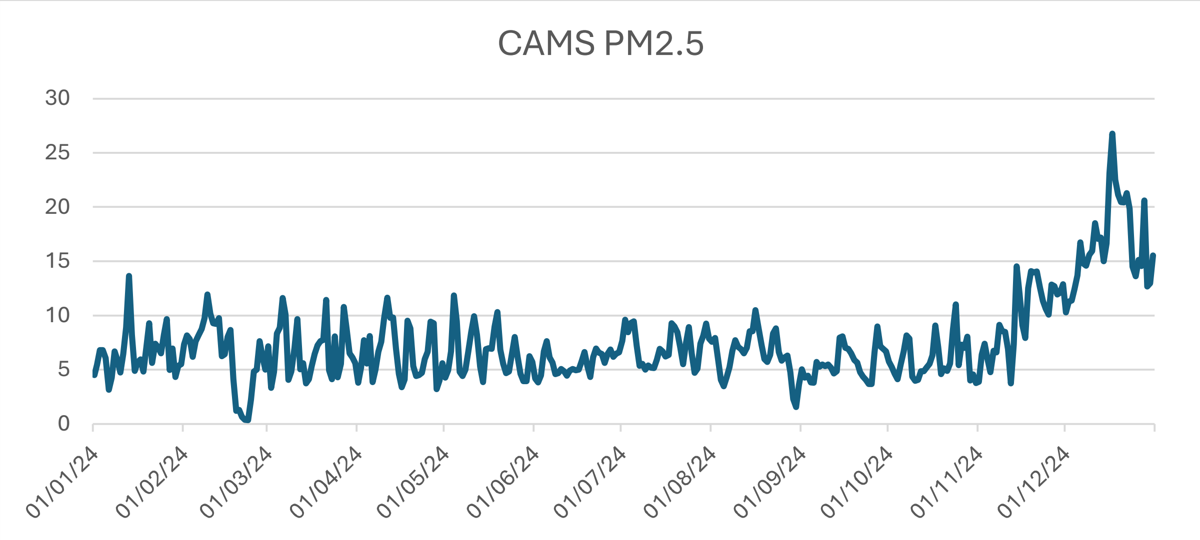
The air quality in the project area—Minawar, Gilgit—is generally considered to be good to moderate, owing largely to its rural and mountainous setting in Gilgit-Baltistan. The natural ventilation provided by the region's topography, including frequent wind movement, helps disperse air pollutants and maintain better ambient air conditions compared to urban centers.

However, in recent years, localized air quality stressors have emerged, primarily due to increased vehicular traffic along the Gilgit-Skardu Road, which borders the project vicinity. Additional contributors to air pollution in the area include the use of diesel generators, emissions from construction machinery, and solid waste burning, particularly during winter months when alternative heating is sought.

While there is no permanent ambient air quality monitoring station in the area, visual assessments and consultations with local stakeholders suggest the absence of any major pollution hotspots near the project site. Nevertheless, short-term degradation in air quality is anticipated during the construction phase of the Medical and Nursing College, driven by dust emissions, exhaust from construction vehicles, and material handling operations.

Remote Sensing-Based Air Quality Analysis

To complement the qualitative assessment, satellite-derived PM2.5 data from the Copernicus Atmosphere Monitoring Service (CAMS) was analyzed using Google Earth Engine for the year 2024, centered on the coordinates 35.8586°N, 74.5118°E. The graph below represents the daily PM2.5 concentration levels recorded throughout the year:



As evident from the graph:

- PM2.5 concentrations remained generally below 10 µg/m^3 for most of the year, indicating relatively good air quality.
- A notable upward trend in PM2.5 begins around late October 2024, peaking in December, likely due to seasonal heating, inversion conditions, and increased combustion of biomass or fossil fuels.
- These seasonal spikes may also be influenced by regional atmospheric transport of pollutants or stagnant meteorological conditions that limit pollutant dispersion

Recommendations

To mitigate potential air quality impacts during construction, the following measures are essential:

- Implementation of dust suppression practices (e.g., water spraying on haul roads and dry surfaces).
- Maintenance of construction machinery to minimize exhaust emissions.
- Scheduling heavy-duty construction activities during favorable weather conditions (low wind stagnation, higher dispersion).
- Use of low-emission fuels and restricting open burning on or near the construction site.

5.3.7. Background Noise

The project site in Minawar, Gilgit is located in a semi-rural setting, with relatively low levels of human activity and traffic. As such, ambient noise levels in the area are generally low and well within acceptable limits for residential and institutional zones. The main sources of background noise include occasional vehicle movement on the Gilgit-Skardu Road, agricultural activities, wind movement, and natural sounds from the surrounding environment.

No heavy industries or large commercial centers are located near the proposed site, which contributes to the quiet and calm acoustic environment. During field visits, no significant sources of noise pollution were identified, and local communities did not report noise-related concerns. This makes the site highly suitable for the establishment of a Medical and Nursing College, where a peaceful environment is essential for academic and healthcare activities.

However, during the construction phase, noise levels are expected to increase temporarily due to the use of construction machinery, transport vehicles, and material handling operations. These impacts will be localized and time-bound, primarily occurring during daytime hours. It is recommended that standard noise control measures such as equipment maintenance, restriction of high-noise activities to daytime, and installation of temporary sound barriers, if necessary, be implemented to ensure minimal disruption to nearby residents and the learning environment once operational.

5.3.8. Solid Waste and Solid Waste Management

The proposed site for the Medical and Nursing College in Minawar, Gilgit, is currently undeveloped and barren. During the environmental assessment and field surveys, no signs of existing solid waste or dumping activities were observed at or around the site. The land is free from residential or commercial encroachments, and there is no ongoing waste generation at present.

Given the current state of the land, the area offers a clean and favorable environment for the proposed development. However, it is anticipated that once the project enters the construction and operational phases, solid waste generation will increase. During construction, waste may include packaging materials, concrete debris, scrap metals, and other construction-related materials. Proper handling and disposal practices will be essential to prevent environmental degradation.

In the operational phase, the college will generate institutional waste, including paper, food waste, plastics, and in the future, biomedical waste when the attached hospital becomes functional. To address this, a Environmental and Solid Waste Management Plan (ESMP) is prepared in accordance with relevant national and local guidelines. This plan should include provisions for:

- Source segregation of waste (general, recyclable, biomedical).
- Safe storage and collection systems across the campus.
- Environmentally sound disposal methods, ensuring compliance with waste management regulations, including the Hospital Waste Management Rules, 2005 for medical waste.

Planning for proper waste management from the start will help maintain the site's current cleanliness and ensure that the institution operates in an eco-friendly and sustainable manner.

5.4. Ecological Environment:

The ecological environment of the project area includes the biological components and natural habitats within and around the site proposed for the Medical and Nursing College at Minawar, Gilgit. The assessment is based on field observations, existing environmental records, and consultations with local residents. The ecological features are relatively limited, as the project is located in a barren, sparsely vegetated area, with limited signs of significant biodiversity or wildlife presence.

5.4.1. Flora (Vegetation)

The project site itself is predominantly barren and rocky, with minimal natural vegetation due to the dry climate, poor soil fertility, and topographical elevation. The few plant species observed are xerophytic and drought-resistant, commonly found in the surrounding hills and disturbed areas. These include species such as:

- Artemisia spp. (wormwood)
- Thymus Linaris

Vegetation density is very low, with scattered bushes and ground cover mainly appearing during spring and early summer following seasonal precipitation. There are no forests or dense tree plantations within or immediately adjacent to the project area. However, cultivated plants and trees are found near settlements outside the project boundary.

The project's construction is not expected to significantly disturb any rare or endangered plant species, as none were identified during the ecological survey.

5.4.2. Fauna (Wildlife)

Due to the barren landscape and limited vegetation, the project area does not support a large population of terrestrial wildlife. No critical habitats, migratory corridors, or protected areas exist in or around the site. Wildlife species that may occasionally pass through or exist in the general area include:

- Indian fox (Vulpes bengalensis)
- Himalayan pika (Ochotona spp.)
- Rock pigeon (Columba livia)
- Sparrows, crows, and other common bird species

The presence of wildlife is relatively minimal and seasonal, depending on food availability and weather. No sightings of endangered or vulnerable species were recorded during field assessments, and none have been reported by local residents.

5.4.3. Agriculture

Agricultural activity is not practiced within the core project area due to its rocky and sloped terrain. However, subsistence-level farming exists in villages adjacent to the buffer zone, where communities grow crops such as:

- Wheat
- Barley

- Potatoes
- Seasonal vegetables

These agricultural patches are mostly irrigated using traditional water channels and streams sourced from nearby glaciers or springs. The project site itself will not disrupt any active farmland, though measures should still be taken to avoid contamination of irrigation water sources during construction.

5.4.4. Livestock

Livestock rearing is a common livelihood practice in the broader Minawar area, especially among rural households. While no grazing or herding activity was observed directly on the project site due to its lack of pasture, the surrounding villages rear livestock such as:

- Goats
- Sheep
- Cows
- Donkeys

These animals are usually grazed in seasonal highland pastures and nearby barren fields. Since the project footprint does not currently serve as grazing land, the development is unlikely to directly affect local livestock practices. However, movement of construction machinery and temporary site enclosures may require coordination with local herders to avoid inconvenience during the peak grazing months.

5.5. Socio-Economic and Cultural Environment

This section provides an overview of the socio-economic and cultural conditions within the Area of Influence (AOI) of the proposed Medical and Nursing College at Minawar, Gilgit. The information has been gathered through field visits, stakeholder consultations, and existing secondary data sources. Understanding these dynamics is essential to assess the project's impact on the local population and to promote inclusive and sustainable development.

5.5.1. Socio-Economic Aspects

The socio-economic landscape of the project area is reflective of a semi-urban setting, where communities rely on a mix of formal employment, small-scale agriculture, and informal trading. The area surrounding Minawar and Gilgit city shows improving access to infrastructure such as roads, schools, and healthcare services, although gaps remain in service quality and coverage, particularly in peripheral localities.

Education levels are gradually improving due to increased access to public and private schools, but higher education options—especially in medical and allied health sciences—remain limited within the region. This scarcity is one of the key motivations behind the proposed project. Local residents have expressed support for the establishment of a

Medical and Nursing College, anticipating better access to education, employment, and healthcare services.

Socially, the area demonstrates strong community cohesion, with cultural and religious values playing an important role in everyday life. Community organizations, village committees, and religious leaders often play a role in dispute resolution and public welfare initiatives.

5.5.2. Settlements of the Study Area / AOI

The core project site at Minawar is **uninhabited**, consisting of barren land allocated for institutional development by the government. However, several residential settlements lie within the **1-kilometer buffer zone** around the project site. These include:

- **Minawar Village** (the nearest major settlement)
- **JalalAbad (Next to Gilgit River)**
- **Chamugarh (Next to Gilgit River)**
- **Danyore Town**
- **Parts of Gilgit city periphery**

These communities are primarily composed of extended families living in traditional-style homes. Access to basic services such as electricity, water supply, and sanitation varies but has improved in recent years through public investment. Communities in the area maintain a traditional lifestyle with strong cultural roots, yet they are welcoming of development projects that bring opportunities for their youth and local economy.

5.5.3. Administrative Setup

Administratively, the project area falls under the Gilgit District, which is part of the Gilgit Division of Gilgit-Baltistan. The district is governed by the Deputy Commissioner and supported by Assistant Commissioners and Union Council-level administrations.

Local governance structures include:

- District Administration (for planning and public service delivery)
- Municipal Corporations (for urban areas like Gilgit)
- Village/Community Committees (informal but active in rural and semi-rural settings)

The area is also represented politically in the Gilgit-Baltistan Assembly, and decision-making related to development projects often involves coordination between district authorities, community leaders, and relevant government departments.

5.5.4. Demography

According to the latest available census and district data, Gilgit District has a population of approximately 330,000. The population in the immediate AOI (Minawar and adjacent areas) consists of both permanent residents and a growing number of seasonal laborers and students.

Key demographic characteristics include:

- Average household size: 6 to 8 members
- Literacy rate: Around 70% (higher in urban areas like Gilgit)
- Gender ratio: Fairly balanced, though male labor migration is common
- Languages spoken: Shina (majority), Burushaski, Urdu, and English (in official and educational settings)

Population growth is moderate, but demand for healthcare and educational services is on the rise, especially due to increasing awareness and urban expansion.

5.5.5. Economic Aspects

The local economy is driven by a mix of public sector employment, small businesses, agriculture, and remittances. In Gilgit city and nearby areas, many people are employed in:

- Government offices
- Educational institutions
- Health departments
- NGOs and development projects

Minawar itself is more rural in nature, with economic activities based on:

- Small-scale agriculture (subsistence farming)
- Livestock rearing
- Construction labor
- Transportation services

The introduction of the Medical and Nursing College is expected to stimulate the local economy by creating direct employment (construction and operations), indirect jobs (hospitality, transport, retail), and long-term educational benefits. It will also reduce the economic burden on families who currently send students to other cities for medical education.

5.6. Religious, Archaeological, and Cultural Aspects

The region of Gilgit-Baltistan, including the Minawar area, is historically rich and culturally vibrant. However, the specific site selected for the proposed Medical and Nursing College is relatively barren and undeveloped, with no direct indication of religious, archaeological, or culturally significant resources present on-site. The following subsections describe the relevant context in detail.

5.6.1. Religious Aspects

The population around the project area predominantly practices Islam, and the community includes various sects living in harmony. Religious values are deeply embedded in daily life, with mosques serving as not only places of worship but also centers for social gathering and community decision-making.

There are no religious structures (mosques, shrines, or graveyards) located within the boundaries of the proposed project site. The nearest places of worship are located within the settlements of Minawar, Pari Bangle, Oshkhandas, Jalalabad and Danyore, at a sufficient distance from the construction zone. As such, the proposed project is not expected to interfere with any religious practices or infrastructure.

However, the construction activities will be scheduled in consideration of prayer timings and religious observances (e.g., Friday prayers, Ramadan), and noise and dust control measures will be enforced to minimize any indirect disturbance to nearby communities.

5.6.2. Archaeological Aspects

Gilgit-Baltistan is home to several renowned archaeological sites, including Buddhist rock carvings and ancient fortifications, particularly along the ancient Silk Route. However, no known archaeological sites or protected historical monuments exist within or near the proposed project site at Minawar.

A physical inspection and field survey conducted during the initial environmental assessment revealed no signs of ancient structures, artifacts, or cultural remnants on the proposed construction land. Moreover, local community members confirmed that the area has not historically been used for burial grounds, sacred purposes, or cultural events.

Nevertheless, as a precaution, the contractor will be required to adopt a “chance-find procedure” during excavation. If any object of potential archaeological significance is discovered during construction, work will be halted, and the relevant heritage department will be immediately informed for assessment and guidance.

5.6.3. Cultural Aspects

The project site does not host any cultural gathering grounds, community halls, or traditional celebration points. Therefore, no cultural heritage or activity is expected to be disrupted by the project’s construction or operation.

The local community has shown a positive attitude toward the project, recognizing the potential for educational advancement, employment, and improved health infrastructure.

Culturally, the project aligns with community aspirations for modern development while respecting traditional values.

6. STAKEHOLDER CONSULTATIONS

6.1. Introduction

Stakeholder consultation is a critical component of the Environmental Impact Assessment (EIA) process. It ensures that the concerns, expectations, and insights of those potentially affected by the project are taken into account. Effective stakeholder engagement promotes transparency, fosters trust, and helps in identifying potential environmental and social impacts at an early stage. For the proposed establishment of the Medical and Nursing College in Minawar, Gilgit, various stakeholders were consulted, including local community members, relevant government departments, nearby residents, and representatives of civil society.

6.2. Objectives of the Consultation

The main objectives of the stakeholder consultation process were:

- To inform stakeholders about the scope, nature, and expected benefits of the proposed project.
- To gather information on local environmental, social, and cultural conditions.
- To understand community concerns and expectations regarding the project's implementation.
- To incorporate community input into the planning and decision-making process.
- To ensure the project is socially acceptable and environmentally sustainable.

6.3. Methodology

The consultation process included individual interviews, informal group discussions, Focus Group Discussion (FDG) and community meetings. These interactions were held both at the project site in Minawar and within surrounding communities. The consultation sessions were facilitated in local languages (Shina and Urdu), ensuring effective communication and maximum participation.

Key participants in the consultation process included:

- Local residents of Minawar village
- Local leaders and influential community members
- Nearby land users and business owners
- Representatives from the Gilgit-Baltistan Health Departments
- Forest Department, GB
- Irrigation and Water Management Department
- Gilgit-Baltistan Waste Management Company

- Environmental Officer, Planning and Development Department Gilgit-Baltistan
- Officials from the Gilgit-Baltistan Environmental Protection Agency (GB-EPA)

6.4. Summary of Stakeholder Feedback

The overall feedback from stakeholders was **positive**, with strong support for the project. The key concerns and suggestions raised are summarized below:

Table 20 Summary of Stakeholder consultation

Stakeholder Group	Key Concerns / Feedback
Local Residents	The local community welcomed the establishment of the Medical and Nursing College, recognizing it as a much-needed initiative to address the growing demand for quality healthcare and education in the region. Participants highlighted the importance of improving local access to medical services and training opportunities. They also emphasized the need for job creation, advocating for the inclusion of local residents in both construction-phase employment and post-construction operational roles within the college and its associated facilities. This was seen as a key factor in ensuring that the project contributes to the socio-economic upliftment of the Minawar area and the broader Gilgit-Baltistan region.
Community Leaders	During the community consultations, participants emphasized the importance of utilizing the local workforce and ensuring transparency in the recruitment process. It was strongly recommended that residents of Minawar be given employment priority, especially for positions in Basic Pay Scale (BPS) 1 to BPS 5, which should be exclusively reserved for local candidates. For BPS-5 and above, a merit-based selection process involving formal testing and interviews was advised to ensure fairness and equal opportunity. Additionally, stakeholders expressed concern over the extraction of construction materials, such as sand, stones, and gravel, particularly from areas outside the project site. They

	recommended that any such material sourced from within or outside the Minawar area should be subject to local taxation or applicable levies, ensuring that the economic benefits of the project are shared with the local community and that environmental impacts are minimized. Community members also suggested that, during the admission process for medical and nursing students, a special quota should be reserved for residents of Minawar. This would ensure that local youth benefit directly from the establishment of the college and are encouraged to pursue careers in healthcare, ultimately contributing to the sustainability and development of the region.
Health Department Officials – Director Health Services Planning and Procurement, Dr. Mubasher Hasan	Dr. Mubasher Hasan expressed his full support for the establishment of the Medical and Nursing College in Gilgit, acknowledging it as a vital development to strengthen healthcare services and education in the region. He emphasized the need to align the academic and operational aspects of the project with national health education standards, ensuring the college meets professional accreditation requirements and delivers quality education and healthcare. He highlighted the importance of effective waste management during both the construction and operational phases of the project. He stressed that all waste types must be handled and disposed of properly, with special attention to infectious medical waste, which should be incinerated following standard health and safety protocols to prevent health risks. While appreciating the inclusion of solarization in the project design as a step toward sustainable energy use, Dr. Hasan noted that reliance on diesel generators during nighttime construction could result in localized greenhouse gas (GHG) emissions. He advised that suitable environmental mitigation measures be incorporated into the construction plan to minimize emissions and environmental impact.

	Dr. Hasan also pointed out the need for clear and enforceable health and safety standards for construction workers. It was mutually agreed that these standards would be integrated into the project's bidding documents, ensuring that occupational health and safety of workers is a priority throughout the project lifecycle. Additionally, he confirmed that a Memorandum of Understanding (MoU) would be signed with the Gilgit-Baltistan Waste Management Company for the collection and proper disposal of both organic and inorganic hospital waste during the operational phase. Finally, Dr. Hasan reviewed the project design and confirmed that sewage and sullage (sewerage) waste generated from the facility would be disposed of through properly constructed soakage pits, as included in the project's design documents. This approach is expected to manage wastewater safely and minimize any environmental or public health risks.
Deputy Director Gilgit-Baltistan Environmental Protection Agency Department (GB-EPA) – Mr. Munawwar Hussain Mosvi	The Deputy Director emphasized the critical importance of strict adherence to environmental safeguards during all phases of the project, particularly during construction. It was highlighted that the proponent must ensure full compliance with the Gilgit-Baltistan Environmental Protection Act, 2014, and relevant IEE/EIA Regulations, 2024. The Department also advised that a comprehensive assessment of the project's potential impacts—including both the centroid (core zone) and the extent of expansion (area of influence)—must be thoroughly documented, with clear mitigation strategies. Regular monitoring and reporting will be essential to ensure environmental compliance and sustainability throughout the project lifecycle.
Divisional Forest Officer Gilgit – Mr. Imran Khan	Mr. Imran Khan, the Divisional Forest Officer Gilgit, shared his views on the environmental aspects of the proposed Medical and Nursing College project. He noted that no existing vegetation or

	plantations are present at the project site. However, he strongly emphasized the need to incorporate plantation activities within and around the project premises as part of the overall site development and environmental enhancement plan. He recommended that native and locally adaptable plant species be used for all landscaping and afforestation activities and assured that the Forest Department would facilitate the provision of such plant species to support the plantation drive. He also stressed the importance of improving green belts throughout the project area to enhance ecological balance, reduce dust pollution, and promote a healthier environment. Additionally, Mr. Khan highlighted the necessity of allocating a dedicated budget for public awareness campaigns focused on environmental conservation, tree plantation, and sustainable development practices to ensure community involvement and long-term success of green initiatives. Regarding wastewater management, the DFO expressed concern over the potential environmental impacts of improper sewerage disposal. He advised that sewage must be safely managed and should not be allowed to discharge into nearby Gilgit river. Proper distance should be maintained between wastewater disposal points and natural watercourses, ensuring that no effluents contaminate the river system.
Deputy Director, Irrigation and Water Management Department – Mr. Naqeeb Ahmad	Mr. Naqeeb Ahmad, Deputy Director of the Irrigation and Water Management Department, provided his technical input regarding the proximity of the proposed Medical and Nursing College to local water bodies. He informed that a River Protection Act is currently under review and is in the final stages of approval by the Gilgit-Baltistan Cabinet. Once enacted, the legislation will mandate that all construction activities maintain a minimum distance of 300 feet from any river or major watercourse.

	He emphasized that, under the upcoming law, any construction found within the 300-foot restricted buffer zone will be subject to dismantling. Therefore, he strongly recommended that no infrastructure or development activities be undertaken within this defined river buffer zone to ensure compliance with future legal requirements and avoid potential project disruptions. Additionally, Mr. Naqeeb stressed the importance of proper solid and liquid waste management throughout both the construction and operational phases of the project. He advised that all waste should be appropriately collected, treated, and disposed of to prevent any adverse impact on nearby water bodies and the overall environment.
Environmental Specialist, Planning and Development Gilgit-Baltistan. **Mr. Zarmast Khan & Mr. Irfan Ali**	Mr. Zarmast Khan and Mr. Irfan Ali, serving as Environmental Specialists at the Planning and Development Department, Gilgit-Baltistan, shared critical environmental recommendations regarding the proposed Medical and Nursing College project. They emphasized that a comprehensive effluent and discharge management mechanism must be integrated into both the construction and operational phases of the project. It was strongly recommended that no untreated wastewater or effluent should be allowed to enter nearby water bodies, particularly rivers, to safeguard aquatic ecosystems and prevent pollution. During the construction phase, they urged that construction debris, excess soil, and other materials must be carefully managed and properly disposed of at designated locations to prevent land and water contamination. The implementation of environmentally sound construction practices was recommended as a priority. Furthermore, they stressed the need to assess and clearly define the capacity and design of soakage pits that will be used for wastewater management. The soakage pit design should be based on expected load and soil absorption capacity, ensuring it can

	effectively handle effluent generated by the facility without causing overflow or seepage that could impact groundwater or surface water quality.
Manager, Gilgit-Baltistan Waste Management Company	The Manager of the Gilgit-Baltistan Waste Management Company (GBWMC) confirmed that the company will assume full responsibility for managing hospital waste upon the operationalization of the Medical and Nursing College Teaching Hospital. He expressed concerns over common deficiencies observed in hospital infrastructure across the region, particularly the absence of dedicated drainage systems in rooms and operation theaters (OTs), and the reliance on manual waste handling, which poses serious hygiene and safety risks. To mitigate these issues, he strongly recommended integrating a centralized drainage network to manage wastewater from post-cleaning activities in clinical areas. Additionally, he advised the incorporation of sealed, gravity-fed waste chutes within all multi-story blocks to allow direct and hygienic waste transfer to the ground floor, thereby minimizing corridor contamination. For the internal movement of waste, he suggested using a hook-arm garbage container system for transferring sealed bins to the Yellow Room or incinerator facility. These recommendations were acknowledged and should have been incorporated into the project's design, including updated internal waste flow mechanisms and sanitation infrastructure. As part of the action plan, it is proposed that a formal MoU be finalized with GBWMC before hospital commissioning, labeled chute and bin systems be installed, and pre-operational mock drills and training be conducted with relevant staff to ensure smooth implementation and regulatory compliance.

6.5. Addressing Community Concerns

In response to the concerns raised, the following measures have been proposed:

- Employment: Priority will be given to hiring local workers, especially for non-technical roles during construction and support staff roles post-construction.

- Environmental Safety: The project will comply with environmental standards related to dust control, waste management, and noise mitigation.
- Community Updates: A community liaison officer will be appointed to regularly share updates and address community concerns.
- Access and Mobility: Construction will be planned to avoid blocking access to homes, fields, or local roads.

Consultation with Community including Notable/s (Chairman of Youth Committe

Figure 13 Community consultation photographs

Table 21 Community representatives

S. No	Name	Cell No
01	Ansar	03555404010
02	Rahman Ullah	03555437530
03	Muhib Ullah	03555228005

04	Atif Nawaz	03474051373
05	Ismail	03554151960
06	Suhaib Ahmad	03495088128
07	Meraj Alam (Community Leader)	--------------------

6.6. Conclusion

The stakeholder consultation process confirmed that the proposed project is widely supported by the local community and government institutions. The feedback received has been carefully considered and integrated into the project planning and environmental management plan. Continued engagement with stakeholders will be maintained throughout the construction and operational phases to ensure inclusivity, transparency, and local ownership.

Consultation with Director Health Services Planning and Procurement

Consultation with Deputy Director Irrigation and Water Management

Consultation with District Forest Officer (DFO) Gilgit

Consultation with Climate Change Cell, Planning and Development Department

Consultation with Manager, Gilgit-Baltistan Waste Management Company

Consultation with Deputy Director, Gilgit-Baltistan Environmental Protection Agency

Figure 14 Consultation with Government stakeholders

7. ANTICIPATED IMPACTS AND MITIGATION MEASURES

7.1. Introduction:

The screening of potential environmental impacts is a crucial step in the environmental assessment process. It involves identifying, evaluating, and assessing the likely environmental and social impacts that could arise from the proposed Medical and Nursing College and its associated facilities throughout the design, construction, and operational phases. This chapter presents the identified impacts, assesses their significance, and outlines the corresponding mitigation measures to minimize or eliminate any negative effects.

The screening process ensures that the project complies with local, national, and international environmental regulations, and helps to integrate sustainable development principles into the planning and implementation phases. The identification of potential impacts and their mitigation measures ensures that adverse effects are minimized, and that the project contributes to the sustainable development goals of the region.

7.2. Impact Assessment Methodology

To evaluate the potential environmental and social impacts of the proposed Medical and Nursing College project, the following methodology will be used to assess the Likelihood and Consequence of each identified impact. This will help determine the Significance of the impact and guide appropriate mitigation measures.

7.3. Likelihood and Consequence of Impact

The table below defines the criteria for the Likelihood and Consequence of impacts. The likelihood refers to how probable it is that an impact will occur, and the consequence refers to the severity or extent of the impact.

a) Likelihood

The impact assessment requires assigning a value for both the likelihood and probability of an outcome occurring and the consequence or severity of a potential outcome. Based on the preassigned values, a matrix format is used to place the specific hazard within a specific location of the matrix. This location can then be used to determine impact score for that activity.

The likelihood or probability is given the following types and number:

S. No	Likelihood	Description
01	**Very Unlikely**	Rare event with less than 5% chance of occurrence.
02	**Unlikely**	Unlikely event with a 5-20% chance of occurrence.
03	**Likely**	Likely event with a 20-50% chance of occurrence.

04	**Very Likely**	Highly likely event with a 50-80% chance of occurrence
05	**Almost Certain**	Certain event with a greater than 80% chance of occurrence

b) Consequence

Next is the Consequence or severity, presented below:

S. No	Consequence/ Severity	Description
01	**Negligible**	No significant effect, minimal or no impact.
02	**Minor**	Slight impact with negligible lasting effects
03	**Moderate**	Noticeable impact, manageable with mitigation.
04	**Major**	Significant impact, requires serious mitigation
05	**Critical**	Unacceptable impact, requires immediate and major intervention.

Impact = Likelihood x Consequence Table

This table calculates the **Impact** by multiplying the **Likelihood** score by the **Consequence** score. The resulting number will help prioritize impacts and determine the necessary mitigation efforts.

Table 22 Likelihood and Consequence of Impact

Likelihood \ Consequence	1 - Negligible	2 - Minor	3 - Moderate	4 - Major	5 - Critical
1 - Very Unlikely	1	2	3	4	5
2 - Unlikely	2	4	6	8	10
3 - Likely	3	6	9	12	15
4 - Very Likely	4	8	12	16	20
5 - Almost Certain	5	10	15	20	25

- **Low Impact**: Score of 1-8 (No significant action required, routine monitoring)
- **Medium Impact**: Score of 9-15 (Moderate mitigation required)
- **High Impact**: Score of 16-25 (High mitigation required, major intervention needed)

Impact Significance		**Consequence**		
		High	**Medium**	**Low**
Likelihood	**High**	**Substantial/High**	**Substantial/High**	**Moderate/Medium**
	Medium	**Substantial/High**	**Moderate/Medium**	**Slight/Low**
	Low	**Moderate/Medium**	**Slight/Low**	**No Change**

7.4. Impact Assessment Matrix

The Impact Assessment Matrix will evaluate the potential impacts during the **Design**, **Construction**, and **Operational Phases** of the project. The following matrix highlights the **Impacts**, their **Likelihood**, **Consequence**, and **Mitigation Measures** for each phase of the project.

Design Phase:

Table 23 Impact Assessment Matrix during design phase

Activity	Likelihood	Consequence	Impact (Consequence x Likelihood)	Residual Impact
Land Use and Site Disturbance	Likely (3)	Major (4)	High	Minor (4)
Biodiversity Impact (Flora & Fauna)	Unlikely (2)	Moderate (3)	Low	Negligible (2)
Water Management Design	Very Likely (4)	Moderate (3)	Medium	Minor (3)
Air Quality (Dust from site prep)	Likely (3)	Moderate (3)	Medium	Minor (2)
Waste Generation (construction materials)	Very Likely (4)	Major (4)	High	Moderate (6)

Noise Pollution (site preparation)	Likely (3)	Major (4)	High	Minor (3)

Construction Phase:

Table 24 Impact Assessment Matrix during construction phase

Activity	Likelihood	Consequence	Impact (Consequence x Likelihood)	Residual Impact
Air Quality (Dust from construction)	Very Likely (4)	Major (4)	High	Moderate (6)
Noise Pollution (from equipment)	Very Likely (4)	Major (4)	High	Moderate (5)
Waste Generation (construction waste)	Almost Certain (5)	Major (4)	High	Moderate (7)
Water Use (from construction activities)	Likely (3)	Moderate (3)	Medium	Minor (3)
Soil Erosion (during earthworks)	Likely (3)	Major (4)	High	Moderate (5)
Traffic Disruption (movement of materials)	Likely (3)	Moderate (3)	Medium	Minor (3)
Water Pollution (runoff into water bodies)	Very Likely (4)	Critical (5)	High	High (8)

Operational Phase

Table 25 Impact Assessment Matrix during construction phase

Activity	Likelihood	Consequence	Impact (Consequence x Likelihood)	Residual Impact
Water Consumption (hospital)	Very Likely	Moderate	Medium	Low
Waste Management (hospital waste)	Almost Certain	Critical	High	High

Energy Consumption (electricity)	Very Likely	Major	High	Medium
Noise Pollution (hospital operations)	Likely	Moderate	Medium	Low
GHG Emissions (from generators)	Very Likely	Major	High	Medium
Employment (local hiring)	Almost Certain	Major	High	High
Water Quality (wastewater disposal)	Very Likely	Critical	High	High
Biodiversity Impact (planting trees)	Unlikely	Minor	Low	Very Low

7.5. Impact Assessment Matrix with Phase-Specific Explanations:

The Impact Assessment Matrix with phase-specific explanations provides a comprehensive evaluation of potential environmental and social impacts at each stage of the project—design, construction, and operation. It considers the likelihood and consequences of impacts during each phase, with activities analyzed separately for their specific risks. The initial impact rating reflects potential impacts before mitigation measures, while the residual impact indicates remaining impacts after mitigation strategies are applied. This approach ensures that each phase is addressed independently, allowing for targeted mitigation measures tailored to the unique risks of that phase, ultimately reducing negative impacts and ensuring the project's sustainability and compliance with environmental and social standards.

1. Land Use and Site Disturbance

Activity	Phase	Likelihood	Consequence	Impact (Likelihood x Consequence)	Mitigation Measures	Residual Impact

Land Clearing & Site Disturbance	Design	Likely	Major	High	Avoid land clearing in sensitive areas, plan minimal land use	Medium
Land Clearing & Site Disturbance	Construction	Very Likely	Major	High	Implement erosion control, limit land clearance, and preserve vegetation	Medium
Land Use (Ongoing)	Operation	Likely	Moderate	Medium	Implement green spaces, minimize footprint, and preserve surrounding natural areas	Low

Explanation:

- **Design Phase**: While direct land disturbance is not typical in the design phase, the planning and design decisions made at this stage influence the overall land use and site disturbance during construction. Proper planning minimizes land disturbance and avoids sensitive areas.
- **Construction Phase**: In the construction phase, significant land clearing and site disturbance will occur. This will have major consequences due to soil erosion, habitat destruction, and loss of vegetation.
- **Operation Phase**: The operational phase involves the use of the land for the medical and nursing college. Although the impact on land use is lower than in the construction phase, long-term use will still have moderate effects.

Activity	Phase	Likelihood	Consequence	Impact (Likelihood x Consequence)	Mitigation Measures	Residual Impact

Habitat Disturbance	Design	Unlikely	Moderate	Low	Avoid designing in sensitive biodiversity areas, preserve corridors	Low
Habitat Disturbance	Construction	Very Likely	Major	High	Limit land clearing, use fencing for wildlife protection, schedule work around breeding seasons	Medium
Habitat Disturbance	Operation	Unlikely	Minor	Low	Maintain green areas, plant native species, avoid disturbing local wildlife	Low

2. Biodiversity Impact

Explanation:

- **Design Phase**: The design phase influences how much biodiversity is affected by planning and site selection. It is unlikely that significant impacts occur, but poor design choices can indirectly harm biodiversity, especially in ecologically sensitive areas.
- **Construction Phase**: During construction, habitat loss and disruption to local wildlife will occur. This is highly likely given the nature of land clearing and infrastructure development. It is essential to mitigate the impact by limiting disturbance and timing construction activities.
- **Operation Phase**: Once operational, the project's impact on biodiversity will be relatively low, but ongoing operations, such as traffic and waste generation, may

have minor impacts on local wildlife. Maintaining green spaces and preserving surrounding natural areas can mitigate this.

3. Water Management

Explanation:

Activity	Phase	Likelihood	Consequence	Impact (Likelihood x Consequence)	Mitigation Measures	Residual Impact
Water Management Planning	Design	Very Likely	Major	High	Ensure comprehensive water management plans, include drainage systems and water harvesting	Low
Water Contamination (Runoff)	Construction	Very Likely	Critical	High	Implement runoff control measures, sedimentation ponds, silt fences, and proper waste disposal	Medium
Water Usage & Wastewater	Operation	Likely	Critical	High	Implement on-site wastewater treatment, regular water quality monitoring	Low

- **Design Phase**: Proper design of water management systems is crucial. This includes planning drainage systems, stormwater management, and wastewater handling. Inadequate design can lead to major issues in later phases.
- **Construction Phase**: During construction, runoff and erosion are significant concerns. Poorly managed surface runoff can pollute local water bodies and cause significant environmental harm.
- **Operation Phase**: The operational phase involves water usage, including wastewater generation. The project must have systems in place to treat wastewater before it is released into the environment. If wastewater management is inadequate, it can lead to severe contamination of water resources.

4. Waste Generation

Activity	Phase	Likelihood	Consequence	Impact (Likelihood x Consequence)	Mitigation Measures	Residual Impact
Waste Generation (General & Hazardous)	Design	Likely	Moderate	Medium	Develop waste management protocols for design-phase documentation and planning	Low
Construction Waste Generation	Construction	Very Likely	Major	High	Implement waste segregation, recycling, and proper disposal of hazardous materials	Medium
Operational Waste Generation (Medical & General)	Operation	Very Likely	Critical	High	Implement a comprehensive waste management plan, including hazardous medical waste disposal	Low

Explanation:

- **Design Phase**: Waste generation in the design phase is typically minimal and consists of office waste like paper and electronic waste. Although this is not a major concern, having a waste management plan in place helps to mitigate any impact.

- **Construction Phase**: The construction phase generates a significant amount of waste, including construction debris, packaging, and potentially hazardous waste. It is essential to manage this waste properly to avoid contamination and environmental degradation.
- **Operation Phase**: The operational phase involves daily waste generation, especially from medical activities. Medical waste is hazardous and requires careful handling and disposal to avoid significant health and environmental risks.

5. Noise and Vibration

Activity	Phase	Likelihood	Consequence	Impact (Likelihood x Consequence)	Mitigation Measures	Residual Impact
Noise from Planning and Meetings	Design	Likely	Minor	Low	Manage office noise, restrict construction planning meetings to daytime	Low
Noise from Construction Equipment	Construction	Very Likely	Major	High	Implement noise barriers, limit work hours, and use quieter equipment	Medium
Operational Noise (Hospital)	Operation	Likely	Moderate	Medium	Implement noise-reduction measures in hospital design (e.g., soundproofing), restrict noisy operations to designated areas	

Explanation:

- **Design Phase**: Noise during the design phase is limited to office activities, meetings, and planning. It has a low impact, but it should still be managed to prevent disturbances.
- **Construction Phase**: Construction activities, including the use of heavy machinery, will generate significant noise. This is a high-impact issue, particularly in residential areas.
- **Operation Phase**: While the operation of the hospital may generate moderate noise from machinery, patient care, and staff activities, the impact can be mitigated with design measures like soundproofing.

6. Air Quality and Emissions

Activity	Phase	Likelihood	Consequence	Impact (Likelihood x Consequence)	Mitigation Measures	Residual Impact
Dust and Emissions from Design Planning	Design	Unlikely	Minor	Low	No direct air quality impacts during this phase	Low
Dust, Emissions, and Vehicle Emissions during Construction	Construction	Very Likely	Major	High	Control dust using water sprinkling, limit vehicle emissions, and ensure proper disposal of construction materials	Medium

Hospital Emissions (GHG, Waste Incineration)	Operation	Likely	Moderate	Medium	Implement waste-to-energy solutions, use energy-efficient systems, and adopt renewable energy sources	Low

Explanation:

- **Design Phase**: No significant air quality impacts during the design phase.
- **Construction Phase**: Dust from earthworks and emissions from construction machinery and transport vehicles are significant concerns during construction. Proper dust control and managing emissions from vehicles and machinery are essential.
- **Operation Phase**: The operational phase generates emissions from hospital activities, particularly waste incineration and energy consumption. However, by using renewable energy and proper waste management systems, these emissions can be reduced.

3 Occupational Health and Safety

Activity	Phase	Likelihood	Consequence	Initial Impact	Mitigation Measures	Residual Impact
Absence of OHS considerations in design	Design	Medium	High	High	Include comprehensive OHS guidelines in design and bidding documents; consult health & safety experts during planning.	Low

On-site construction work	Construction	High	High	High	Enforce OHS protocols (helmets, gloves, masks, etc.); assign safety officers; conduct safety training; install signage and barriers; first aid availability.	Medium
Handling of construction machinery	Construction	High	Medium	High	Train operators; maintain equipment; provide PPE; schedule rest periods to avoid fatigue.	Low
Exposure to biohazardous/infectious materials	Operation	Medium	High	High	Provide training for medical staff; implement infection control protocols; supply proper PPE; ensure functional incineration and waste disposal systems.	Medium

Emergency preparedness for hospital staff	Operation	Medium	High	High	Develop and regularly update an Emergency Response Plan; conduct drills; install fire extinguishers and alarms; create clear evacuation routes.	Low

Explanation:

Design Phase: There are no direct physical health and safety risks during the design phase. However, failure to integrate occupational health and safety standards into the design and planning documents may lead to increased risks during later stages. Including safety protocols in the architectural and engineering plans is essential to ensure safe implementation during construction and operation.

Construction Phase: This phase poses substantial health and safety risks to workers due to heavy machinery use, working at heights, and handling hazardous materials. Without proper safety gear, training, and supervision, the likelihood of accidents and injuries is high. Implementation of robust health and safety protocols, provision of PPE, and regular safety drills are key mitigation measures.

Operational Phase: In the operational phase, hospital staff may be exposed to health risks including infections, biohazardous waste, and emergency incidents. Ensuring availability of PPE, adherence to infection control protocols, and regular health and safety training can effectively reduce these risks. Emergency response systems should also be well established.

7.6. Cumulative Effects:

Cumulative environmental effects refer to the combined, incremental impacts of the proposed project when considered alongside existing or foreseeable developments in the area. Although the Medical and Nursing College project is a stand-alone institutional facility, its construction and long-term operation may contribute to regional environmental pressures when viewed in conjunction with ongoing urban expansion, infrastructure development, and increased vehicular activity in the Gilgit region.

Key cumulative impacts include:

- **Healthcare and Hazardous Waste Burden:**

The introduction of a large-scale medical facility will significantly increase the volume of infectious, pharmaceutical, pathological, and general waste. When combined with existing hospitals in Gilgit city (e.g., RHQ, SSG Hospital, and Cardiac Hospital), this may place additional pressure on incineration and disposal infrastructure managed by the Gilgit-Baltistan Waste Management Company (GBWMC). Without proper waste segregation, emission control, and monitoring, there is a risk of long-term air and soil contamination from persistent pollutants such as dioxins and furans.

- **Cumulative Air Emissions from Incineration:**

  The installation of a 100 kg/hour dual-chamber incinerator, although essential for in-situ treatment of hospital waste, will add to local air pollutant loads, particularly if older or less efficient incinerators are still in use elsewhere in the city. Cumulative emissions, including particulate matter, carbon monoxide, and POPs, may exceed local air quality thresholds if not properly monitored or filtered.

- **Groundwater Demand and Resource Stress:**

  With boreholes planned for both the construction and operational phases, and the possibility of uplifting water from the Gilgit River, the project will contribute to increased water extraction in an already water-scarce region. When combined with existing demands from urban expansion and agriculture, this may affect groundwater recharge rates and long-term aquifer sustainability.

- **Traffic Congestion and Road Safety Risks:**

  The establishment of a teaching hospital and college will introduce over 1,200 PCU trips per peak hour, especially when considering patient influx, staff, students, and supply vehicles. This contributes to cumulative traffic congestion along the Karakoram Highway (KKH) and adjacent link roads, increasing air pollution and accident risk in the area.

- **Pressure on Public Infrastructure and Sanitation Systems:**

  The project will increase demand for sanitation services, drainage, and solid waste management, particularly during peak periods or outbreaks. Inadequate scaling of municipal services in response to cumulative population growth and institutional expansion may lead to localized pollution and health hazards.

Mitigation Measures for Cumulative Effects:

- Coordinate with GBWMC to ensure phased upgrades in incineration capacity and monitoring of emission standards.
- Include stack emission testing in the environmental monitoring plan.
- Conduct periodic groundwater level assessments to evaluate long-term extraction impacts.

- Implement a Traffic Management Plan (TMP) in coordination with local authorities.
- Promote inter-agency dialogue for integrated infrastructure planning in the region.

8. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

8.1. Introduction

The Environmental and Social Management Plan (ESMP) provides a structured approach to managing and mitigating the potential environmental and social impacts identified during the screening and impact assessment process of the proposed Medical and Nursing College project in Minawar, Gilgit. The ESMP outlines the specific actions, roles, responsibilities, and monitoring mechanisms that will be implemented during the design, construction, and operational phases of the project to ensure environmental and social safeguards are adhered to in line with relevant laws and best practices.

The ESMP is a critical component of the Environmental Impact Assessment (EIA) and ensures that the mitigation measures proposed in response to the identified impacts are effectively integrated into the project lifecycle. It also provides a practical tool for monitoring, evaluating, and reporting on environmental and social performance.

8.2. Objectives of the ESMP

The main objectives of the ESMP are as follows:

- To ensure that the environmental and social impacts identified during the assessment process are properly mitigated and managed.
- To define specific measures that will be implemented during the design, construction, and operational phases to prevent, reduce, or compensate for adverse impacts.
- To outline the roles and responsibilities of key institutions involved in the project for implementing mitigation and monitoring measures.
- To support compliance with relevant national environmental regulations, such as the Gilgit-Baltistan Environmental Protection Act, 2014, and international good practices.
- To ensure the health, safety, and well-being of workers and the surrounding community throughout the project's lifecycle.

8.3. Institutional Responsibilities

Several institutions and stakeholders will be involved in the implementation of the ESMP. Their roles and responsibilities are outlined below:

Project Proponent (Health Department, Gilgit-Baltistan)

- Ensure overall compliance with the ESMP during all project phases.
- Allocate financial and human resources for the implementation of mitigation and monitoring measures.

- Coordinate with other relevant government agencies and consultants.

Project Management Unit (PMU)

- Oversee day-to-day management and coordination of the ESMP.
- Ensure environmental and social considerations are included in the design and bidding documents.
- Monitor contractor performance and ensure timely reporting.

Environmental Consultant

- Assist the PMU in implementing and updating the ESMP as needed.
- Provide training and capacity building for workers and stakeholders.
- Support environmental and social monitoring and reporting tasks.

Contractors

- Comply with the mitigation measures outlined in the ESMP during construction.
- Implement site-specific health, safety, and environmental management measures.
- Report any non-compliance or environmental incidents to the PIU.

Gilgit-Baltistan Environmental Protection Agency (GB-EPA)

- Review and approve the ESMP as part of the EIA process.
- Conduct periodic inspections and compliance audits.
- Enforce environmental laws and guidelines.

8.4. Mitigation Management Matrix

The Mitigation Management Matrix (MMM) provides the framework for the implementation of the mitigating measures and environmental management during construction and operation phases of the project.

Tables 25, 26, 27, 28 reflect the impacts arising from project activities, their mitigation measures and responsibilities for the implementation of ESMP during design, construction and operation phases respectively.

A dedicated Mitigation Management Matrix for Hospital Waste Management is also included under the operational phase (Table 28), addressing waste segregation, transport, storage, treatment, and disposal in accordance with regulatory and environmental standards. For detailed waste handling protocols and system design, refer to Annexure-3: Hospital Waste Management Plan (HWMP).

Environmental and Social Management Plan (ESMP)

Mitigation Management Matrix (Design Phase)

Table 26 Mitigation Management Matrix (Design Phase)

Sr. No.	Potential Impact / Project Activity	Mitigation Option / Action	Performance Monitoring Indicators	Implementation	Supervision
1	Site Selection and Design	• Avoid steep slopes and erosion-prone areas. • Integrate adequate stormwater drainage and soakage pits into design. • Site layout to minimize land disturbance and tree cutting. • Include EHS considerations in architectural planning.	• Approved site plan with proper drainage. • EPA-reviewed environmental design.	Design Consultant	Proponent
2	Lack of ESMP Integration in Design	• Incorporate mitigation measures in detailed drawings and BOQs. • Include environmental clauses in bidding documents. • Prepare construction environment plan and health & safety guidelines.	• Bid documents reflect ESMP. • Contractor includes EMP in execution plan.	Design Consultant	Proponent
3	Seismicity	• The proposed project and the associated structures will be designed and constructed as per Seismic Building Code of Pakistan 2007 (SBC-07) to comply with minimum requirements for seismic safety of structures.	• Confirmation of design incorporation; Check Geological Investigation results	Health Department	PMU / Proponent

4	Public Disclosure of Final Design	• Final project design and ESMP at accessible locations (EPA office, district administration, hospital site). • Conduct stakeholder meetings before start of construction. • Integrate feedback from disclosure into final design, where feasible.	• Record of disclosure events. • Meeting minutes. • Final design reflecting feedback.		

Mitigation Management Matrix (Construction Phase)

Table 27 Mitigation Management Matrix (Construction Phase)

Sr. No.	Potential Impact / Project Activity	Mitigation Option / Action	Performance Monitoring Indicators	Implementation	Supervision
1	Borrow Materials from Earth Borrow Site	• elect sites with minimal ecological and community impact. • Obtain NOCs and restore site post-use. • Avoid excavation near water bodies and agricultural land. • Dust suppression during excavation.	• Restored borrow site. • Compliance with NOCs.	Contractor	Supervising Consultant
2	Installation and Operation of Batching/Asphalt Plant	• Site selection away from residential areas. • Install dust filters and noise silencers • Regular maintenance.	• Stack emissions testing. • Location approval. • Maintenance records.	Contractor	Supervising Consultant / GB-EPA

		• Treat wastewater before discharge.			
3	Construction Camps and Camp Sites	• Avoid sensitive ecosystems. • Provide sanitation facilities and waste disposal. • Use fencing and restricted access. • Establish grievance redressal for communities.	• Camp hygiene inspections. • Community complaint logs.	Contractor	Supervising Consultant
4	Wastewater Generation at Construction Camps	• Provide septic tanks and soakage pits. • Regular cleaning and maintenance. • Prevent discharge into water bodies. • Design drainage to avoid stagnation.	• Inspection of sanitation system. • Water quality monitoring reports.	Contractor	Supervising Consultant / Project Director / GB-EPA
5	Community Safety	• Erect warning signs and safety barriers. • Limit construction near schools and public places during peak hours. • Emergency contact display. • Employ community liaison officer.	• Incident reports. • Community engagement feedback.	Contractor	Supervising Consultant / Project Director
6	Influx of Labor	• Workers to be housed in designated areas. • Engage local labor as priority. • Awareness training on local culture.	• Labor registry. • Reports of social conflict. • Worker camp inspection.	Contractor	Supervising Consultant

		• Monitor for illegal settlement.			
7	Gender-Based Violence (GBV)	• Implement Code of Conduct for labor. • Conduct GBV and SEA training • Set up confidential grievance mechanism. • Collaborate with local organizations for GBV response.	• GBV awareness sessions held. • Incident response log. • Grievance records.	Contractor	Supervising Consultant / Project Director
8	Ecological Impacts During Construction	• Mark and avoid ecologically sensitive zones. • Avoid vegetation removal unless necessary • Replant native species post-construction. • Ban hunting and poaching by laborers.	• Flora/fauna inspection logs. • Area re-vegetation records.	Contractor	Supervising Consultant / Project Director
9	Air and Dust Pollution from Earthworks	• Water sprinkling on exposed surfaces. • Cover vehicles transporting loose materials. • Limit vehicle speeds on unpaved roads. • Maintain machinery to reduce exhaust emissions.	• Visual inspections of dust levels. • Logs of sprinkling and vehicle maintenance.	Contractor	Supervising Consultant / Project Director

10	Noise Pollution	• Use well-maintained machinery with silencers. • Restrict noisy activities to daytime. • Install temporary noise barriers near sensitive receptors. • Distribute PPE (earplugs) to workers.	• Noise level readings. • Worker PPE usage logs. • Community feedback.	Contractor	Supervising Consultant / Project Director
11	Solid and Hazardous Waste Disposal	• Separate hazardous and non-hazardous waste. • Provide on-site labeled bins. • Contract with authorized waste disposal services, i-e., Gilgit-Baltistan Waste Management Company • Train workers in waste handling.	• Waste logs. • Site inspections. • Waste disposal receipts.	Contractor	Supervising Consultant / Project Director
12	Soil Erosion and Contamination	• Store chemicals on impervious surfaces in bunded areas. • Train workers on chemical handling and Material Safety Data Sheet (MSDS). • Provide chutes and drainage in slope areas. • Avoid excavating near productive land.	• Site inspections. • Erosion control structures installed.	Contractor	Supervising Consultant / Project Director

13	Occupational Health & Safety	• Prepare and enforce Health & Safety Plan. • Provide PPE and conduct safety drills. • On-site paramedic and first-aid box availability. • Install warning signs around dangerous areas.	• Safety audit reports Incident and injury logs. • Availability of PPE and first aid.	Contractor	Supervising Consultant / Project Director

Mitigation Management Matrix (Operational Phase)

Table 28 Mitigation Management Matrix (Operational Phase)

Sr. No.	Potential Impact / Project Activity	Mitigation Option / Action	Performance Monitoring Indicators	Implementation	Supervision
1	Biomedical and Infectious Waste Generation	• Segregate waste at source using color-coded bins. • Store infectious waste in leak-proof containers. • Install on-site incinerator with pollution control device. • Train hospital staff in handling biomedical waste	• Waste management logs. • EPA certification for incinerator. • Staff training records.	Hospital Management/Gilgit-Baltistan Waste Management Company (GBWMC)	Health Department / Medical Superintendent of Hospital

		• Ensure implementation of Hospital Waste Management Plan (Annex)			
2	Energy Use and GHG Emissions	• Use solar panels for power supply. • Optimize energy consumption with efficient equipment. • Limit diesel generator use to backup only. • Conduct annual energy audits.	• Solarization records. • Fuel consumption reports. • Energy audit reports.	Facility Maintenance Unit	Health Department /Medical Superintendent of Hospital
3	Noise from Equipment and Generators	• Place generators in acoustic enclosures. • Limit generator operations to essential backup only. • Schedule maintenance of noise-producing equipment. • Train staff on minimizing unnecessary noise.	• Noise monitoring reports. • Community complaints. • Maintenance logs.	Hospital Admin / Contractor	Health Dept / Environmental Cell

4	Wastewater and Effluent Disposal	• Treat wastewater before discharge through soakage pits. • Maintain and regularly clean septic tanks. • Prevent any overflow near water bodies. • Monitor effluent quality.	• Water quality reports. • Inspection records of septic/soakage systems.	Facility Maintenance Unit	Hospital Management/Medical Superintendent of Hospital
5	Occupational Health & Safety	• Develop H&S protocols for hospital staff. • Provide PPE to all operational personnel. • Conduct annual health screening and training. • Maintain incident logbooks and emergency response kits.	• Health audit logs. • Staff training and injury reports. • Safety inspection records.	Hospital Management	Health Department / Medical Superintendent of Hospital

Mitigation Management Matrix – Hospital Waste Management (Operational Phase)

Table 29 Mitigation Management Matrix – Hospital Waste Management

Environmental Aspect	Potential Impacts	Mitigation Measures	Responsibility	Monitoring Indicators	Frequency
Improper segregation of waste	Risk of infection, mixing of hazardous and general waste	• Implement strict color-coded bin system with pictorial labels • Staff training on waste segregation at source	Waste Management Officer (WMO), Department Heads	• Segregation compliance reports • Availability of labeled bins	Daily
Internal waste transport	Exposure risk due to open handling or spillage	• Use gravity-fed sealed chutes from all blocks • Place sealed color-coded bins at ground floor collection points	WMO, Sanitary Supervisor	• Visual inspection • Chute cleaning and condition reports	Weekly
External movement of waste	Manual handling risk, contamination during transfer to Yellow Room or incinerator	• Use **hook-arm garbage truck** for moving sealed bins from collection points to disposal areas • Restrict manual handling	GBWMC, Facility Manager	• Transport logs • Truck condition and PPE usage checks	Daily
Yellow Room management	Overflow, odor, pest risk	• Maintain <24-hour storage for	Hospital Admin, WMO	• Room audit reports • Inventory logs	Daily

		infectious/special waste • Restrict access • Maintain ventilation and signage		• Temperature/humidity records	
Incinerator emissions	Air pollution (dioxins, furans), regulatory non-compliance	• Operate dual-chamber incinerator • Include emission control systems • Calibrate equipment and monitor emissions per NEQS/WHO standards	Incinerator Operator, EPA	• Stack emissions reports • Maintenance logs	Monthly
Incinerator ash disposal	Ash leachate into soil/groundwater	• Dispose ash into lined ash pits with cover • Monitor pit levels and empty at 4–6 month intervals	WMO, Sanitation Supervisor	• Ash pit logs • Visual inspections • Soil quality checks (if needed)	Monthly
Placental waste management	Contamination risk, odor	• Use sealed, lined **placenta pits** near maternity units • Follow burial standards and cover immediately after use	Facility Manager	• Pit condition reports • Odor complaints log	Weekly
Non-risk waste handling	Visual pollution, overflow behind incinerator	• Use designated temporary storage area behind incinerator	GBWMC	• Cleanliness records • Transport logs	Biweekly

		• GBWMC to clear green bins regularly			
Spill or emergency situation	Worker and public exposure to infectious materials	• Maintain spill kits in every department • Train staff on emergency waste handling protocols	WMO, HSE Officer	• Spill response logs • Training records	Quarterly / As needed

8.5. Reporting Mechanism

The implementation of the ESMP requires a structured reporting mechanism to ensure transparency, accountability, and timely decision-making. Contractors shall submit monthly Environmental and Social Compliance Reports to the Supervising Consultant. These reports will include updates on mitigation actions taken, environmental incidents (if any), monitoring results, grievances received, and corrective actions adopted.

The Supervising Consultant will consolidate these into quarterly Environmental and Social Performance Reports for submission to the Proponent and Gilgit-Baltistan Environmental Protection Agency (GB-EPA). A final Environmental Compliance Report will be prepared at the end of the construction phase.

Key Reporting Documents:

- Monthly ESMP Compliance Reports (by Contractor)
- Quarterly Environmental Monitoring Reports (by Supervising Consultant)
- Final Compliance Report (by Supervising Consultant & Proponent)

8.6. Non-Compliance of ESMP

Failure to comply with the ESMP can result in environmental degradation, social disruption, and potential legal action. The following protocol shall be followed in case of non-compliance:

- **Detection:** Identified through internal monitoring or community complaints.
- **Documentation:** Non-compliance incident recorded in the site log and reported to the Supervising Consultant.
- **Rectification:** Immediate corrective actions to be implemented within a defined timeline.
- **Escalation:** Serious or repeated violations reported to GB-EPA and relevant authorities.
- **Sanctions:** May include withholding of payments, penalties, or work stoppage.

The Contractor shall be held accountable for implementing corrective measures and preventing recurrence of violations.

8.7. Environmental and Social Management Budget

An Environmental and Social Management Budget of PKR 120.00 million has been estimated for the implementation of the ESMP of the proposed Medical and Dental College in Minawar, Gilgit, over a period of three years. This represents approximately 0.509% of the total project cost of PKR 23576.604 million, following national environmental best practices. The budget covers costs associated with Health, Safety and Environment (HSE), capacity building, waste management, community awareness, and green infrastructure development.

It also includes optional environmental monitoring costs, which may be incurred only when required or recommended by the relevant environmental authority (e.g., GB-EPA). All E&S mitigation costs will be integrated into the bid documents to ensure contractors are bound by these requirements.

8.7.1. Environmental Monitoring Cost (Optional)

Environmental monitoring helps verify compliance with mitigation measures and track environmental quality parameters such as air, water, and noise. However, **the Gilgit-Baltistan Environmental Protection Agency (GB-EPA) has recommended this activity as optional** for the project due to its limited and low-impact nature. It may be activated if any unforeseen risks or impacts arise during implementation.

Table 30 Environmental Monitoring Cost

Component	Parameters	Sampling Plan (Samples × Frequency × Years)	Frequency	Responsibility	Unit Cost (PKR)	Total Cost (PKR)
Construction Phase (3 years)						
Ambient Air Quality	PM10, PM2.5, SO_2, NO_2, CO	6 × 2 × 3 = 36	Bi-annually	Contractor	50,000	1,800,000
Surface Water Quality	BOD, COD, pH, Heavy Metals	3 × 2 × 3 = 18	Bi-annually	Contractor	40,000	720,000
Groundwater Quality	Priority parameters	3 × 2 × 3 = 18	Bi-annually	Contractor	40,000	720,000
Noise Level	Day/Night	6 × 2 × 3 = 36	Bi-annually	Contractor	8,000	288,000
Operation Phase (3 years)						

Ambient Air Quality	PM10, PM2.5, SO_2, NO_2, CO	3 × 1 × 3 = 9	Annually	Client	50,000	450,000
Surface Water Quality	BOD, COD, pH, Heavy Metals	1 × 1 × 3 = 3	Annually	Client	40,000	120,000
Groundwater Quality	Priority parameters	1 × 1 × 3 = 3	Annually	Client	40,000	120,000
Noise Level	Day/Night	2 × 1 × 3 = 6	Annually	Client	8,000	48,000
Miscellaneous	Calibration, logistics, reporting	-	-	-	-	1,000,000
Total (Optional)						**5,266,000**

Note: Environmental monitoring is optional and subject to enforcement by GB-EPA or other competent authorities.

8.7.2. Health, Safety and Environment (HSE) Cost

To ensure the health and safety of workers, communities, and infrastructure throughout the project lifecycle, provisions for HSE measures have been included in line with IFC-WBG guidelines. This includes personal protective equipment (PPE), medical services, HSE staff, safety signage, and public safety infrastructure.

Table 31 Cost of HSE & Staffing

A. Personal Protective Equipment (PPE) and Safety Supplies

Item	Quantity	Unit Cost (PKR)	Total Cost (PKR)
Safety Shoes	200	3,000	600,000
Gloves	1,000	500	500,000
Dust Masks	2,500	30	75,000
Ear Plugs	1,000	40	40,000
Safety Helmets	200	2,000	400,000
Safety Jackets	250	600	150,000

First Aid Kits	5	5,000	25,000
Rain Coats	100	2,500	250,000
Safety Cones	100	2,000	200,000
Sign Boards	50	2,000	100,000
Reflective Tapes	100	600	60,000
Gum Boots	100	2,500	250,000
Sub-Total (A)			**2,700,000**

B. HSE Staffing and Medical Services

Designation/Item	Quantity	Monthly Cost (PKR)	Duration (Months)	Total Cost (PKR)
HSE Engineer	1	80,000	36	2,880,000
Environmental Specialist	1	200,000	36	7,200,000
Dispenser	1	50,000	36	1,800,000
Establishment of Dispensary	1	Lump Sum	-	1,000,000
Sub-Total (B)				**12,880,000**

C. Logistics and Emergency Response

Item	Monthly Cost (PKR)	Duration (Months)	Total Cost (PKR)
Ambulance (Rent)	100,000	36	3,600,000
Vehicle for HSE Staff	100,000	36	3,600,000
Sub-Total (C)			**7,200,000**

| Total HSE Cost (A + B + C) | | | | 22,780,000 |

8.7.3. Summary of Environmental and Social Management Budget

Table 32 Summary of Environmental Budget

Sr. No.	Component	Cost (PKR)	Cost (Million PKR)
1.	Environmental Monitoring (Optional)	5,266,000	5.27
2.	HSE and Staffing	22,780,000	22.78

3.	Capacity Building and Trainings	3,000,000	3.00
4.	Waste Management Plan Implementation	2,500,000	2.50
5.	Greenbelt/Plantation along facility boundary	4,500,000	4.50
6.	Public Consultation and Awareness Campaigns	2,000,000	2.00
7.	Third Party Environmental Audit (Annually × 3)	3,000,000	3.00
8.	Miscellaneous / Contingencies (10%)	7,000,000	7.00
Total		**50,046,000**	**50.05 Million PKR**

Note: Total ESMP budget represents a placeholder value of 0.509% of the project cost. Final budget can be adjusted in line with the actual need, authority requirements, and contractor's bid provisions.

8.7.4. Training on Environment and Social Aspects

Personnel, including the EPC Contractor's team, will undergo training to ensure awareness of relevant environmental and social aspects, impacts, and risks associated with the project, along with corresponding control measures. The training will also emphasize the environmental benefits of improved personal performance and highlight the potential consequences of non-compliance with specified procedures.

Visitors to the site will receive environmental and social awareness training as part of the site induction. This training will ensure that all personnel clearly understand and follow the requirements of the EIA and ESMP during the construction phase. The EPC Contractor will be primarily responsible for providing training to all construction personnel according to the Training Plan shown below:

Table 33 Training Schedule

Target Audience	Trainers	Contents	Schedule
Contractor Supervisors/Managers	Third Party	Induction training per 'Training Plan'	Before the start of construction activities
Selected management staff from Contractor	EPC Contractor	Key findings of EIA, Mitigation measures, ESMP	Before the start of construction activities

All site personnel	EPC Contractor	Mitigation measures of EIA and ESMP, Camp rules	Before and during construction activities
Construction crew	EPC Contractor	ESMP, Waste disposal procedures	Before and during construction activities
Drivers	EPC Contractor	Road safety, Defensive driving, Road access restrictions, Vehicle movement restrictions, Waste disposal	Before and during the construction phase
Construction Staff	EPC Contractor	Waste disposal, Vehicle movement restrictions	Before and during the construction phase
Camp staff	EPC Contractor	Camp operation, Waste disposal, Natural resource conservation, Housekeeping, Camp Rules	Before and during the construction phase
Construction Staff of Contractors	EPC Contractor	Introduction to the Gender Code of Conduct, Respectful and Inclusive Behavior, Preventing and Addressing Sexual Harassment, Equal Opportunities and Non-Discrimination, Promoting Women's Participation	Before and during the construction phase

8.8. Grievance Redressal Mechanism (GRM)

An effective Grievance Redressal Mechanism (GRM) is critical for ensuring transparency, accountability, and public confidence in the implementation of the proposed Medical and Dental College Project in Minawar, Gilgit. The GRM is designed to address concerns and complaints from all stakeholders, including community members, contractors, workers, and government institutions, in a timely and transparent manner.

The mechanism provides a formal channel for affected individuals or groups to lodge grievances related to environmental and social impacts, land use, noise, dust, access, safety, labor practices, or any unanticipated issue that arises during project implementation.

8.8.1. Objectives of the GRM

- Ensure that complaints and concerns are received, reviewed, and addressed promptly.
- Promote stakeholder engagement by providing accessible and transparent grievance channels.
- Reduce the risk of conflict through early identification and resolution of issues.
- Strengthen accountability and trust among local communities and project stakeholders.

8.8.2. Grievance Redress Structure

The GRM will be implemented at **three levels** to facilitate easy access and timely resolution of grievances:

Level 1: Contractor/Field-Level Resolution

- **Who can be contacted:** Site engineer, HSE officer, or contractor representative.
- **Mechanism:** A complaint register will be maintained at the construction site to record verbal or written complaints.
- **Resolution Timeline:** Within 5 working days.
- **If unresolved:** Escalation to Project Grievance Committee.

Level 2: Project Grievance Redress Committee (PGRC)

- **Composition:** Representatives from the project proponent (Health Department), contractor, local administration, community elders, and Environmental/Social Safeguard Specialist.
- **Frequency of Meetings:** Fortnightly (or as needed based on complaint load).
- **Resolution Timeline:** Within 10 working days after escalation.
- **Documentation:** All grievances and actions taken will be documented in the Project Grievance Logbook.

Level 3: Appeal to Regulatory Authority

- **Authority:** Gilgit-Baltistan Environmental Protection Agency (GB-EPA) or any court of competent jurisdiction.
- **Timeline:** As per regulatory procedure.
- **Condition:** To be used when grievance remains unresolved after Level 2 or if parties are not satisfied with PGRC decisions.

8.8.3. Grievance Submission Channels

To ensure inclusive access, the following channels will be available for lodging complaints:

- **Verbal complaint** at the construction site to designated HSE officer.
- **Written complaint** via letter addressed to the site office or project management office.
- **Phone call or SMS** to a dedicated grievance contact number.
- **Complaint box** at the project site for anonymous grievances.
- **Email** submission to the Health Department or designated grievance focal person.

8.8.4. Grievance Redress Procedure

1. **Receipt and Logging:**
    - All grievances will be recorded in a **Grievance Register** with details such as date, nature of complaint, complainant details (optional), and channel used.
2. **Assessment and Categorization:**
    - Complaints will be categorized by severity and urgency (e.g., minor, major, emergency).
3. **Investigation and Action:**
    - The concerned team will investigate and propose corrective measures, if needed, in consultation with relevant stakeholders.
4. **Resolution and Feedback:**
    - Actions taken and resolution status will be communicated to the complainant, if identified.
5. **Monitoring and Reporting:**
    - A quarterly report on grievance status will be prepared and shared with GB-EPA and other stakeholders as part of environmental compliance monitoring.

8.8.5. Awareness and Capacity Building

To ensure the community and workers are aware of their rights and avenues for complaint:

- The GRM procedure will be disseminated through **posters, awareness sessions, and public meetings**.

- Contact details of the GRM focal person will be **displayed prominently at the site** and in nearby public places.
- Workers and subcontractors will be **trained** on grievance submission protocols.

8.8.6. Key Principles of the GRM

Principle	Description
Accessibility	Available to all stakeholders, including marginalized and vulnerable groups
Confidentiality	Identities of complainants will be protected upon request
Timeliness	Clearly defined timelines for resolution at each level
Non-retaliation	No individual will be punished for lodging a grievance
Transparency	Records of all complaints and resolutions will be maintained and disclosed
Accountability	Designated personnel will be responsible for managing the GRM process

CHAPTER 9: CONCLUSION AND RECOMMENDATIONS

Conclusion

The proposed establishment of the Medical and Nursing College in Minawar, Gilgit, represents a strategically significant development in strengthening the region's healthcare and education infrastructure. The Environmental Impact Assessment (EIA) study comprehensively evaluated the project's potential environmental and social impacts during both construction and operational phases. Baseline assessments, stakeholder consultations, and technical analyses were conducted in line with GB-EPA guidelines and international best practices.

The findings indicate that the project is environmentally viable and socially beneficial, provided that the proposed mitigation measures, environmental safeguards, and regulatory compliance protocols are properly implemented. Key environmental components such as air quality, water resources, waste management, noise levels, land use, and ecological footprint were assessed. Most impacts identified are localized, temporary, and manageable, with no irreversible or long-term environmental degradation anticipated.

The project will address critical issues in the region, such as the shortage of trained healthcare professionals, limited access to tertiary healthcare, and outmigration of skilled workers. Furthermore, it is expected to generate employment, improve community health outcomes, and promote local research on regional health challenges.

One of the most sensitive components of the project is the generation and management of healthcare waste, for which a comprehensive Hospital Waste Management Plan (HWMP) has been developed and integrated into the Environmental and Social Management Plan (ESMP). Stakeholders, including the Gilgit-Baltistan Waste Management Company (GBWMC), have confirmed post-operational support, further strengthening the project's sustainability.

Overall, the EIA concludes that the project is acceptable for environmental approval subject to the adoption of recommended mitigation, monitoring, and management strategies outlined in this report.

Recommendations

In light of the EIA findings, the following recommendations are made to ensure sustainable implementation and regulatory compliance:

1. **Implementation of the ESMP**
    - Ensure that the Environmental and Social Management Plan (ESMP), including hospital waste management measures, is fully implemented during all project phases.

- Assign a dedicated Environmental and Social Safeguards Officer (ESSO) and Waste Management Officer (WMO) to oversee environmental compliance.

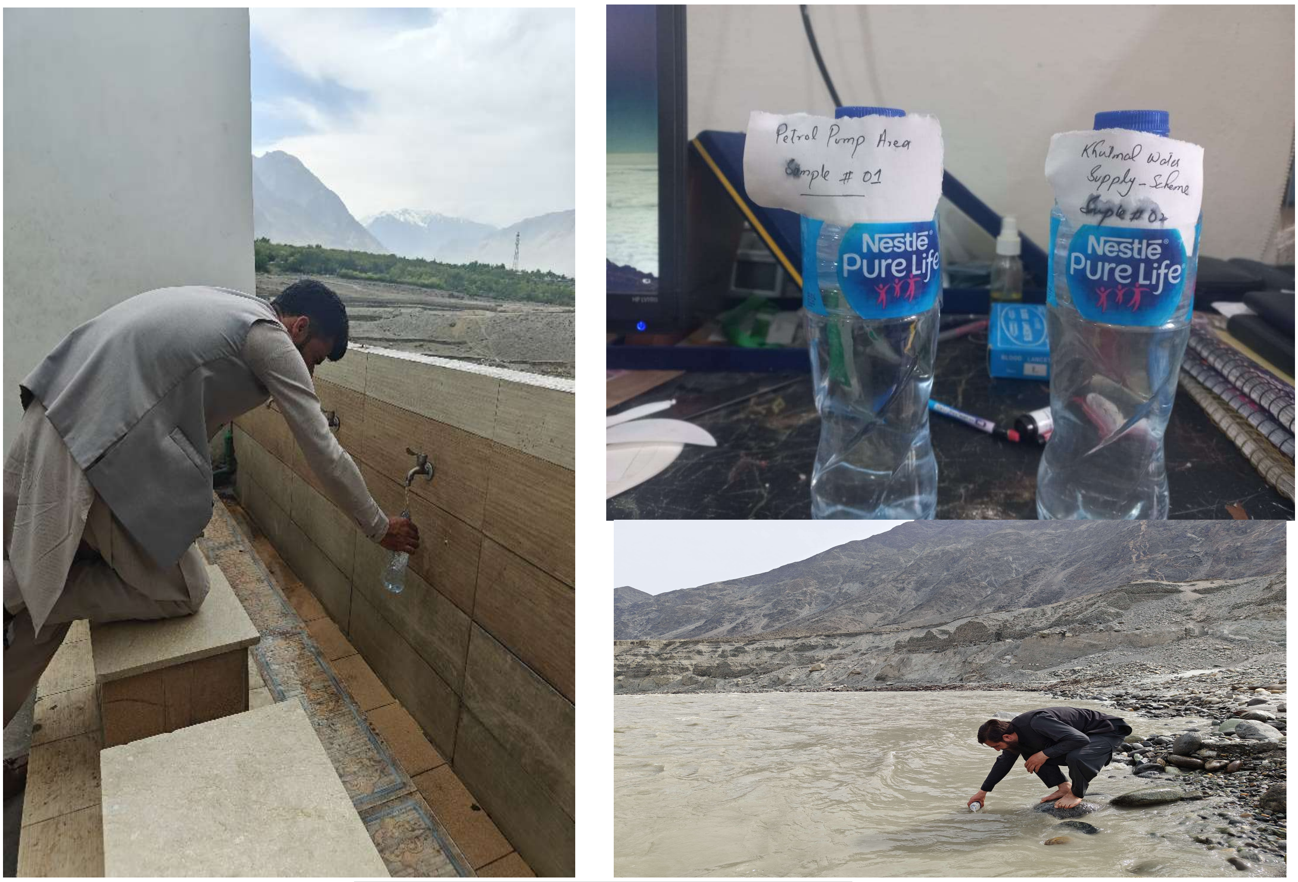
2. **Finalization of MoU with GBWMC**
   - Formalize and operationalize the agreement with the Gilgit-Baltistan Waste Management Company (GBWMC) for the transportation and treatment of hospital waste post-commissioning.
3. **Infrastructure Integration**
   - Incorporate gravity-based waste chutes, sealed drainage systems, and hook-arm garbage transport systems in all multi-story and clinical blocks, as per design commitments.
   - Ensure installation of centralized washing and drainage mechanisms in OTs, wards, and waste handling areas.
4. **Air Quality and Emission Control**
   - Operate the dual-chamber incinerator in line with WHO and Stockholm Convention standards and install emission control devices to prevent the release of hazardous air pollutants.
5. **Water Quality Assurance**
   - Use borehole water as the primary water source, with quarterly water quality testing.
   - Ensure disinfection of any alternative water sources before use.
6. **Training and Capacity Building**
   - Conduct mandatory training for staff on waste segregation, infection control, emergency response, and environmental awareness.
   - Include refresher training at regular intervals, particularly for sanitation, nursing, and technical staff.
7. **Monitoring and Reporting**
   - Implement the monitoring framework as outlined in the ESMP, including daily logs, quarterly reports, and annual environmental audits.
   - Share monitoring results with GB-EPA and relevant stakeholders for transparency and accountability.
8. **Stakeholder Engagement**
   - Maintain continuous engagement with local communities, regulatory bodies, and municipal service providers throughout the project lifecycle.

ANNEXURES

Annexure 1 Photographs of the Project site

Figure 15 Project site depicting barren and inhabitant land

Figure 16 Boring at project site



Water Collection from the field and samples for Analysis

Annexure 2 Meteorological Data

Table 34 Monthly Maximum Temperatures (ºC)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1984	9.3	10.5	19.9	23.9	26.6	36.8	35.4	38.4	29.3	25.1	15.9	10.5	23.5
1985	8.5	14.5	21.2	25.8	27.6	33.6	38.4	34.9	32.1	25	17.9	10.5	24.2
1986	9	11.7	15.6	22.4	27.1	33	35.9	32.2	31.2	27.3	17.4	9	22.7
1987	9.6	13.6	18.8	23.9	26.6	31.7	34.2	36.2	33.4	21.3	18.3	12.4	23.3
1988	10.3	12.5	16.5	26	32.4	34.6	37.6	34.7	33.4	24.2	20.5	12.8	24.6
1989	9.1	11	17.5	23.1	25.1	33	32.8	31.3	31.9	26.7	17	12.3	22.6
1990	11.5	10.5	17.5	23.2	34.2	34.7	38.6	37.6	34	25.5	19.8	12.3	24.9
1991	8.2	12	17.2	23.4	25.3	34.1	34.5	36.1	32.6	24.6	18.6	12.6	23.3
1992	9.3	11.1	15	23	28.5	34.6	36	35.5	29.9	24.7	19.2	13.1	23.3
1993	9.3	15.2	16.8	27	30.1	33.4	33.7	34.6	33.6	25.8	17.7	13.5	24.2
1994	9.8	10.9	18.8	22.1	29.8	34.1	38.2	38.2	30.7	25.2	19.7	10.8	24
1995	7.7	12.5	18.3	22.4	29.3	33.6	36.9	36.5	32.5	25	20.1	9.9	23.7
1996	8.9	13.5	17.9	24.3	23.2	32.3	35.5	35.8	35.5	24.6	19	12	23.5
1997	12	14.7	17.7	26.4	28.6	34.3	39.7	35.5	32.9	25.2	17.9	12.3	24.8
1998	9.8	13	18.7	26	28.9	31	38.2	36.5	33	28.5	21.9	14.9	25
1999	11.1	13	18.4	23.4	30.7	35.1	37.8	34.3	34.1	26.6	17.9	14.6	24.8
2000	10.6	13.3	19.3	26.5	34.9	35.2	34.6	35.3	32.9	27.8	19.9	12.9	25.3
2001	12.6	16.4	21.6	26.7	34.8	35.9	37.2	35.5	31.1	28.2	18	13	25.9
2002	11.2	14.1	21.3	24	30.7	34.5	35	36.1	30.3	28.5	20.9	13.3	25
2003	13.4	13.5	17.6	25.2	26.3	35.3	38.2	35	30.9	26	18.4	12	24.3
2004	11.3	15.6	23.4	24.9	30.1	33.2	34.7	34	33	24.1	20.6	13	24.8
2005	9	10.8	20	22.9	27.4	35.3	35.8	35.9	33.5	27.1	18.3	11.5	24
2006	8.5	16.9	20.3	24.9	34	32.3	36.8	32.5	30.1	27.2	19	11.2	24.5
2007	12.4	16	17.8	29.1	32	35.2	33.7	33.9	31	25.5	20.9	12.6	25
2008	7.8	12.5	23	25.6	32.5	37.6	36.5	35.5	30.3	27.4	19.2	11.5	25
2009	9.5	12.7	18.5	22.7	31.1	32.1	36.1	36.8	31	25.1	18.7	12.5	23.9
2010	13.9	12.5	22.1	24.4	26.5	30.9	33.2	31.2	29.3	28.1	22.8	14.6	24.1
2011	11.9	11.6	20	25.6	33.2	36.6	34.2	35.3	29.5	25.9	19.6	13.9	24.8
2012	10.5	12.1	17.9	24.9	27.1	32.4	37.1	34.8	28.3	24.6	20.5	13	23.6
2013	10.6	13.8	21.7	25.6	28	36.4	39	33.9	31.6	28.4	18.1	13.2	25

Table 35 Monthly Minimum Temperatures (ºC)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1984	-3.9	-0.9	6.4	9.2	12.5	16.1	19.2	20.4	11.9	5.8	1.5	-3.1	7.9
1985	-1.4	-1.3	5.7	9.9	12	14.4	20	19	12.6	6.9	1.3	-0.2	8.2
1986	-3.3	1.3	4.6	9	11.2	14.4	18.7	17.2	12.1	4.9	1.9	-0.7	7.6
1987	-4.6	0.6	6.2	8.8	9.9	13.5	16	17.3	12.7	7.5	-0.2	-2.8	7.1
1988	0.2	0.6	5.2	8.6	11.6	13.4	19.1	17.1	12.6	6.3	-0.5	-1.8	7.7
1989	-3.7	-1.4	6.1	6.9	9.9	13.3	16.4	14.5	11.3	4.8	1.3	0.4	6.7
1990	-1.1	2	3.8	7.6	11.9	15.8	18.5	16.3	12.4	4.8	-0.9	-2.1	7.4
1991	-3.1	1.9	6.1	8.1	11.2	13.5	16	14.7	11.7	4.8	-0.3	1.8	7.2
1992	-0.5	1.6	4.5	9.2	11.5	13.5	17.5	16.6	12.3	5.8	0.2	-2	7.5
1993	-3.6	1.1	4	8.8	12.3	13.8	16.5	15.9	12.2	5.3	1.3	-2	7.1
1994	-1.1	0.8	7.3	7.5	12.5	14.3	19.1	19.6	12.3	5.9	0.6	-1.8	8.1
1995	-5.5	-0.8	5	9.6	12.3	14.7	17.6	17.7	12.5	7.3	-1.1	-2.4	7.2
1996	-3.6	1.4	6.1	8.4	9.3	13.3	13.9	18.7	12.3	5.6	-1.5	-5.7	6.5
1997	-4.3	-2.4	4.5	9.2	11.4	15.5	18.2	15.5	12.9	7.4	1.5	-0.9	7.4
1998	-2.3	1.8	5.1	9.3	13	15.1	17.9	16.3	12.4	7.7	-0.8	-4.5	7.6
1999	-0.9	2.4	6.7	9.8	12.1	13.3	17.3	16.8	12.8	4.4	0.9	-6.8	7.4
2000	-4	-2.2	2.6	7.8	11.9	14.5	16.7	14	9.4	4.6	-0.2	-1.3	6.2
2001	-5.6	0	3.6	9.4	12.8	15.2	18.6	14.7	9.3	3.9	-0.7	-1.1	6.7
2002	-4.6	0.3	5.1	9	11.2	14.6	15.7	15.8	8.7	6.1	1.1	-1.5	6.8
2003	-3.2	0.2	5.3	8.9	9.5	13.6	17.3	18.5	13.1	4.5	0.5	-1.6	7.2
2004	0	1.1	6.9	9.8	11.3	14.8	16.4	16.3	11.2	6.7	1.3	0.3	8
2005	0	0.9	7.5	8	10.9	14	17.5	16.1	11.8	4.9	-1.1	-6	7
2006	-2.3	4.1	5.9	7.7	12.8	14.4	18.8	18.3	12.6	7.4	2.1	-2.5	8.3
2007	-4.8	2.5	5.1	10.7	13.5	15.9	16.6	17.3	13.6	5.2	-0.8	-3	7.6
2008	-3	-1.7	6	10.1	12.8	18.1	17.9	17.5	11.4	7.1	1	-1.5	8
2009	0.1	2.5	6.1	9.3	11.5	14.3	16	17	12.2	6.5	-0.4	0	7.9
2010	-1.9	1.9	7.3	10.3	12.4	13.9	16.7	17.8	13.3	5.9	-0.8	-5.9	7.6
2011	-4.3	1	5.8	8.5	12.8	15.8	18.1	18	14.1	8	3.3	-3.1	8.2
2012	-3.7	0.2	5.3	10.1	11.6	14.3	17.3	19	15	6.4	0.9	-1.7	7.9
2013	-4.8	1.6	6.3	10.3	12.1	16.7	18.8	18.4	12.5	7.8	0.5	-2	8.2

Table 36 Mean Monthly Rainfall (mm)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1984	0	0	8.1	3.5	57.6	6	4.3	7	14.4	0	3.2	0.6	104.7
1985	2.3	1.2	1.8	9.8	37.8	0	11.3	11.3	0	0.2	0.2	25.1	101
1986	0	9.9	14	24.2	6.8	5.8	12.3	26.8	4.8	0	14.7	14.3	133.6
1987	0	0	5.7	45.3	14.8	16	13	0	2.2	102.4	0	0	199.4
1988	0	8.2	26.7	10	0.5	22.6	38.1	15.6	5	4.7	0	4.8	136.2
1989	0.8	2.3	2	3.3	68.8	2	35.7	40.5	2	TR	2.2	TR	159.6
1990	6	5.5	6.6	17.9	TR	4.2	10.9	12.4	0	3.7	0	22.1	89.3
1991	0.7	10.8	21.3	10.6	30.1	8.2	17.1	5.7	13.4	0.5	0	0	118.4
1992	6.7	1.5	10.8	9.1	0.5	TR	0.3	2.4	61.3	1.7	TR	0	94.3
1993	TR	0.2	0	TR	16.1	3	43.5	1.9	2.1	0.4	27.4	0	94.6
1994	3.2	8.8	18.6	4.5	32.5	8.8	13.6	2	11.4	3.2	0.6	12	119.2
1995	0.1	3.6	1	25.7	18.6	9.8	22.5	5.6	7.1	4.8	2	7.5	108.3
1996	20.1	6	40.1	41.1	72.8	48	13.2	4.2	TR	5.7	0	0.5	251.7
1997	0	TR	12.1	2.1	2	3.9	12.5	88.1	0.1	3.4	0.8	3.7	128.7
1998	6	8.6	6.8	58.9	44.8	17.6	3.1	7.3	14.3	0.5	0	0	167.9
1999	1.6	34.5	6.8	89.7	15.8	3.5	12	18.5	11.6	4.1	8.7	0	206.8
2000	4.9	TR	1.7	13.3	0.7	18.7	22.4	16.6	12.9	2	0	4	97.2
2001	0	0.5	12.9	6.2	1.8	20.6	12.7	14	1.3	0.6	15	2.4	88
2002	0.5	9.3	2.9	31.2	9.4	18	16.4	20.8	3.7	0	0	0.2	112.4
2003	TR	33.4	18.5	23.8	87.2	6.9	15.4	9.4	17.6	8.4	0.3	4.7	225.6
2004	0.4	6.9	6	45.2	13.3	14.8	4.8	10.4	2.3	6.5	TR	36.5	147.1
2005	11.2	14.1	12.4	58.9	32.6	2.7	9.3	2.1	2.1	TR	4	0.4	149.8
2006	15.4	6	2.1	23	1.5	11.1	8.1	39	11.9	4.7	4	5.8	132.6
2007	0	1.3	11.9	15.2	12	18.8	12.5	6.3	6.3	0	0	0	84.3
2008	2.9	TR	TR	8.3	75.8	15.6	3.5	10.9	8.3	12.9	1	31.5	170.7
2009	32.2	4.7	6.1	42.9	3.1	21.6	2.5	1.4	16.8	1.2	TR	8.6	141.1
2010	TR	13.3	20.7	24.6	60.7	23.2	52.9	60.1	10.4	1	0	0.6	267.5
2011	4.7	35.5	10.6	5.8	16.6	19.8	14.5	11.1	32.7	4.9	0.2	2.3	158.7
2012	TR	2.6	36.9	11.3	18.4	9.3	1.1	11.3	49	0.2	2.2	5.1	147.4
2013	3.1	3.6	3.2	5.6	50	7.1	3.4	47.6	14.4	1.5	14	0	153.5

Table 37 Mean Wind at Synoptic Hours (1200 UTC) in Knots

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1984	0.2	1.5	2.2	5.2	2.8	2.4	1.8	2	1.8	1	0.1	0.1	1.8
1985	0.4	1	2.5	3.4	2.6	2	3.5	1.5	1.5	0.9	0.6	0.5	1.7
1986	0.3	1.2	2.9	3.1	4.4	3.4	2.8	2.4	2.1	0.3	0.5	0.2	2
1987	0.5	2	3	3.3	3.5	2.9	4.5	1.8	2	1.3	0.4	0.5	2.1
1988	0.7	1.8	3.8	3	2.6	0.8	1.3	1.9	1	1.3	0.1	0.7	1.6
1989	1	2.3	2.6	3.3	1.9	4.6	1.5	1.4	1.6	1.5	1.2	0.7	2
1990	1.1	0.9	2.9	2.4	1.7	2.4	1.3	2.5	0.9	0.4	0.4	0.8	1.5
1991	0.5	1.9	2.3	4.1	2.6	1.8	3.1	3	2.1	1.3	0.6	0.7	2
1992	0.6	2.1	2.3	2.7	4.1	0.3	2.9	1.6	1.3	1	0.3	0.2	1.6
1993	0.7	1.8	2.5	2.7	3.7	2.3	1.8	1.9	0.8	1.6	0.3	0.5	1.7
1994	1.7	2.1	2.7	3.5	2.8	3.4	1.9	1.7	1.7	0.7	0.2	0.3	1.9
1995	0.4	1.4	2.8	2.2	2.4	1.6	1	3.1	2.4	0.7	0.1	0.1	1.5
1996	0.3	1.8	2	2.7	1.8	2.1	1.9	1.5	0.9	0.4	0.1	0.1	1.3
1997	0.2	0.6	2.3	1.9	3.1	4	0.6	2.4	2.4	1.2	0.4	0	1.6
1998	0.1	0.7	3.2	2.7	2.3	3.2	1.8	1.8	1.7	0.4	0	0	1.5
1999	0.5	1.3	2.6	2.1	3.4	3.3	3.5	3.1	1.7	0.6	0.3	0	1.9
2000	0.7	2.1	3.5	3.8	5	2.3	2.4	5.3	2.8	1.6	0.6	0.1	2.5
2001	0.1	2.6	4.2	4.2	4.1	2.1	2.7	3.1	2.6	1.1	0.1	0.3	2.3
2002	0.6	0.8	2.2	2.4	2.9	2.8	5	1.9	3.1	0.6	0	0.5	1.9
2003	0.3	1.1	3.1	2	4.3	4.8	3.2	2.2	1.7	0.6	0.3	0.1	2
2004	0.5	2.4	3.4	3.9	2.2	3.5	3.7	3.1	1.3	1.8	0.6	0	2.2
2005	0.6	1.1	2	2.1	4.7	3.9	3.2	2.9	2.2	1.4	0.5	0.1	2.1
2006	0.3	1.4	2.3	4	5.9	6.7	4.2	2.9	2	1.1	0.3	0.1	2.6
2007	0.1	1.2	3.7	1.5	6.3	5.5	3.2	3	3.1	1.3	0	0	2.4
2008	0.5	0.7	3.9	3.6	5.4	4.3	4.7	4.6	2.2	0.6	0.5	0.1	2.6
2009	0.5	1.6	3.4	2	5.7	3.8	4.6	2.8	1.3	1.7	0.1	0.3	2.3
2010	0.5	0.7	1.8	2.1	1.9	2.2	2.6	0.7	2.6	1.3	0	0	1.4
2011	0	2.6	3.7	3.5	3.9	5.4	3.9	2.8	2.5	0.5	0.3	0	2.4
2012	0.6	2.7	4	7.5	5.9	6.9	4.6	4	1.9	1.7	0.2	0	3.3
2013	0.1	1.6	2.4	5.3	3.1	3.7	3.8	2.6	3.1	1.3	0	0.1	2.3

Table 38 Mean Wind Direction at Synoptic Hours (0000 UTC)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1984	S23E	S45E	S67E	W	N77W	S6E	S40E	S23W	S45E	W	W	W
1985	S67W	N72W	S31W	E	S34E	W	S56E	S37W	E	S67W	S18W	S45W
1986	S66W	S73W	N10W	W	S83W	S	S45W	N	S45W	CALM	S	N23E
1987	S73W	W	S38E	S45E	S75E	W	S45W	W	N45E	W	S38W	S73W
1988	N87W	N80W	N56W	S68W	S70W	CALM	S52W	N84W	S62W	S74W	S66W	N23W
1989	S45W	W	N87W	S70W	N74W	S29E	S63W	W	W	S18E	W	N82W
1990	S28W	S45W	N45W	S45E	S45W	S76W	S56E	S20E	S68E	N	S45W	S67E
1991	S75W	N82W	N78W	N45E	W	S18E	N75E	S45W	S60W	S23W	CALM	S23W
1992	S3E	N85W	S45W	S69W	N67W	S64W	S78E	S9E	S66W	S45W	CALM	CALM
1993	S58W	N15E	S66W	S12W	N75W	N38W	S55W	S18W	S45W	S60W	S23W	S34W
1994	S74W	S82W	S68W	S23W	S11W	S45W	S45W	S23E	S45E	W	W	N76E
1995	CALM	S	W	S45W	N23W	N45W	S45W	S	S23E	N45W	CALM	S28W
1996	W	N50W	S41E	S27E	S5E	S45W	W	N23E	E	N77W	CALM	N45W
1997	W	S72E	N36E	S45E	S45W	N45W	S45E	S	S45W	CALM	E	CALM
1998	E	W	N66W	W	S41E	S57W	S45E	CALM	S27W	S66W	CALM	CALM
1999	W	W	N24W	W	S23W	S45E	S41E	S56E	W	W	W	W
2000	W	S85W	S71W	S45W	E	S38W	S45W	CALM	S38W	CALM	W	W
2001	S	S75W	N	N45E	E	W	CALM	E	E	W	CALM	CALM
2002	CALM	CALM	S	E	N45E	W	W	CALM	S60W	CALM	W	CALM
2003	CALM	N45E	S	W	CALM	N60E	CALM	S66W	W	N45W	CALM	CALM
2004	W	S76W	S77W	W	S45W	E	S45E	CALM	S23E	S45W	CALM	W
2005	W	CALM	S	N45W	E	W	CALM	S60W	CALM	W	CALM	CALM
2006	CALM	CALM	N14E	CALM	W	CALM	S80W	N45W	S75W	W	CALM	N45E
2007	CALM	W	CALM	N82W	S65W	N45W	W	S55W	N45W	S45E	CALM	CALM
2008	S68W	S68W	N63W	S16E	CALM	CALM	S75E	CALM	CALM	W	S45E	S57W
2009	S83W	W	S72W	CALM	E	S75E	N62E	E	S67W	W	CALM	S82W
2010	W	CALM	E	N45W	E	CALM	CALM	CALM	S62W	CALM	CALM	CALM
2011	CALM	CALM	W	S45E	W	N68E	E	S62E	N79W	CALM	W	CALM
2012	W	S45W	W	S45W	E	S23E	S45E	W	W	W	W	S63W
2013	S	S45E	S45W	E	E	E	CALM	CALM	CALM	CALM	CALM	CALM

Table 39 Mean Wind Direction at Synoptic Hours (1200 UTC)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1984	S38W	S11E	S56W	S2W	S50E	S56E	S66E	S	S32E	S64W	S45W	S45W
1985	S53W	S37W	S66W	S26E	S57E	S54E	S74E	S76E	E	S22E	N80W	S76E
1986	S27E	S63W	S9E	S4E	S50E	S65E	S77E	S	S37E	S45W	S66W	N23E
1987	S	S47E	S10E	S72E	S32E	S49E	S24W	E	S56E	CALM	S	S27W
1988	S64W	S19E	S29W	S	S45E	S49E	S62E	S76E	S5W	S16E	S45E	S84W
1989	S55W	S20W	S34W	S57W	S43E	S43E	S35E	S66E	S38E	S41E	S45E	S18W
1990	S42E	S45W	S	S21W	S56E	S53E	S49E	S28E	S66E	S68W	S66E	S50E
1991	W	S55W	N88W	S34W	N45E	S3W	S60E	S57E	S41W	S52W	S52W	S31E
1992	S79W	S87W	N85W	S69W	S45E	S52E	E	S	S53E	S53W	S23W	S23E
1993	S73E	N87E	S10E	S2W	S38E	S9E	S77E	S2E	S70E	S28W	S27W	S67W
1994	N83E	S22W	S4W	S7E	S64E	S45E	S43E	S32E	S67W	S58W	N45W	N73E
1995	S45E	S40E	S80E	S36E	S61W	S60W	S65E	S71E	S6W	S11W	S45W	E
1996	S45E	S47W	S21E	S20E	S83E	S63E	S82E	S24E	S31W	CALM	W	E
1997	S60E	S22E	E	S12E	S45E	S83E	S45E	S42E	S60E	S77E	CALM	CALM
1998	W	S41W	S10W	S81E	S51E	S28E	N71E	S66E	S64E	N79W	CALM	CALM
1999	S23E	N50W	S79W	S82W	S76E	S89E	S64E	S81E	S45E	S45E	S	CALM
2000	W	S15E	S70W	S80E	N83E	S85E	N25E	S83E	N73E	S23E	W	S
2001	E	S40E	S42E	S85E	S69E	E	N81E	S60E	S21E	E	E	E
2002	S58E	E	S75E	S74E	S76E	S45E	S31W	S63E	S80E	N79E	CALM	E
2003	S60E	S34W	S61W	S87W	S83E	S72E	S67E	S38E	S45E	S23W	S45W	W
2004	E	N84W	S54W	S19E	S62E	S44E	S57E	S85E	S60W	S45W	CALM	W
2005	W	S65W	S43W	S85W	S69E	S64E	S84E	S50E	N37W	S14W	S22W	S45W
2006	S27W	N45W	S23W	S20E	S59E	S42E	S18E	E	S68E	W	E	W
2007	W	W	S72W	S	S47E	S66E	S75E	S05W	S45E	S36E	CALM	CALM
2008	S36E	S36W	S33W	S75E	S76E	S80E	S73E	S76E	S68E	E	E	W
2009	S68W	S80W	S76W	S06W	S67E	N82W	S86E	S77E	S62W	W	N23E	W
2010	W	W	S52W	W	E	S83E	S76E	E	W	E	CALM	CALM
2011	CALM	N13W	S62W	E	S76E	N87E	S12W	S36W	S82W	W	S45E	CALM
2012	S45W	S76E	S87W	S78E	S86E	S62E	S82E	E	S63E	S11E	N45W	CALM
2013	W	S03W	S03E	S32E	S45E	S86E	N85E	W	N83E	S75E	CALM	W

Table 40 Relative Humidity at 0000 UTC (%)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1984	83	74	56	67	74	----	67	69	80	74	81	79	----
1985	76	65	53	68	73	65	63	73	79	74	77	79	70.4
1986	79	64	64	76	72	78	75	84	84	86	82	79	76.9
1987	87	73	71	74	87	80	78	87	82	93	84	83	81.6
1988	80	76	81	76	81	83	77	81	82	89	80	79	80.4
1989	83	74	63	71	86	74	84	86	84	88	82	68	78.6
1990	85	70	67	79	70	73	70	75	85	84	85	85	77.3
1991	84	74	70	76	87	74	79	81	85	88	85	82	80.4
1992	85	59	72	74	79	74	73	76	88	84	85	86	77.9
1993	81	77	60	61	79	80	80	83	85	79	88	86	78.3
1994	84	80	66	76	77	83	81	76	82	86	84	94	80.8
1995	93	78	70	73	78	53	76	83	78	91	81	87	78.4
1996	88	70	70	75	91	81	84	75	76	83	80	83	79.7
1997	82	70	68	69	69	69	73	80	84	85	88	80	76.4
1998	85	69	61	73	79	78	68	78	87	82	84	84	77.3
1999	82	77	63	69	73	72	69	83	82	84	80	83	76.4
2000	82	59	52	72	66	64	78	85	80	83	78	80	73.3
2001	80	65	59	69	65	71	63	80	78	77	89	82	73.2
2002	87	78	58	78	71	72	78	82	82	87	81	82	78
2003	80	82	75	78	84	74	73	76	88	88	84	84	80.5
2004	79	65	65	82	79	80	80	76	83	85	82	81	78.1
2005	79	83	69	79	82	80	80	73	87	85	86	88	80.9
2006	85	78	64	75	71	75	69	85	86	85	89	85	78.9
2007	82	70	65	62	73	76	84	77	81	79	84	83	76.3
2008	80	68	65	66	76	70	76	77	86	86	87	83	76.7
2009	81	67	66	75	76	74	75	74	78	82	84	81	76.1
2010	81	75	71	79	84	82	78	87	82	85	85	81	80.8
2011	85	81	66	71	77	71	75	76	83	85	83	82	77.9
2012	75	70	64	71	78	72	73	70	78	80	80	76	73.9
2013	79	74	63	68	77	65	67	82	84	79	86	83	75.6

Annexure 3 Hospital Waste Management Plan

1. Introduction

Healthcare waste management is a critical component of hospital operations, particularly in a facility like the proposed Medical and Nursing College in Gilgit, which will house both educational and clinical functions. Medical waste, if not properly managed, poses significant health risks to healthcare personnel, patients, the public, and the environment. Recognizing the complexity and hazards associated with hospital waste, this Hospital Waste Management Plan (HWMP) has been developed to ensure that all types of waste are handled in a safe, environmentally sound, and legally compliant manner.

This HWMP is designed in accordance with the Hospital Waste Management Rules, 2005, which place full responsibility for the safe handling and disposal of hospital waste on healthcare facilities (Section 3). The rules require the preparation of a Waste Management Plan (WMP) by a designated Waste Management Officer (Section 15), and the establishment of a central, secure waste storage facility (Section 19) clearly marked with biohazard symbols and accessible only to authorized personnel.

Furthermore, the plan is aligned with the National Hazardous Waste Management Policy, 2022, which emphasizes the minimization of hazardous waste generation, source segregation, use of best available technologies, and environmentally sound disposal.

The HWMP also reflects Pakistan's obligations under the Basel Convention, which regulates the classification and transboundary movement of hazardous healthcare waste, and the Stockholm Convention, which targets the reduction of Persistent Organic Pollutants (POPs) such as dioxins and furans produced during incineration. The WHO Guidelines for Safe Healthcare Waste Management (2004) have been consulted to ensure best practices.

The plan integrates the forthcoming responsibilities of the Gilgit-Baltistan Waste Management Company, a government entity. As confirmed during stakeholder consultations with the Director Planning (Health Department) and Manager of GBWMC, the company will assume full responsibility for waste treatment and disposal upon the hospital's operationalization, under the supervision of the hospital's Waste Management Team.

2. Objectives

The objectives of the Hospital Waste Management Plan (HWMP) for the Medical and Nursing College, Gilgit, are as follows:

- Ensure compliance with the Hospital Waste Management Rules, 2005, the National Hazardous Waste Management Policy, 2022, and international obligations under the Basel and Stockholm Conventions.
- Promote effective segregation of waste at the point of generation into infectious, hazardous, general, and recyclable categories to minimize health risks and improve treatment efficiency.

- Establish a streamlined system for internal waste collection, transport, and secure storage using appropriate infrastructure such as color-coded bins, dropping points, and designated Yellow Rooms.
- Facilitate environmentally sound treatment through dual-chamber incineration, safe placenta and ash disposal, and emission control practices in line with best available technologies.
- Safeguard the health and safety of hospital staff, patients, and waste handlers through the provision of PPE, vaccination programs, hygiene facilities, and emergency response protocols.
- Ensure smooth coordination with the Gilgit-Baltistan Waste Management Company (GBWMC) for the final collection, treatment, and disposal of all hospital waste streams.
- Build institutional capacity by training healthcare and sanitation staff on proper waste handling procedures, compliance standards, and infection control.
- Monitor and evaluate the effectiveness of the HWMP through daily logs, monthly reviews, and annual third-party audits, with a focus on continuous improvement.
- Support the hospital's environmental and public health goals by promoting sustainable practices, including waste minimization, reuse, and responsible material selection.

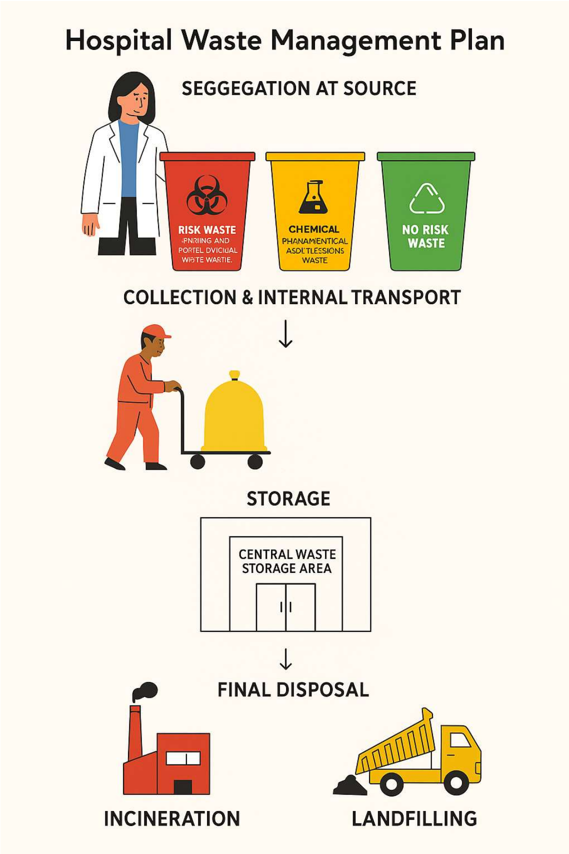
3. Sources and Characteristics of Hospital Waste:

The hospital environment generates a wide variety of waste materials, each differing in composition, potential health risk, and required disposal method. The categorization and identification of major sources of hospital waste are essential for implementing effective and compliant waste management practices. Waste from different departments—such as wards, operation theatres, laboratories, pharmacies, and vaccination campaigns—can be broadly classified into four main types: sharp waste, infectious and pathological waste, chemical or pharmaceutical (special) waste, and general non-hazardous waste. Each category presents unique hazards and requires tailored handling procedures, particularly when dealing with sharps or substances contaminated with blood and bodily fluids. Understanding these sources and their characteristics supports the design of appropriate segregation, storage, transport, and disposal systems across the hospital. The table below outlines the specific types of waste generated from key functional areas of the hospital and classifies them according to their risk profile.

Major Sources of Hospital Waste and Characteristics				
Sources	***Risk Waste***		***Special Waste***	***No-Risk Waste***
	Sharp	***Infectious and Pathological waste***	***Chemical, pharmaceutical and cytotoxic waste***	***Non-Hazardous and general waste***
Wards (Medical/ Surgical/ Child/ CCU/ITC	Hypodermic needles, intravenous set needles, broken vials and ampoules	Dressings, bandages, gauze and cotton contaminated with blood or body fluids; gloves and masks contaminated with blood or body fluids	Broken thermometers and blood-pressure gauges, spilt medicines, spent disinfectants	Packaging, food scraps, paper, flowers, empty saline bottles, Sanitary napkins, non-bloody intravenous tubing and bags
Operating theatre/ labor room	Needles, intravenous sets, scalpels, blades, saws	Blood and other body fluids; suction canisters; gowns, gloves, masks, gauze and other waste contaminated with blood and body fluids; tissues, organs, fetuses, body parts	Spent disinfectants Waste anesthetic gases	Packaging; uncontaminated gowns, gloves, masks, hats and shoe covers
Laboratory	Needles, broken glass, Petri dishes, slides and cover slips, broken pipettes	Blood and body fluids, microbiological cultures and stocks, tissue, infected animal carcasses, tubes and containers contaminated with blood or body fluids	Fixatives; formalin; xylene, toluene, methanol, methylene chloride and other solvents; broken lab thermometers	Packaging, paper, plastic containers
Pharmacy store			Expired drugs, spilt drugs	Packaging, paper, empty containers
Vaccination campaigns	Needles and syringes		Bulk vaccine waste, vials, gloves	Packaging
Radiology Room	Used syringes, IV needles, broken glass vials used for contrast	Blood-contaminated cotton, gauze, swabs from contrast media procedures	Expired contrast media, used X-ray fixer and developer solutions, damaged lead aprons or shielding gloves	Packaging from films, uncontaminated gloves and masks, empty contrast bottles

Source: Gilgit-Baltistan Environmental Protection Agency

4. Hospital Waste Management Flow:



This section presents the systematic healthcare waste management framework adopted at the Teaching Hospital of the Medical and Nursing College, Gilgit. It outlines a structured approach for handling, transporting, and disposing of all categories of medical waste generated within the facility. The process is designed to meet the regulatory requirements of the Hospital Waste Management Rules, 2005, and align with international standards, including the Basel and Stockholm Conventions and WHO healthcare waste management guidelines.

The waste management plan comprises four core operational steps—Segregation at Source, Collection & Internal Transport, Temporary Storage, and Treatment & Final Disposal. Each stage is supported by dedicated infrastructure and protocols that reduce contamination risks, improve hygiene, and enhance environmental protection. Key facilities include floor-based waste dropping points, a secure Yellow Room for hazardous waste storage, a dual-chamber incinerator, lined placenta pits, and ash disposal pits, all functioning under the oversight of the Gilgit-Baltistan Waste Management Company (GBWMC).

This integrated waste flow model not only ensures environmental safety and infection control but also demonstrates the hospital's commitment to sustainability, transparency, and responsible healthcare delivery in the region.

4.1. Responsible Waste Collection

The safe and responsible collection of hospital waste is the backbone of any effective waste management system, especially in clinical environments where multiple types of hazardous and non-hazardous waste are generated daily. At the Teaching Hospital of the Medical and Nursing College, Gilgit, the importance of meticulous waste collection is heightened by the dual role of the facility as both a service provider and a medical training institute.

Responsible waste collection begins at the point of generation—whether in **wards**, **operation theaters**, **labour rooms**, **pharmacy units**, or **laboratories**—where waste is immediately segregated, recorded, and sealed. This step minimizes occupational exposure, prevents accidental spillage, and ensures traceability of hazardous materials. Healthcare staff are trained to follow standard protocols for identifying and handling **risk waste** (e.g., sharps and infectious materials),

special waste (e.g., pharmaceutical and chemical waste), and **non-risk waste** (e.g., general refuse).

All waste bags are labeled and inspected before collection. Damaged or leaking containers are promptly replaced to prevent exposure and maintain hygiene. The collected waste is tracked and recorded systematically, with all entries documented at the **central Yellow Room**, serving as the monitoring and compliance node for the facility.

Through this responsible collection framework, the hospital ensures compliance with regulatory requirements, protects the health of its staff and patients, and supports the efficient functioning of downstream waste treatment systems. It also builds a culture of accountability and environmental stewardship within the healthcare system.

4.2. Operational Steps of Waste Management:

I. Segregation at Source

Waste segregation at source is one of the most critical components of an effective hospital waste management system. In a clinical environment such as the Teaching Hospital of the Medical and Nursing College, Gilgit, where both medical care and academic training take place, the diversity and volume of waste produced requires a highly organized segregation strategy.

All hospital units—including wards, operation theaters, labour rooms, outpatient departments, laboratories, and pharmacies—follow strict protocols to ensure waste is separated immediately after patient care or medical procedures. Waste is disposed of in clearly color-coded bins, each designated for a specific category of waste, and strategically placed throughout the facility at all points of care including bedside units, procedure trolleys, and injection stations.

- **Red Bin – Risk Waste**
  Used for high-risk items that pose a biological hazard:
  - **Sharps Waste**: Needles, scalpels, broken glass and any item capable of causing puncture or cuts.
  - **Infectious and Pathological Waste**: Gauze, dressings, suction containers, blood-soaked items, tissues and other items contaminated with bodily fluids.
- **Yellow Bin – Special Waste**
  Designated for chemical and pharmaceutical items that require controlled handling:
  - **Chemical Waste**: Laboratory reagents, Spent disinfectants, fixatives etc.
  - **Pharmaceutical and Cytotoxic Waste**: Expired drugs, chemotherapy agents, spillage residues and containers with hazardous chemical remnants.
- **Green Bin – No-Risk Waste**
  Reserved for general, non-contaminated materials similar to domestic refuse:
  - **General Waste**: Paper, food scraps, empty IV bags, clean packaging materials, disposable cups, uncontaminated PPE, and plastics.

Each bin is clearly labeled and includes visual guidance for appropriate disposal to reduce handling errors. Sharps are placed in puncture-proof safety boxes, while recyclable items—such as medicine bottles and plastic containers—are to be emptied, cleaned, and de-capped before being placed in the correct bin. Bins are regularly monitored and emptied by trained staff as part of the hospital's scheduled waste collection routines.

By implementing this robust segregation system, the hospital minimizes cross-contamination risks, enhances the efficiency of subsequent treatment processes (like incineration or recycling), and complies with both national regulations and international healthcare waste management standards. It also contributes to public health protection and environmental sustainability, reflecting the hospital's commitment to safe and responsible healthcare delivery.

II. Collection & Internal Transport

As part of the proposed Hospital Waste Management Plan for the Medical and Nursing College Teaching Hospital, Gilgit, an efficient and hygienic system for the internal collection and transportation of waste is being recommended to meet best practices in infection control, operational safety, and environmental compliance.

Waste is expected to be generated across all major blocks of the hospital—including wards, operation theaters, labour rooms, pharmacies, laboratories, and particularly in the Main Hospital Building, which comprises the Accident & Emergency Block, Outpatient Department (OPD), Diagnostic and Storage Block, and the Radiology Storage Block.

To minimize manual handling and reduce the risk of exposure, it is proposed that each multi-story block be equipped with three gravity-fed vertical waste chutes, categorized as follows:

- **Red Chute** – for **Risk Waste** (e.g., sharps, infectious, pathological waste)
- **Yellow Chute** – for **Special Waste** (e.g., chemical and pharmaceutical waste)
- **Green Chute** – for **No-Risk Waste** (e.g., general, non-contaminated materials)

These chutes will channel the waste directly into dedicated, color-coded bins on the ground floor of each respective block. This contact-free, floor-to-ground movement system will limit corridor-level exposure and improve hygiene within patient care areas.

From the ground-floor bin collection points, waste will be transferred to the central Yellow Room or directly to the on-site dual-chamber incinerator using a hook-arm garbage truck operated under the supervision of the Gilgit-Baltistan Waste Management Company (GBWMC). The truck will lift and transport sealed bins from each block's ground-floor waste zone, streamlining internal logistics and enabling secure transfer without unnecessary manual handling.

All waste transport activities will be carried out by trained sanitary staff equipped with full Personal Protective Equipment (PPE), including gloves, boots, aprons, and masks. Standard operating procedures will ensure that waste bags are inspected prior to transport, and any ruptured or leaking containers are immediately replaced.

The proposed chute-and-bin system, combined with mechanical transfer via hook-arm vehicles, will support the hospital's long-term goals of infection prevention, regulatory compliance, and sustainable, centralized waste handling infrastructure.

III. Temporary Storage (Yellow Room)

The hospital utilizes a centralized Yellow Room for the temporary storage of hazardous medical waste. Although not originally designated in the architectural design, the space has been appropriately adapted for this purpose and is clearly marked with biohazard signage, with access strictly limited to authorized personnel in line with regulatory requirements. Located near the on-site incinerator, this setup allows for efficient and safe transfer of risk waste for treatment. Storage duration is limited to 24 hours to prevent biological degradation, odor development, or pest infestation. These practices align with the standards outlined in Section 19 of the Hospital Waste Management Rules, 2005.

In addition, an open area behind the incinerator, though not formally designated in the structural plan, is being utilized for the temporary storage of non-hazardous (general) waste collected in green bins. This space serves as a holding point before the waste is collected by the Gilgit-Baltistan Waste Management Company (GBWMC) for municipal disposal. Both areas are managed with clear segregation, appropriate labeling, and hygiene protocols to ensure safe and efficient waste handling within the hospital.

IV. Treatment and Final Disposal

The final stage of the hospital waste management system involves a structured, multi-step process to ensure the safe, hygienic, and environmentally compliant disposal of all categorized waste types. Each method is carefully chosen based on the nature of the waste and is implemented with appropriate infrastructure and operational protocols.

- **Incineration:**

A dual-chamber, high-temperature incinerator with a capacity of 100 kg per hour is used for the thermal destruction of infectious waste, sharps, and certain pharmaceutical residues. This incinerator is located in close proximity to the Yellow Room (central risk waste storage area) to allow efficient and safe transfer.
Key features of the incinerator include:

- Primary and secondary combustion chambers to ensure complete destruction of pathogens and hazardous organics.

- Equipped with pollution control devices in compliance with WHO standards and the Stockholm Convention to limit emissions and environmental impacts.
- Operated by trained personnel with safety and maintenance protocols in place.
- Must have Hybrid mode i-e., electrical and deiseal generator.

Placenta Pits

Specially lined placenta pits are designated for the safe burial of placental and maternity-related anatomical waste from labor and delivery units. These pits:

- Are constructed with proper lining to avoid leachate contamination.
- Include lockable covers to prevent access by unauthorized persons or animals.
- Are maintained in accordance with Hospital Waste Management Rules, 2005
- If not properly dumped into the the pits, the waste must be incinerated.

Ash Pits

The residue generated from the incinerator—primarily ash—is collected and deposited in dedicated ash pits located adjacent to the incinerator. These pits:

- Have a storage capacity of 4–6 months.
- Are enclosed and secure to prevent environmental exposure.
- Are emptied periodically, either for safe landfill disposal or further treatment, depending on the toxicity of the ash.

Non-Risk Waste

Waste classified as non-hazardous (green bin waste)—such as food scraps, packaging, clean plastics, and paper—is collected and managed separately from hazardous waste. Key steps include:

- Daily or scheduled collection and transfer to the Gilgit-Baltistan Waste Management Company (GBWMC) for proper disposal in designated municipal landfill sites.
- Recyclables are separated where possible to support resource recovery and reduce landfill loads.

Temporary Storage Provision:
To address any unforeseen delays or logistic challenges in waste collection by GBWMC, ample open space has been allocated behind the incinerator. This area will serve as a temporary holding zone for non-risk waste. It will:

- Be clearly demarcated and shielded to prevent wind scatter or access by animals.
- Be managed on a short-term basis only, ensuring timely clearance.
- Comply with environmental and public health guidelines for interim storage.

Radioactive Waste Management

If radioactive waste is generated during institutional activities (e.g., from radiological labs or diagnostic equipment), the following protocols shall apply as per Hospital Waste Management Rules 2005:

- Radioactive waste containing Tritium and Carbon-14 isotopes shall be stored separately in clearly labeled containers and shipped to the designated disposal site of the Pakistan Atomic Energy Commission (PAEC). Approved facilities include the Karachi Nuclear Power Plant (KANUPP) in Karachi or the Pakistan Institute of Science & Technology (PINSTECH) in Islamabad.
- In the case of gaseous radioactive waste, portable filter assemblies shall be used to extract iodine and xenon. The used filters, after saturation, shall be handled and disposed of as solid radioactive waste in compliance with national regulations and safety protocols.

5. Conclusion

The Hospital Waste Management Plan (HWMP) for the Medical and Nursing College, Gilgit, outlines a robust and compliant framework for the segregation, collection, transport, storage, treatment, and final disposal of all types of hospital-generated waste. Designed in alignment with national regulations (Hospital Waste Management Rules, 2005; National Hazardous Waste Management Policy, 2022) and international commitments (Basel and Stockholm Conventions), the plan reflects a deep commitment to public health, environmental safety, and institutional accountability.

Key components such as gravity-fed waste chutes, a centralized Yellow Room, dual-chamber incineration, and designated placenta and ash pits form the structural backbone of the system. Operationally, the plan is supported by the Gilgit-Baltistan Waste Management Company (GBWMC), responsible for final disposal and landfill operations. The plan ensures that all hospital waste—from high-risk sharps to general non-hazardous materials—is handled efficiently, transparently, and without adverse impact on the surrounding environment or community.

Through the implementation of this plan, the hospital sets a precedent for sustainable healthcare infrastructure in the region and builds the capacity to adapt, improve, and scale its practices over time in response to growing public health needs and regulatory expectations.

6. Recommendations

To further strengthen the hospital's commitment to environmental health, public safety, and regulatory compliance, the following recommendations are proposed for integration during the design, operation, and future expansion phases of the Medical and Nursing College Teaching Hospital:

- **Centralized Drainage System for Liquid Waste:**

  The hospital design should incorporate a dedicated, centralized drainage system for the safe and efficient disposal of wash water and liquid waste from OTs, patient rooms, diagnostic labs, and sterilization units. This system must include sedimentation chambers, grease traps, and filters before connection to municipal drains or effluent treatment facilities.

- **Environmentally Friendly Gravity Chutes:**

The gravity waste chutes proposed for each block must be designed with airtight, corrosion-resistant materials, proper ventilation, and cleaning access ports to prevent odors, bioaerosol emissions, or pest breeding. State-of-the-art chute systems should include odor seals and sound-dampening insulation to minimize nuisance and operational disturbances.

- **Designated Yellow Room Expansion:**

Although adapted in the current plan, future architectural modifications should formally designate and optimize the Yellow Room for hazardous waste storage. The room should be equipped with cooling, negative pressure airflow, and spill containment features for long-term compliance.

- **Dedicated Wash Areas in All Waste-Generating Units:**

Install dedicated wash stations for each major department (wards, OTs, labs) to facilitate equipment cleaning, with waste streams routed to the centralized drainage system to avoid cross-contamination.

- **Automated Waste Tracking System:**

Implement barcode or RFID-based tracking for waste bags to monitor their movement from generation to disposal, improve traceability, and support internal audits.

- **Emergency Waste Handling Protocols:**

Develop and rehearse emergency response plans for waste spills, chute blockages, incinerator breakdowns, or infectious outbreaks that may alter waste volume or risk level.

- **Continuous Training and Staff Rotation:**

Schedule mandatory quarterly training for all waste-handling staff and rotate duties among teams to prevent burnout and maintain motivation and awareness.

- **Third-Party Environmental Audits:**

Engage independent environmental consultants annually to assess compliance with national and international healthcare waste standards and recommend process improvements.

- **Advisory Committee:**

In accordance with Section 24 of the relevant environmental regulations, the hospital administration must constitute and notify an Advisory Committee through publication in the official Gazette. This committee should comprise representatives from hospital administration, environmental health experts, biomedical waste handlers, and local regulatory authorities, including Gilgit-Baltistan Waste Management Company. Its mandate shall include oversight of waste management practices, monitoring compliance with environmental and health regulations, reviewing audit findings, and recommending corrective actions where necessary.

Annexure 4: Drawing Design of Main Building

This annexure includes architectural drawings, and layout plans for the key components of the proposed Medical and Nursing College. Only those design elements that are essential to understanding the project's structure, functionality, and environmental relevance have been included. These drawings support the technical description and environmental assessment presented in the report.

The following building components are included:

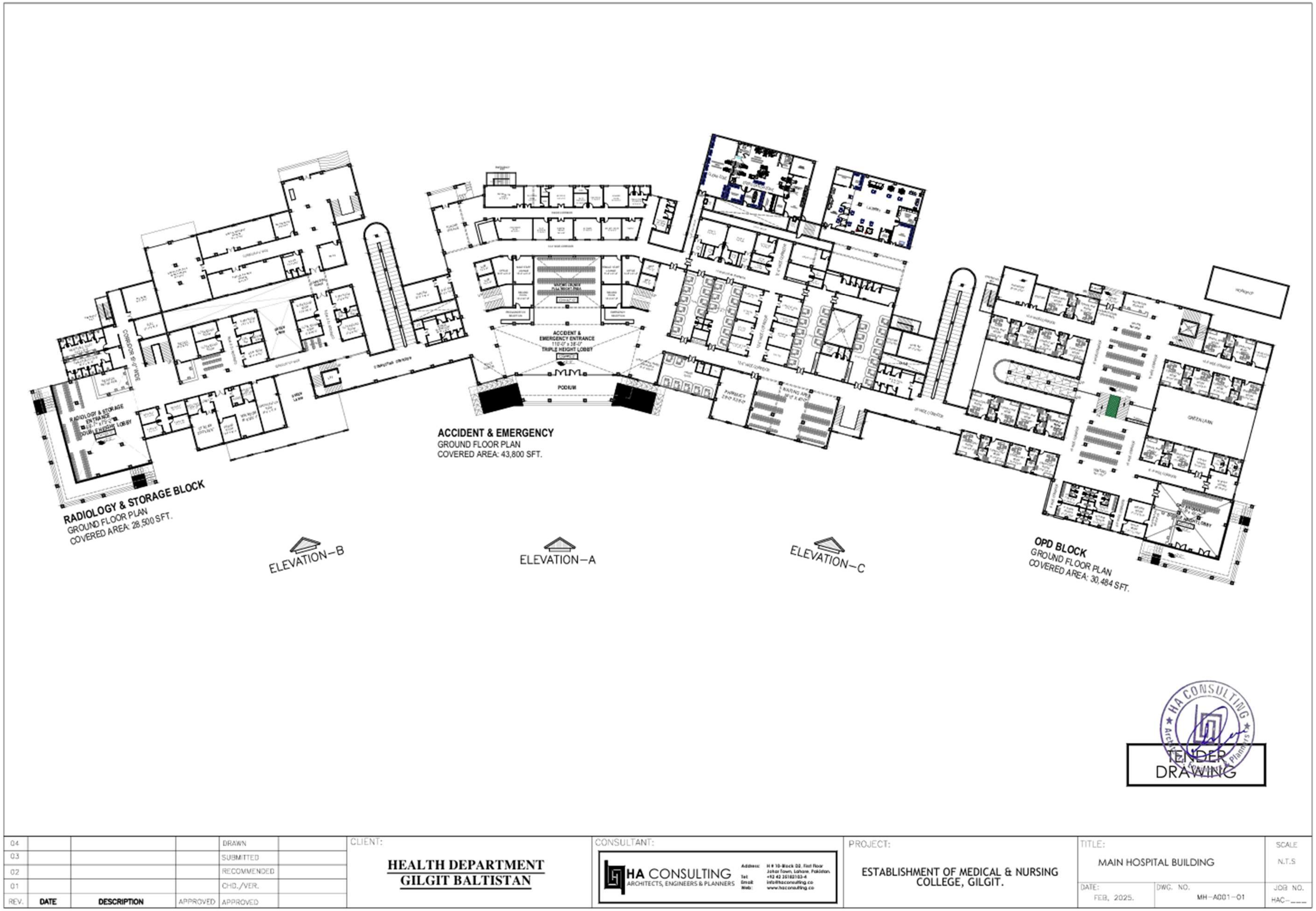
- **Main Hospital Building**
- **Radiology Storage Block**
- **Accident and Emergency Block**
- **OPD Block**
- **Medical College Building**
- **Nursing College Building**

These designs reflect the planned spatial configuration, functional zoning, and integration of medical education and service facilities, which are critical for both regulatory review and stakeholder understanding

MAIN HOSPITAL BUILDING

(ACCIDENT & EMERGENCY BLOCK, OPD BLOCK & DIAGNOSTICS & STORAGE BLOCK)

HA CONSULTING ★ Architects, Engineers & Planners ★


RADIOLOGY & STORAGE BLOCK
GROUND FLOOR PLAN
COVERED AREA: 28,500 SFT.
ACCIDENT & EMERGENCY ENTRANCE
TRIPLE HEIGHT LOBBY
PODIUM
ACCIDENT & EMERGENCY
GROUND FLOOR PLAN
COVERED AREA: 43,800 SFT.
OPD BLOCK
GROUND FLOOR PLAN
COVERED AREA: 30,484 SFT.
ELEVATION–B
ELEVATION–A
ELEVATION–C
TENDER DRAWING
REV. DATE DESCRIPTION APPROVED
DRAWN
SUBMITTED
RECOMMENDED
CHD./VER.
APPROVED
CLIENT:
HEALTH DEPARTMENT
GILGIT BALTISTAN
CONSULTANT:
HA CONSULTING
ARCHITECTS, ENGINEERS & PLANNERS
PROJECT:
ESTABLISHMENT OF MEDICAL & NURSING COLLEGE, GILGIT.
TITLE:
MAIN HOSPITAL BUILDING
SCALE
N.T.S
DATE:
FEB, 2025.
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MH-A001-01
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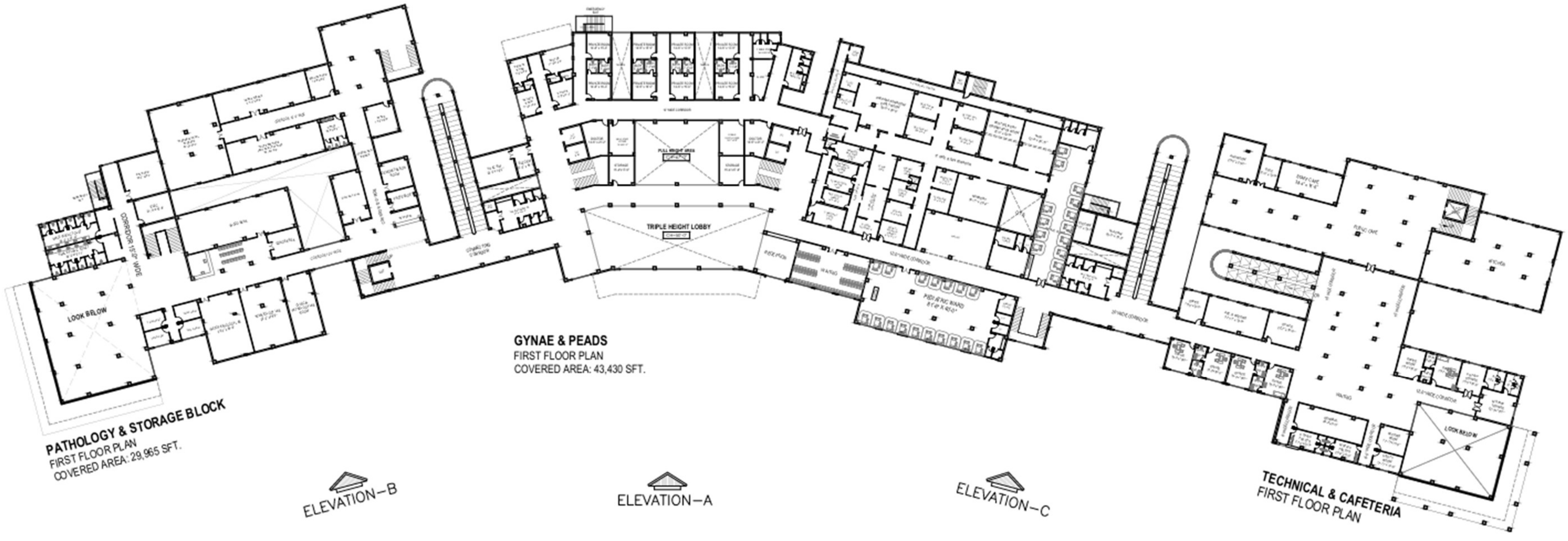
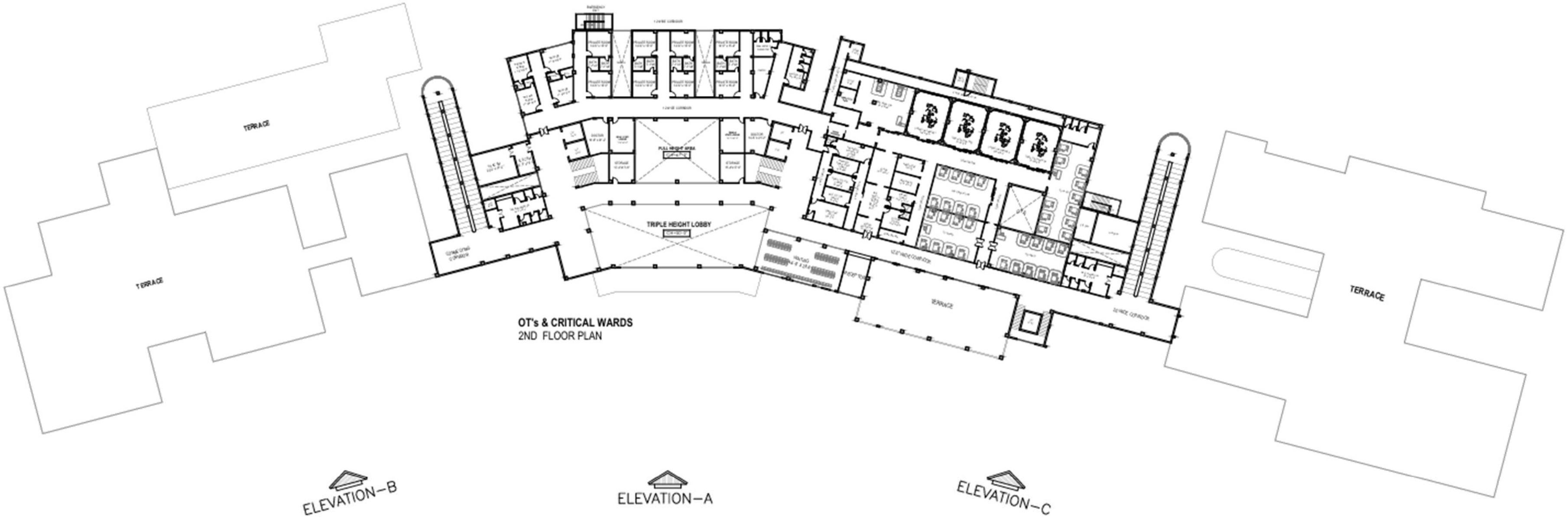


TENDER DRAWING

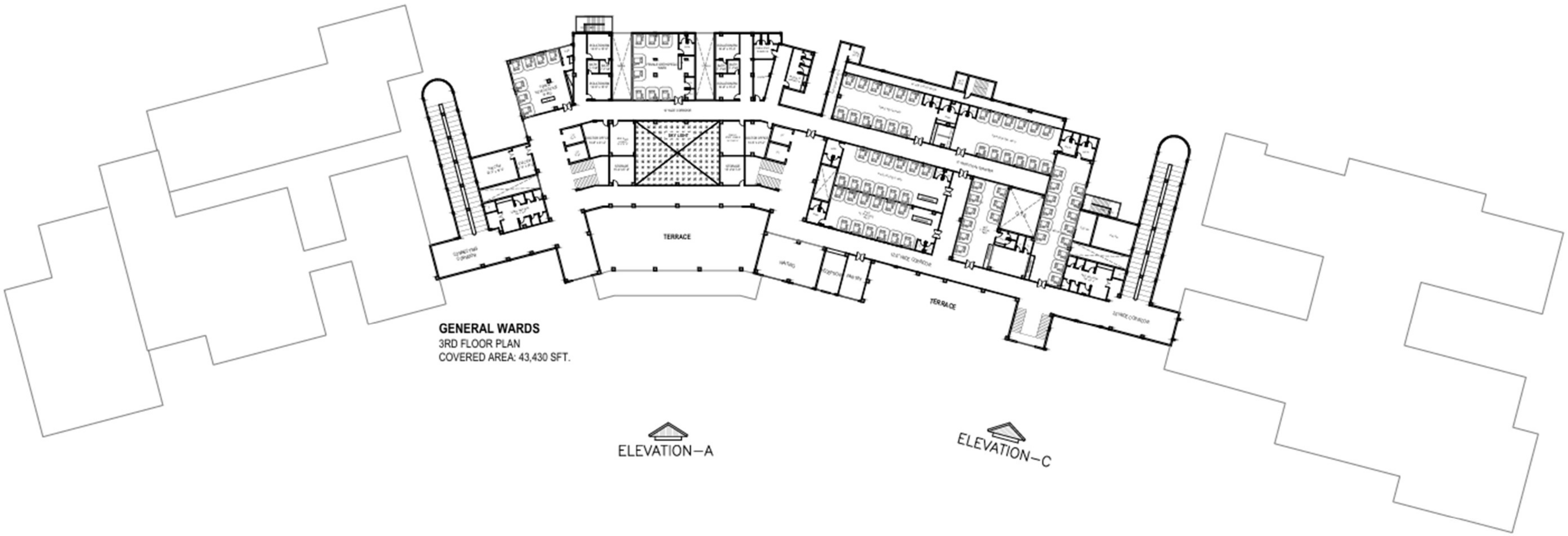
REV.	DATE	DESCRIPTION	APPROVED		CLIENT:	CONSULTANT:	PROJECT:	TITLE:	SCALE
04				DRAWN	HEALTH DEPARTMENT GILGIT BALTISTAN	HA CONSULTING ARCHITECTS, ENGINEERS & PLANNERS	ESTABLISHMENT OF MEDICAL & NURSING COLLEGE, GILGIT.	MAIN HOSPITAL BUILDING	N.T.S
03				SUBMITTED				DATE: FEB, 2025.	JOB NO.
02				RECOMMENDED				DWG. NO. MH-A001-02	HAC-___
01				CHD./VER.					
				APPROVED					



TENDER DRAWING

04				DRAWN	
03				SUBMITTED	
02				RECOMMENDED	
01				CHD./VER.	
REV.	DATE	DESCRIPTION	APPROVED	APPROVED	

CLIENT:	CONSULTANT:	PROJECT:	TITLE:	SCALE
HEALTH DEPARTMENT GILGIT BALTISTAN	HA CONSULTING ARCHITECTS, ENGINEERS & PLANNERS	ESTABLISHMENT OF MEDICAL & NURSING COLLEGE, GILGIT.	MAIN HOSPITAL BUILDING	N.T.S
			DATE: FEB, 2025. DWG. NO. MH–A001–03	JOB NO. HAC–___



04				DRAWN	
03				SUBMITTED	
02				RECOMMENDED	
01				CHD./VER.	
REV.	DATE	DESCRIPTION	APPROVED	APPROVED	

CLIENT: **HEALTH DEPARTMENT GILGIT BALTISTAN**

CONSULTANT: HA CONSULTING — ARCHITECTS, ENGINEERS & PLANNERS

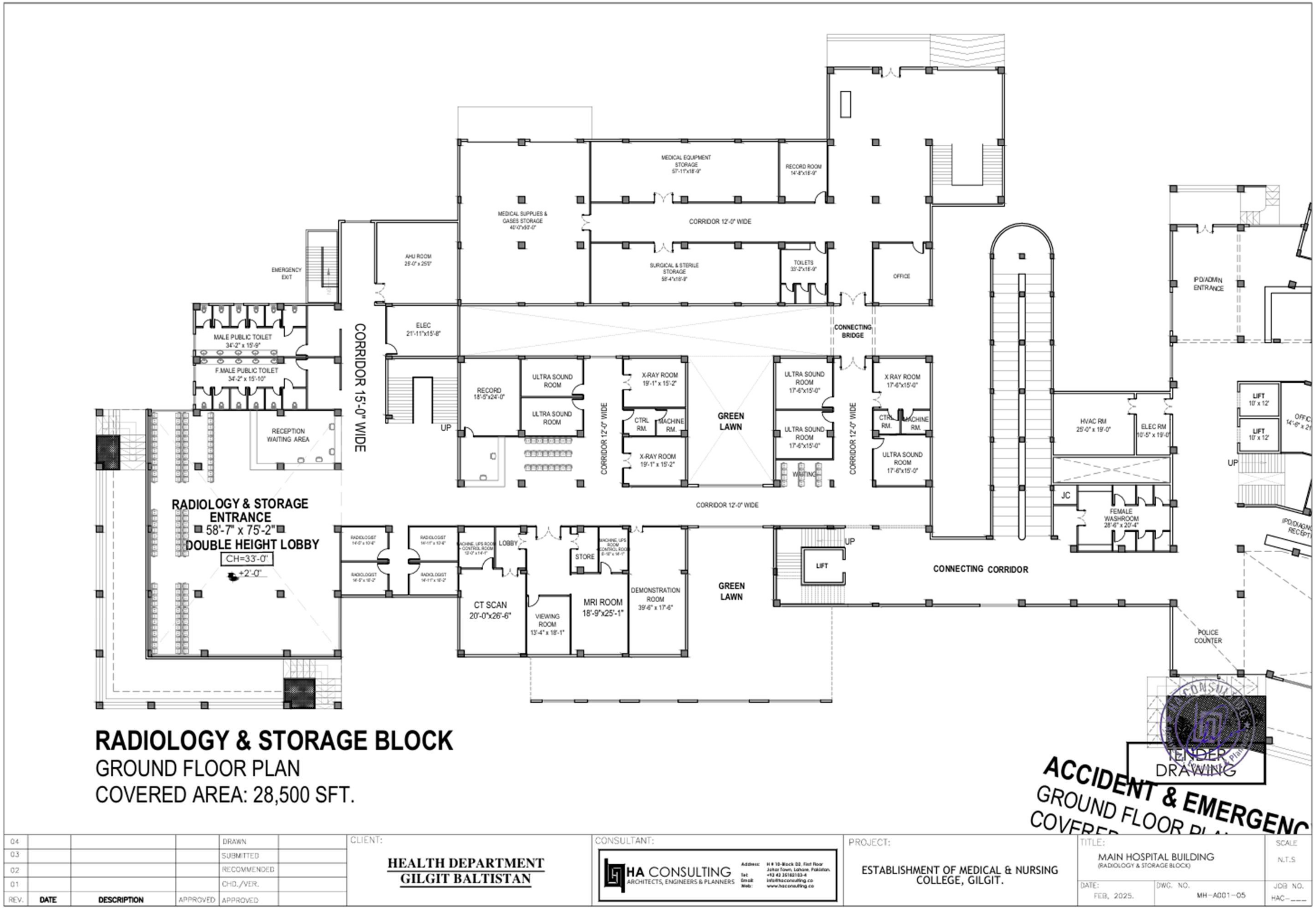
PROJECT: ESTABLISHMENT OF MEDICAL & NURSING COLLEGE, GILGIT.

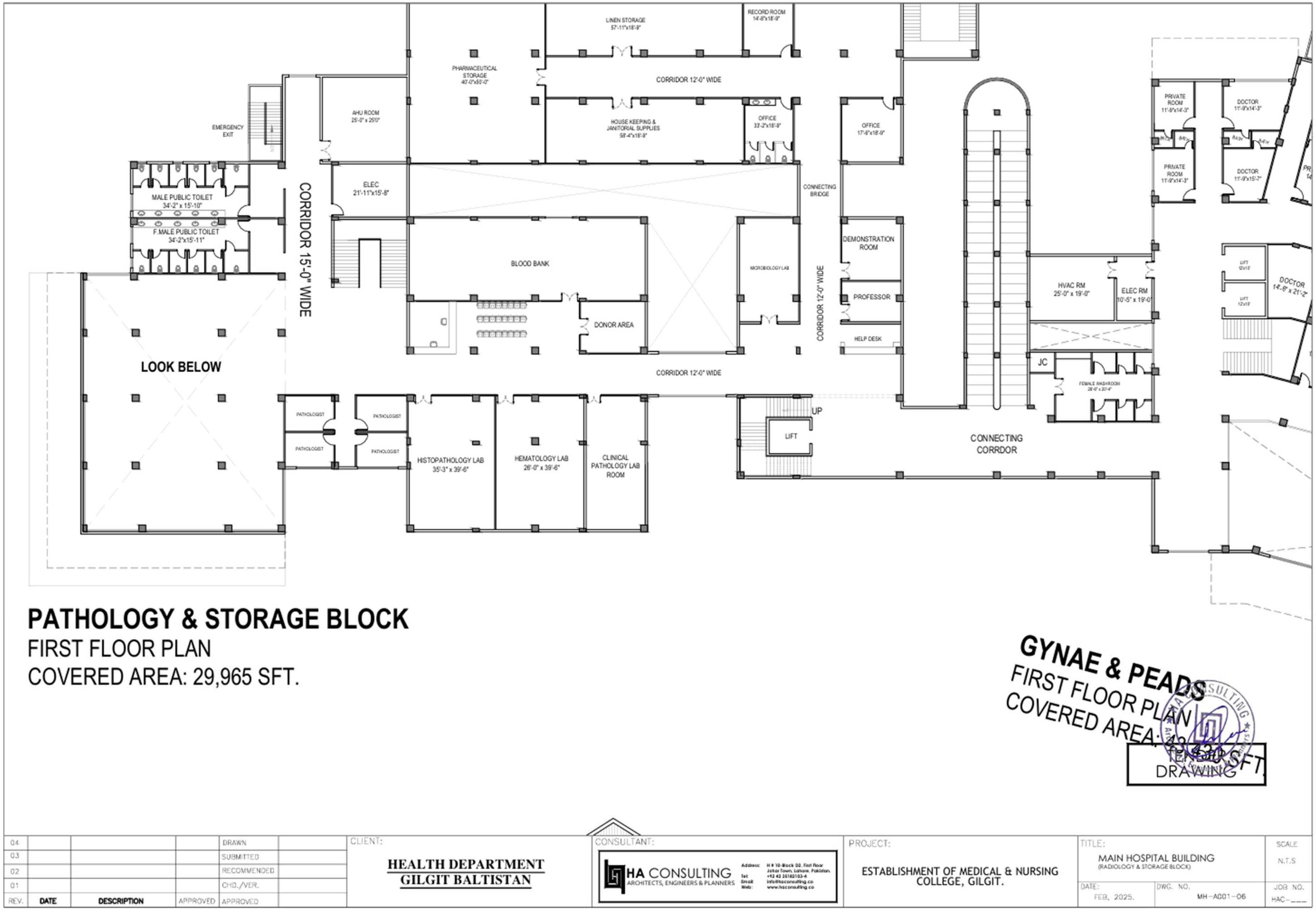
TITLE: MAIN HOSPITAL BUILDING

SCALE: N.T.S

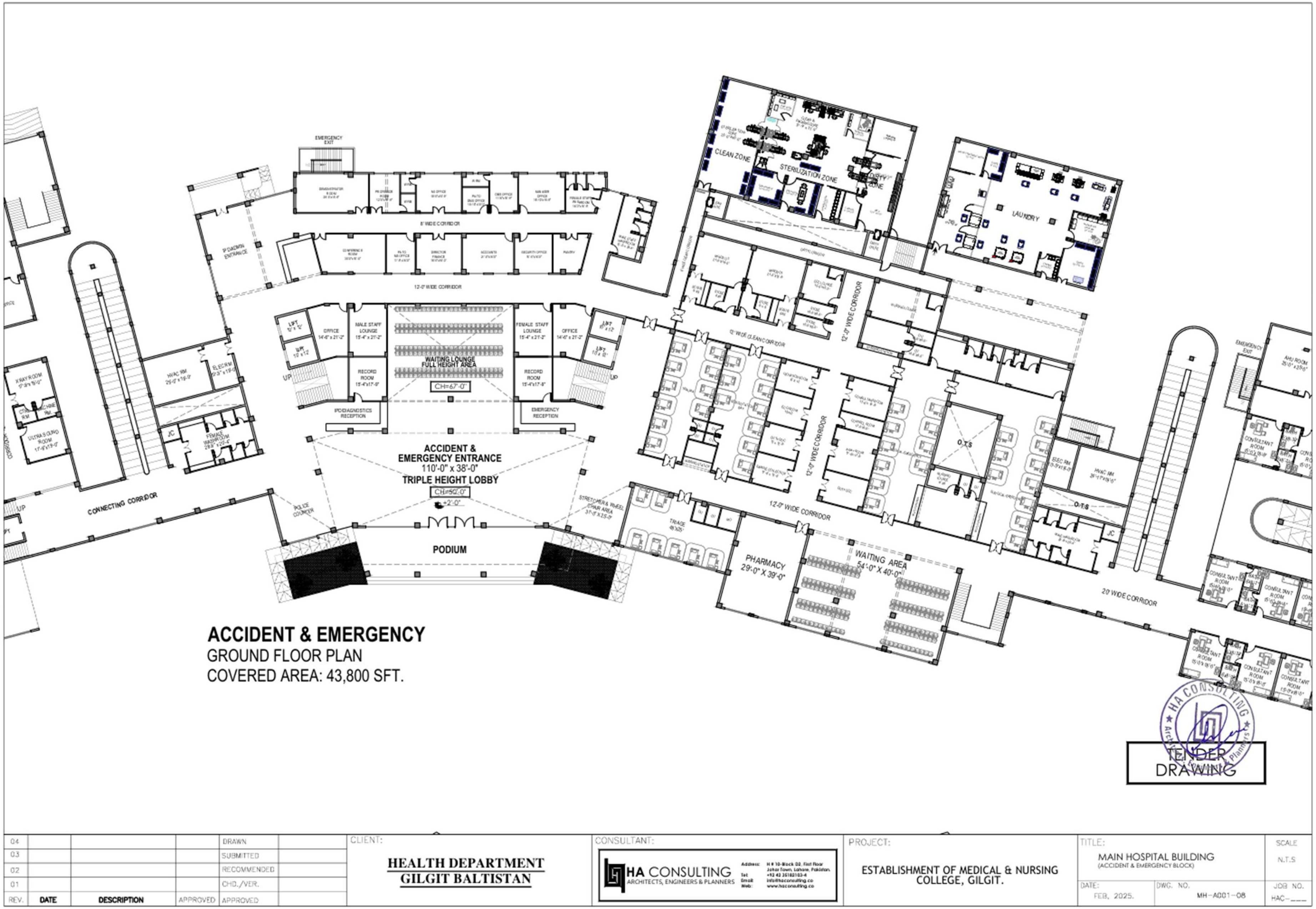
DATE: FEB, 2025. DWG. NO. MH—A001—04 JOB NO. HAC—___

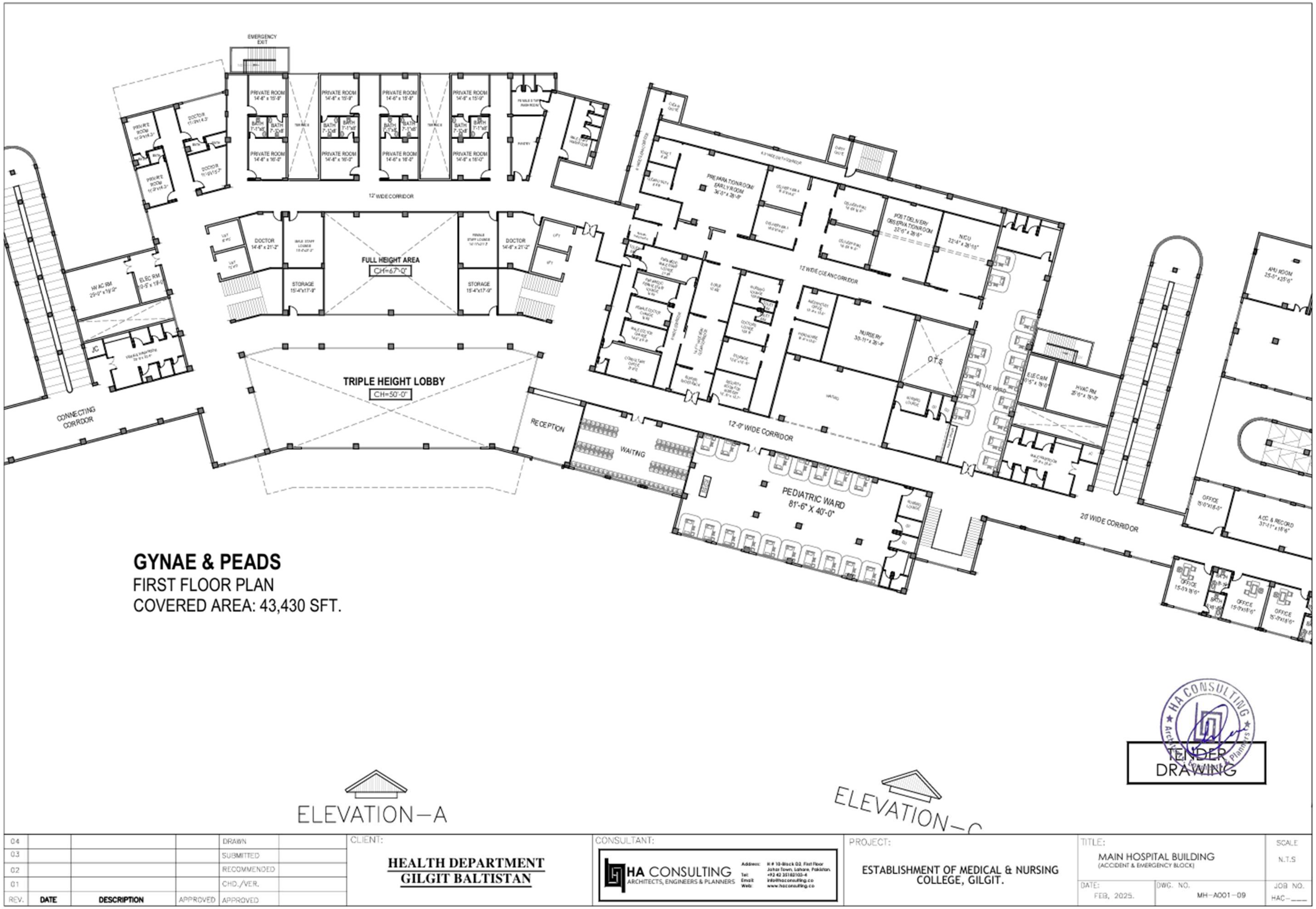
RADIOLOGY & STORAGE BLOCK

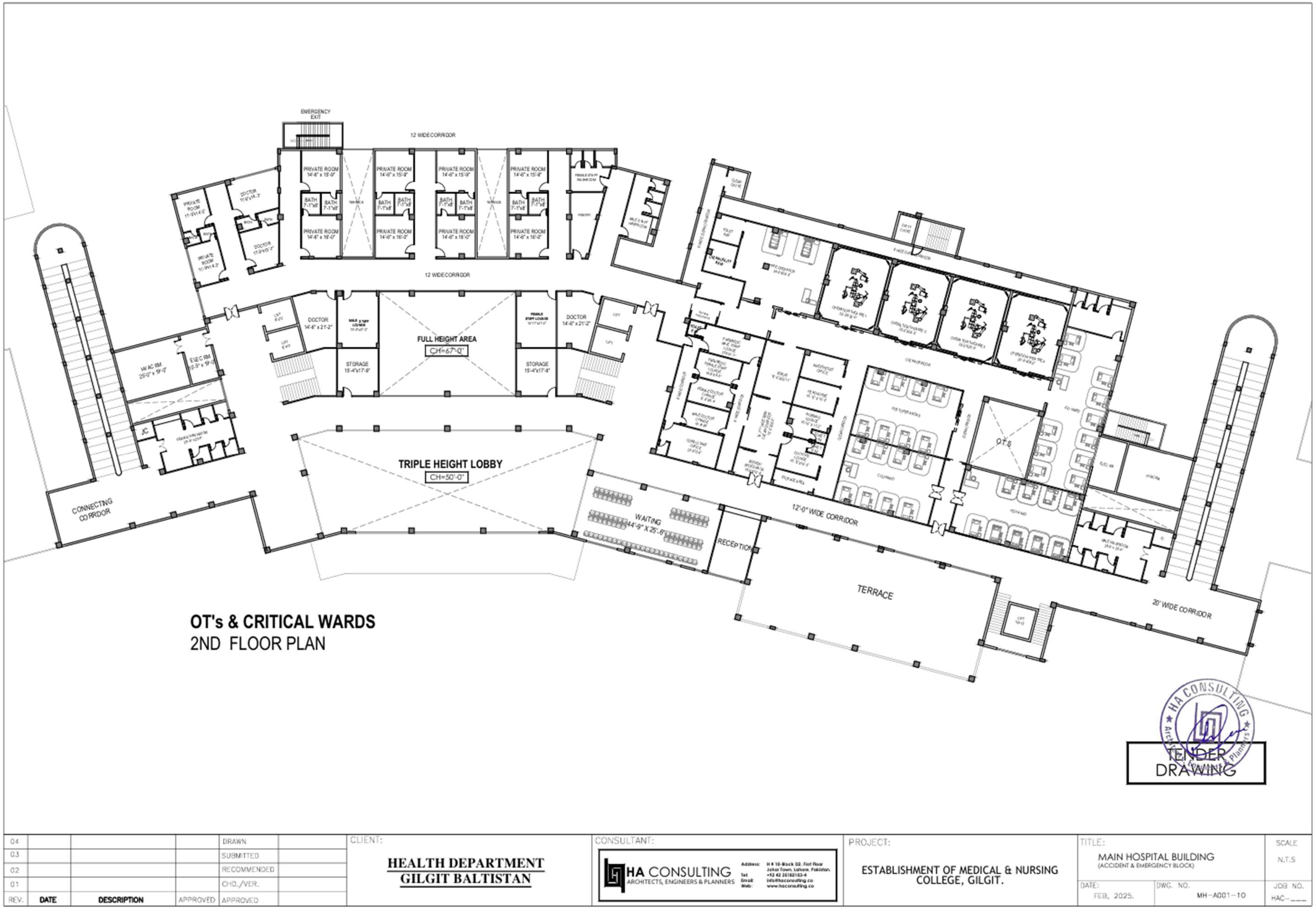

RADIOLOGY & STORAGE BLOCK
GROUND FLOOR PLAN
COVERED AREA: 28,500 SFT.
RADIOLOGY & STORAGE ENTRANCE
58'-7" x 75'-2"
DOUBLE HEIGHT LOBBY
CH=33'-0"
+2'-0"
CORRIDOR 15'-0" WIDE
CORRIDOR 12'-0" WIDE
CONNECTING BRIDGE
CONNECTING CORRIDOR
GREEN LAWN
RECEPTION WAITING AREA
MALE PUBLIC TOILET
F.MALE PUBLIC TOILET
EMERGENCY EXIT
AHU ROOM
ELEC
MEDICAL SUPPLIES & GASES STORAGE
MEDICAL EQUIPMENT STORAGE
RECORD ROOM
SURGICAL & STERILE STORAGE
TOILETS
OFFICE
RECORD
ULTRA SOUND ROOM
X-RAY ROOM
CTRL RM.
MACHINE RM.
WAITING
CT SCAN
20'-0"x26'-6"
VIEWING ROOM
MRI ROOM
18'-9"x25'-1"
DEMONSTRATION ROOM
LOBBY
STORE
LIFT
UP
HVAC RM
ELEC RM
JC
FEMALE WASHROOM
IPD/ADMIN ENTRANCE
POLICE COUNTER
TENDER DRAWING
ACCIDENT & EMERGENC
GROUND FLOOR PLA
CLIENT:
HEALTH DEPARTMENT
GILGIT BALTISTAN
CONSULTANT:
HA CONSULTING
ARCHITECTS, ENGINEERS & PLANNERS
PROJECT:
ESTABLISHMENT OF MEDICAL & NURSING COLLEGE, GILGIT.
TITLE:
MAIN HOSPITAL BUILDING
(RADIOLOGY & STORAGE BLOCK)
SCALE
N.T.S
DATE:
FEB, 2025.
DWG. NO.
MH-A001-05
JOB NO.
HAC-
REV.
DATE
DESCRIPTION
APPROVED
DRAWN
SUBMITTED
RECOMMENDED
CHD./VER.


LINEN STORAGE
RECORD ROOM
PHARMACEUTICAL STORAGE
CORRIDOR 12'-0" WIDE
AHU ROOM
EMERGENCY EXIT
HOUSE KEEPING & JANITORIAL SUPPLIES
OFFICE
OFFICE
PRIVATE ROOM
DOCTOR
PRIVATE ROOM
DOCTOR
MALE PUBLIC TOILET
F.MALE PUBLIC TOILET
CORRIDOR 15'-0" WIDE
ELEC
CONNECTING BRIDGE
BLOOD BANK
MICROBIOLOGY LAB
DEMONSTRATION ROOM
PROFESSOR
HELP DESK
CORRIDOR 12'-0" WIDE
HVAC RM
ELEC RM
DOCTOR
DONOR AREA
LOOK BELOW
CORRIDOR 12'-0" WIDE
JC
FEMALE WASHROOM
PATHOLOGIST
PATHOLOGIST
PATHOLOGIST
PATHOLOGIST
HISTOPATHOLOGY LAB
HEMATOLOGY LAB
CLINICAL PATHOLOGY LAB ROOM
UP
LIFT
CONNECTING CORRDOR
PATHOLOGY & STORAGE BLOCK
FIRST FLOOR PLAN
COVERED AREA: 29,965 SFT.
GYNAE & PEADS
FIRST FLOOR PLAN
TENDER DRAWING
DRAWN
SUBMITTED
RECOMMENDED
CHD./VER.
REV.
DATE
DESCRIPTION
APPROVED
APPROVED
CLIENT:
HEALTH DEPARTMENT
GILGIT BALTISTAN
CONSULTANT:
HA CONSULTING
ARCHITECTS, ENGINEERS & PLANNERS
PROJECT:
ESTABLISHMENT OF MEDICAL & NURSING COLLEGE, GILGIT.
TITLE:
MAIN HOSPITAL BUILDING
(RADIOLOGY & STORAGE BLOCK)
DATE:
FEB, 2025.
DWG. NO.
MH-A001-06
SCALE
N.T.S
JOB NO.
HAC-___

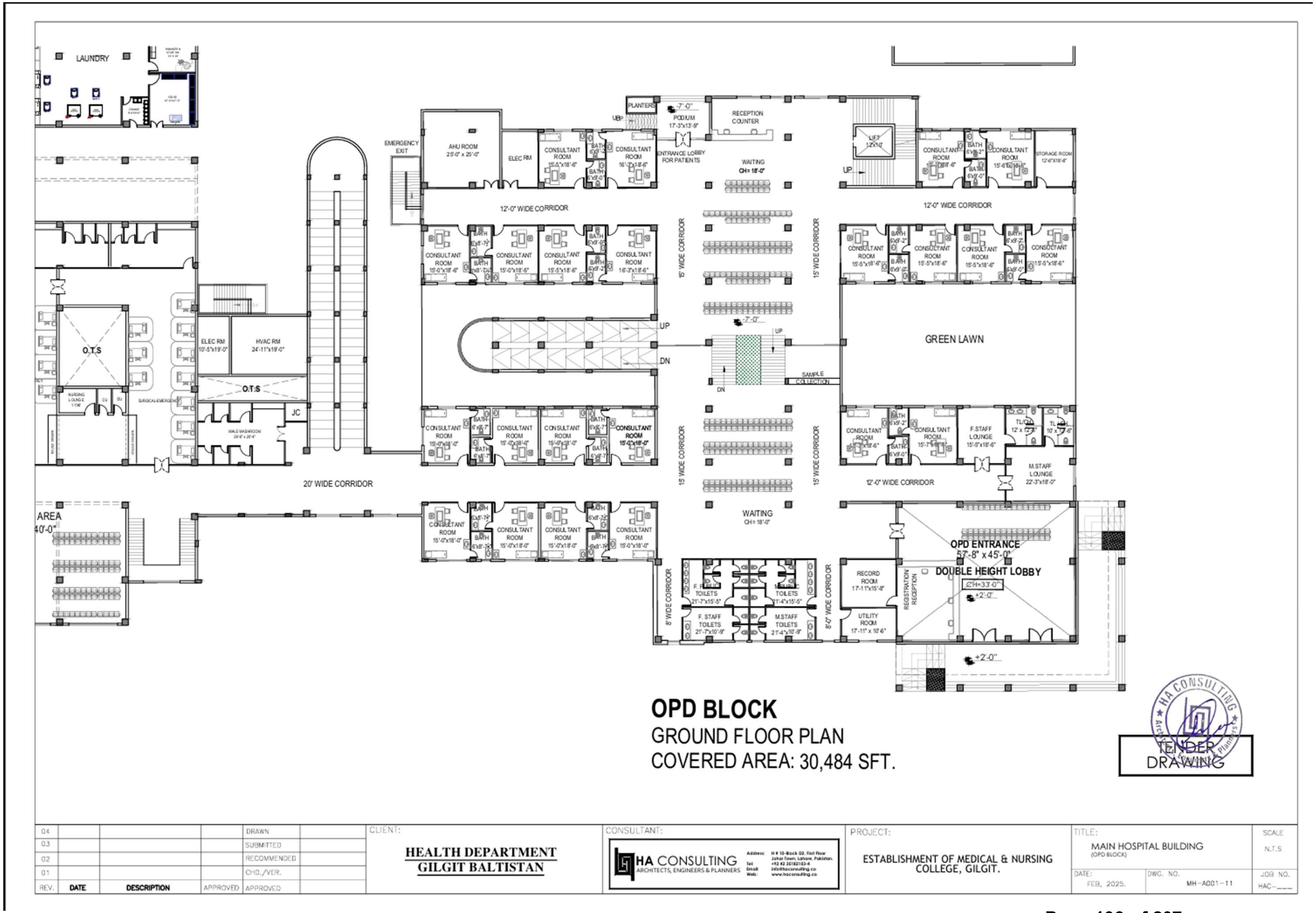
ACCIDENT & EMERGENCY BLOCK

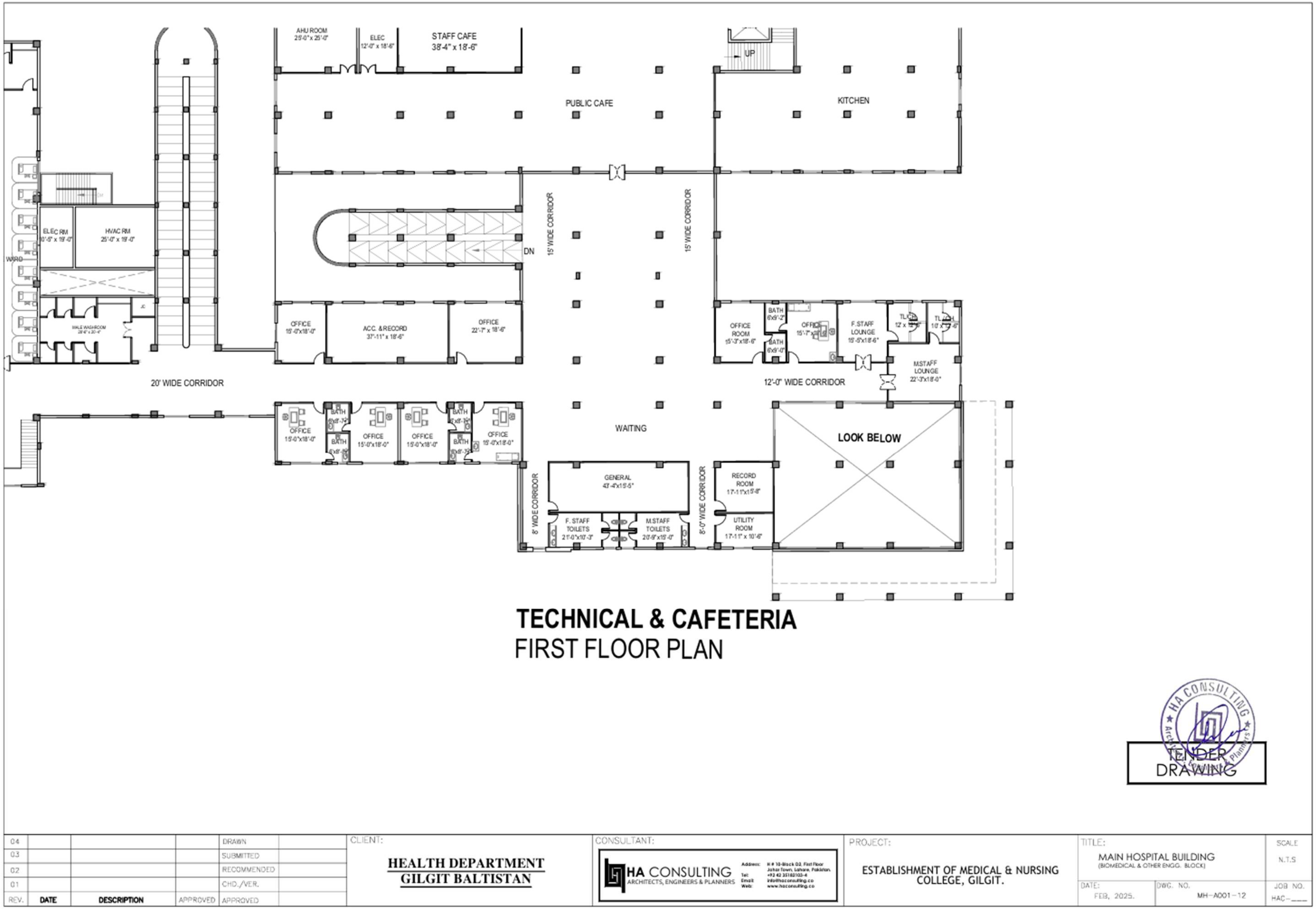

ACCIDENT & EMERGENCY
GROUND FLOOR PLAN
COVERED AREA: 43,800 SFT.
ACCIDENT & EMERGENCY ENTRANCE
110'-0" x 38'-0"
TRIPLE HEIGHT LOBBY
WAITING LOUNGE FULL HEIGHT AREA
PODIUM
PHARMACY
29'-0" X 39'-0"
WAITING AREA
54'-0" X 40'-0"
CONNECTING CORRIDOR
12'-0" WIDE CORRIDOR
20' WIDE CORRIDOR
CLEAN ZONE
STERILIZATION ZONE
LAUNDRY
TENDER DRAWING
CLIENT:
HEALTH DEPARTMENT
GILGIT BALTISTAN
CONSULTANT:
HA CONSULTING
ARCHITECTS, ENGINEERS & PLANNERS
PROJECT:
ESTABLISHMENT OF MEDICAL & NURSING COLLEGE, GILGIT.
TITLE:
MAIN HOSPITAL BUILDING
(ACCIDENT & EMERGENCY BLOCK)
DATE:
FEB. 2025.
DWG. NO.
MH-A001-08
SCALE
N.T.S
JOB NO.
HAC-___
REV.
DATE
DESCRIPTION
APPROVED
DRAWN
SUBMITTED
RECOMMENDED
CHD./VER.

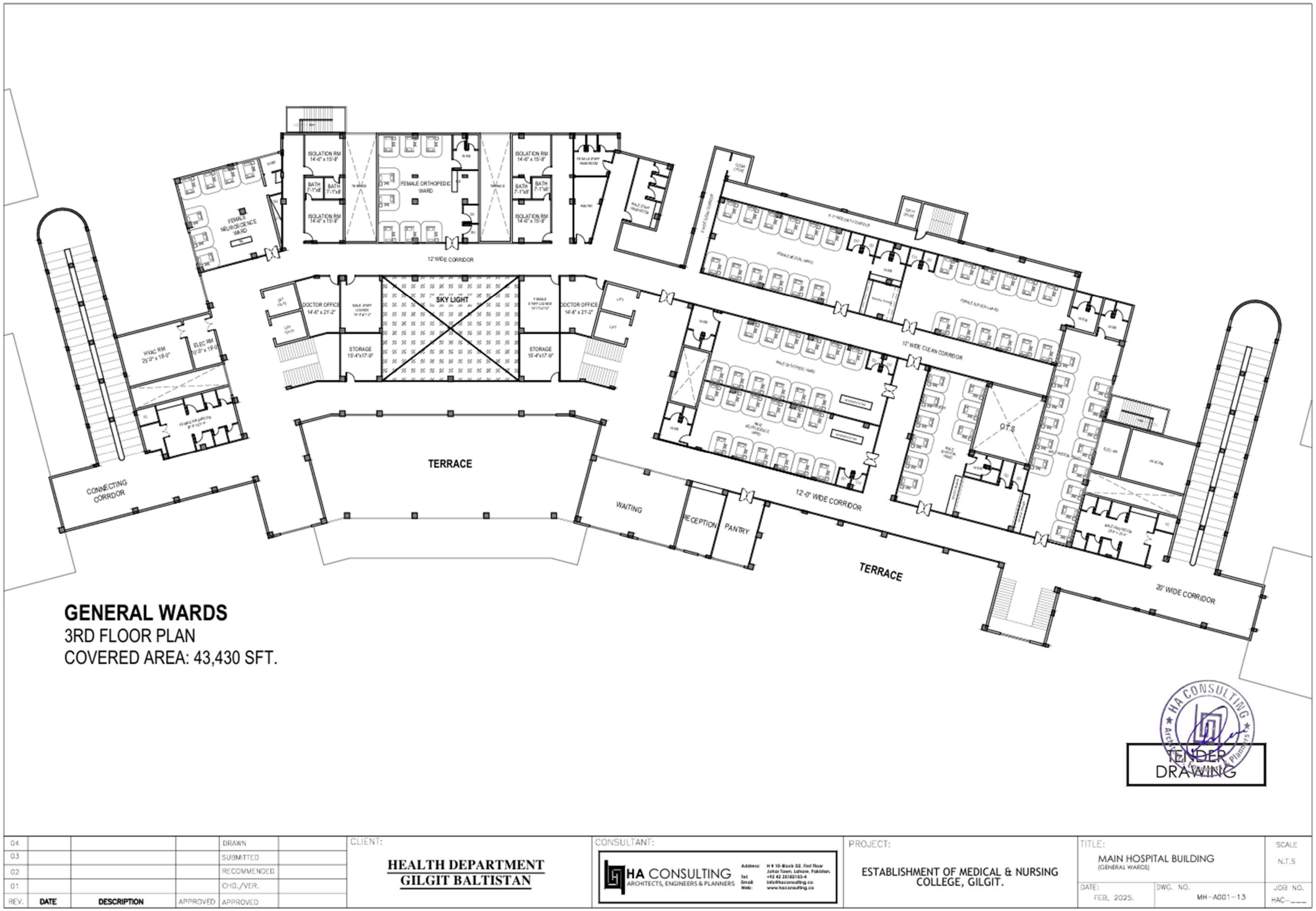

GYNAE & PEADS
FIRST FLOOR PLAN
COVERED AREA: 43,430 SFT.
TRIPLE HEIGHT LOBBY
CH=50'-0"
FULL HEIGHT AREA
CH=67'-0"
PEDIATRIC WARD
81'-6" X 40'-0"
12'-0" WIDE CORRIDOR
20' WIDE CORRIDOR
12' WIDE CORRIDOR
RECEPTION
WAITING
CONNECTING CORRDOR
NURSERY
NICU
EMERGENCY EXIT
ELEVATION—A
ELEVATION—C
TENDER DRAWING
CLIENT:
HEALTH DEPARTMENT
GILGIT BALTISTAN
CONSULTANT:
HA CONSULTING
ARCHITECTS, ENGINEERS & PLANNERS
PROJECT:
ESTABLISHMENT OF MEDICAL & NURSING COLLEGE, GILGIT.
TITLE:
MAIN HOSPITAL BUILDING
(ACCIDENT & EMERGENCY BLOCK)
SCALE
N.T.S
DATE:
FEB, 2025.
DWG. NO.
MH-A001-09
JOB NO.
HAC-___
REV. DATE DESCRIPTION APPROVED
DRAWN
SUBMITTED
RECOMMENDED
CHD./VER.
APPROVED


EMERGENCY EXIT
12 WIDE CORRIDOR
PRIVATE ROOM
BATH
DOCTOR
FULL HEIGHT AREA
CH=67'-0"
STORAGE
TRIPLE HEIGHT LOBBY
CH=50'-0"
CONNECTING CORRIDOR
JC
WAITING
44'-9" X 25'-6"
RECEPTION
12'-0" WIDE CORRIDOR
TERRACE
20' WIDE CORRIDOR
OT's & CRITICAL WARDS
2ND FLOOR PLAN
TENDER DRAWING
HA CONSULTING
DRAWN
SUBMITTED
RECOMMENDED
CHD./VER.
APPROVED
REV. DATE DESCRIPTION APPROVED
CLIENT:
HEALTH DEPARTMENT
GILGIT BALTISTAN
CONSULTANT:
HA CONSULTING
ARCHITECTS, ENGINEERS & PLANNERS
PROJECT:
ESTABLISHMENT OF MEDICAL & NURSING COLLEGE, GILGIT.
TITLE:
MAIN HOSPITAL BUILDING
(ACCIDENT & EMERGENCY BLOCK)
DATE: FEB, 2025.
DWG. NO. MH-A001-10
SCALE N.T.S
JOB NO. HAC-

OPD BLOCK


LAUNDRY
AHU ROOM
ELEC RM
CONSULTANT ROOM
BATH
PLANTERS
PODIUM
RECEPTION COUNTER
ENTRANCE LOBBY FOR PATIENTS
WAITING
LIFT
STORAGE ROOM
EMERGENCY EXIT
12'-0" WIDE CORRIDOR
15' WIDE CORRIDOR
O.T.S
ELEC RM
HVAC RM
UP
DN
GREEN LAWN
SAMPLE COLLECTION
JC
F.STAFF LOUNGE
M.STAFF LOUNGE
20' WIDE CORRIDOR
AREA
OPD ENTRANCE
57'-8" x 45'-0"
DOUBLE HEIGHT LOBBY
REGISTRATION RECEPTION
RECORD ROOM
UTILITY ROOM
F. PUBLIC TOILETS
M. PUBLIC TOILETS
F. STAFF TOILETS
M.STAFF TOILETS
8'-0" WIDE CORRIDOR
OPD BLOCK
GROUND FLOOR PLAN
COVERED AREA: 30,484 SFT.
TENDER DRAWING
CLIENT:
HEALTH DEPARTMENT
GILGIT BALTISTAN
CONSULTANT:
HA CONSULTING
ARCHITECTS, ENGINEERS & PLANNERS
PROJECT:
ESTABLISHMENT OF MEDICAL & NURSING COLLEGE, GILGIT.
TITLE:
MAIN HOSPITAL BUILDING
(OPD BLOCK)
DATE:
FEB. 2025.
DWG. NO.
MH-A001-11
SCALE
N.T.S
JOB NO.
HAC-___
DRAWN
SUBMITTED
RECOMMENDED
CHD./VER.
APPROVED
REV.
DATE
DESCRIPTION
APPROVED


AHU ROOM 25'-0" x 25'-0"
ELEC 12'-0" x 18'-6"
STAFF CAFE 38'-4" x 18'-6"
PUBLIC CAFE
KITCHEN
UP
DN
ELEC RM
HVAC RM 25'-0" x 19'-0"
15' WIDE CORRIDOR
15' WIDE CORRIDOR
OFFICE 15'-0"x18'-0"
ACC. & RECORD 37'-11" x 18'-6"
OFFICE 22'-7" x 18'-6"
OFFICE ROOM
BATH
OFFICE
F.STAFF LOUNGE
M.STAFF LOUNGE
20' WIDE CORRIDOR
12'-0" WIDE CORRIDOR
WAITING
LOOK BELOW
OFFICE 15'-0"x18'-0"
BATH
GENERAL
RECORD ROOM
UTILITY ROOM
F. STAFF TOILETS
M.STAFF TOILETS
8' WIDE CORRIDOR
8'-0" WIDE CORRIDOR
TECHNICAL & CAFETERIA
FIRST FLOOR PLAN
TENDER DRAWING
HA CONSULTING
04
03
02
01
REV.
DATE
DESCRIPTION
APPROVED
DRAWN
SUBMITTED
RECOMMENDED
CHD./VER.
APPROVED
CLIENT:
HEALTH DEPARTMENT
GILGIT BALTISTAN
CONSULTANT:
HA CONSULTING
ARCHITECTS, ENGINEERS & PLANNERS
PROJECT:
ESTABLISHMENT OF MEDICAL & NURSING COLLEGE, GILGIT.
TITLE:
MAIN HOSPITAL BUILDING
(BIOMEDICAL & OTHER ENGG. BLOCK)
SCALE
N.T.S
DATE:
FEB, 2025.
DWG. NO.
MH-A001-12
JOB NO.
HAC-___


GENERAL WARDS
3RD FLOOR PLAN
COVERED AREA: 43,430 SFT.
TERRACE
TERRACE
SKY LIGHT
12' WIDE CORRIDOR
12'-0" WIDE CORRIDOR
12' WIDE CLEAN CORRIDOR
20' WIDE CORRIDOR
CONNECTING CORRDOR
WAITING
RECEPTION
PANTRY
DOCTOR OFFICE
DOCTOR OFFICE
STORAGE
STORAGE
HVAC RM
ELEC RM
ISOLATION RM
BATH
FEMALE ORTHOPEDIC WARD
FEMALE NEUROSCIENCE WARD
O.T.S
TENDER DRAWING
CLIENT:
HEALTH DEPARTMENT
GILGIT BALTISTAN
CONSULTANT:
HA CONSULTING
ARCHITECTS, ENGINEERS & PLANNERS
PROJECT:
ESTABLISHMENT OF MEDICAL & NURSING COLLEGE, GILGIT.
TITLE:
MAIN HOSPITAL BUILDING
(GENERAL WARDS)
DATE:
FEB, 2025.
DWG. NO.
MH-A001-13
SCALE
N.T.S
JOB NO.
HAC-___
REV.
DATE
DESCRIPTION
APPROVED
DRAWN
SUBMITTED
RECOMMENDED
CHD./VER.
APPROVED

MEDICAL COLLEGE BUILDING

3D VIEW OF MEDICAL COLLEGE BUILDING

TENDER DRAWING

REV.	DATE	DESCRIPTION	APPROVED		
04				DRAWN	
03				SUBMITTED	
02				RECOMMENDED	
01				CHD./VER.	
				APPROVED	

CLIENT:
HEALTH DEPARTMENT
GILGIT BALTISTAN

CONSULTANT:
HA CONSULTING
ARCHITECTS, ENGINEERS & PLANNERS
Address: H # 10-Block D2, First Floor Johar Town, Lahore, Pakistan.
Tel: +92 42 35182103-4
Email: info@haconsulting.co
Web: www.haconsulting.co

PROJECT:
ESTABLISHMENT OF MEDICAL & NURSING COLLEGE, GILGIT.

TITLE:
MEDICAL & DENTAL CLINIC

SCALE: N.T.S

DATE: JAN, 2025.

DWG. NO. MD-A001-00

JOB NO. HAC-___

3D VIEW OF MEDICAL COLLEGE BUILDING

TENDER DRAWING

REV.	DATE	DESCRIPTION	APPROVED		
04				DRAWN	
03				SUBMITTED	
02				RECOMMENDED	
01				CHD./VER.	
				APPROVED	

CLIENT: **HEALTH DEPARTMENT GILGIT BALTISTAN**

CONSULTANT: HA CONSULTING — ARCHITECTS, ENGINEERS & PLANNERS

PROJECT: ESTABLISHMENT OF MEDICAL & NURSING COLLEGE, GILGIT.

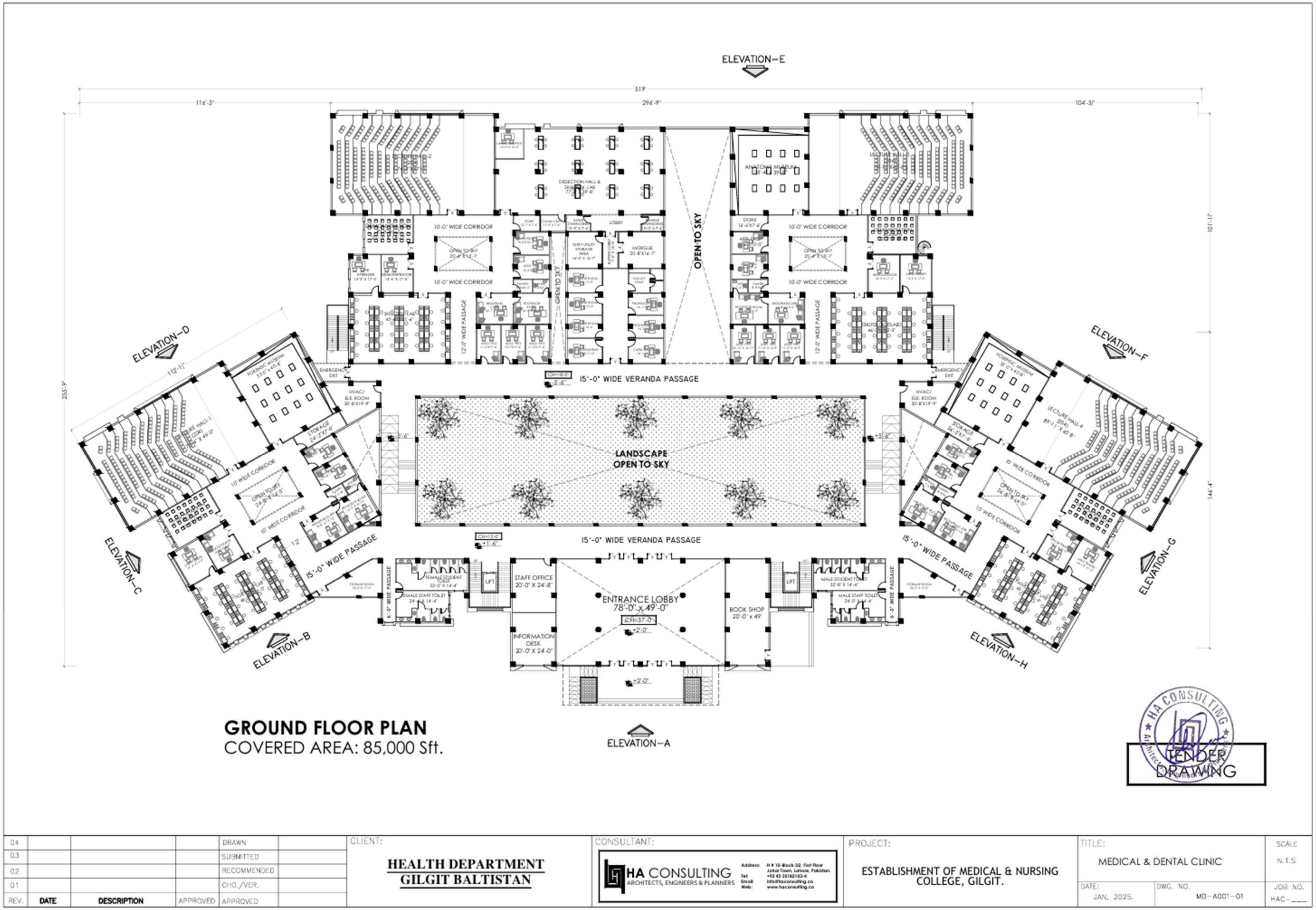
TITLE: MEDICAL & DENTAL CLINIC

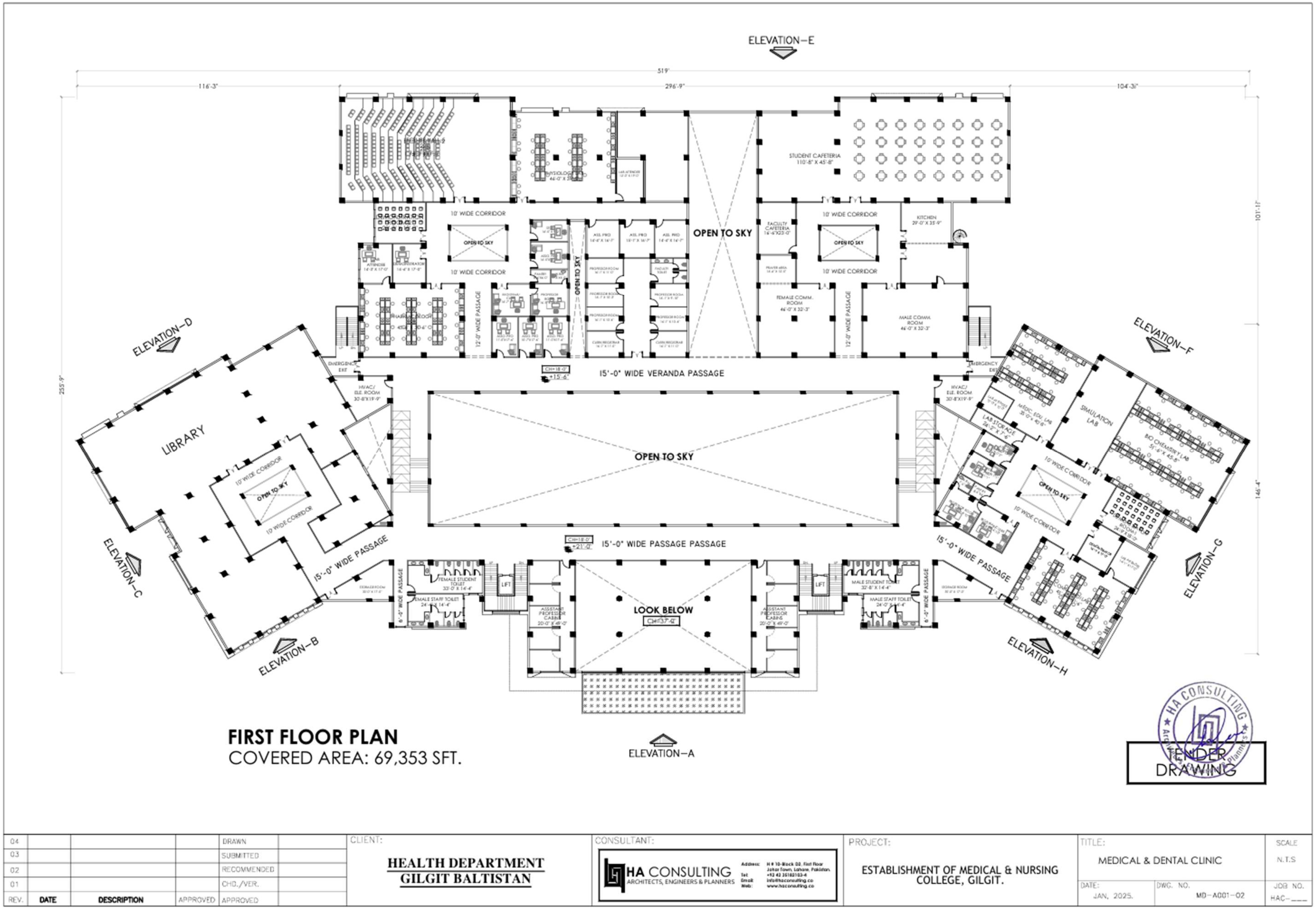
DATE: JAN, 2025.

DWG. NO. MD-A001-00

SCALE: N.T.S

JOB NO. HAC-___


ELEVATION-E
519'
116'-3"
296'-9"
104'-3"
OPEN TO SKY
10'-0" WIDE CORRIDOR
ELEVATION-D
ELEVATION-F
15'-0" WIDE VERANDA PASSAGE
LANDSCAPE
OPEN TO SKY
15'-0" WIDE VERANDA PASSAGE
15'-0" WIDE PASSAGE
ELEVATION-C
ELEVATION-G
STAFF OFFICE
20'-0" X 24'-8"
ENTRANCE LOBBY
78'-0" x 49'-0"
BOOK SHOP
20'-0" x 49'
INFORMATION DESK
20'-0" X 24'-0"
ELEVATION-B
ELEVATION-H
GROUND FLOOR PLAN
COVERED AREA: 85,000 Sft.
ELEVATION-A
TENDER DRAWING
REV. DATE DESCRIPTION APPROVED
DRAWN
SUBMITTED
RECOMMENDED
CHD./VER.
APPROVED
CLIENT:
HEALTH DEPARTMENT
GILGIT BALTISTAN
CONSULTANT:
HA CONSULTING
ARCHITECTS, ENGINEERS & PLANNERS
PROJECT:
ESTABLISHMENT OF MEDICAL & NURSING COLLEGE, GILGIT.
TITLE:
MEDICAL & DENTAL CLINIC
DATE:
JAN, 2025.
DWG. NO.
MD-A001-01
SCALE
N.T.S
JOB NO.
HAC-___


ELEVATION–E
519'
116'-3"
296'-9"
104'-3"
OPEN TO SKY
STUDENT CAFETERIA
10' WIDE CORRIDOR
KITCHEN
FEMALE COMM. ROOM
MALE COMM. ROOM
ELEVATION–D
ELEVATION–F
15'-0" WIDE VERANDA PASSAGE
LIBRARY
10' WIDE CORRIDOR
SIMULATION LAB
BIO CHEMISTRY LAB
OPEN TO SKY
15'-0" WIDE PASSAGE PASSAGE
15'-0" WIDE PASSAGE
ELEVATION–C
ELEVATION–G
LOOK BELOW
ELEVATION–B
ELEVATION–H
FIRST FLOOR PLAN
COVERED AREA: 69,353 SFT.
ELEVATION–A
TENDER DRAWING
DRAWN
SUBMITTED
RECOMMENDED
CHD./VER.
REV. DATE DESCRIPTION APPROVED APPROVED
CLIENT:
HEALTH DEPARTMENT
GILGIT BALTISTAN
CONSULTANT:
HA CONSULTING
ARCHITECTS, ENGINEERS & PLANNERS
PROJECT:
ESTABLISHMENT OF MEDICAL & NURSING COLLEGE, GILGIT.
TITLE:
MEDICAL & DENTAL CLINIC
DATE:
JAN, 2025.
DWG. NO.
MD-A001-02
SCALE
N.T.S
JOB NO.
HAC-___

NURSING COLLEGE BUILDING

TENDER DRAWING

3D VIEW OF NURSING COLLEGE BUILDING

04				DRAWN	
03				SUBMITTED	
02				RECOMMENDED	
01				CHD./VER.	
REV.	DATE	DESCRIPTION	APPROVED	APPROVED	

CLIENT:
HEALTH DEPARTMENT GILGIT BALTISTAN

CONSULTANT:
HA CONSULTING
ARCHITECTS, ENGINEERS & PLANNERS

PROJECT:
ESTABLISHMENT OF MEDICAL & NURSING COLLEGE, GILGIT.

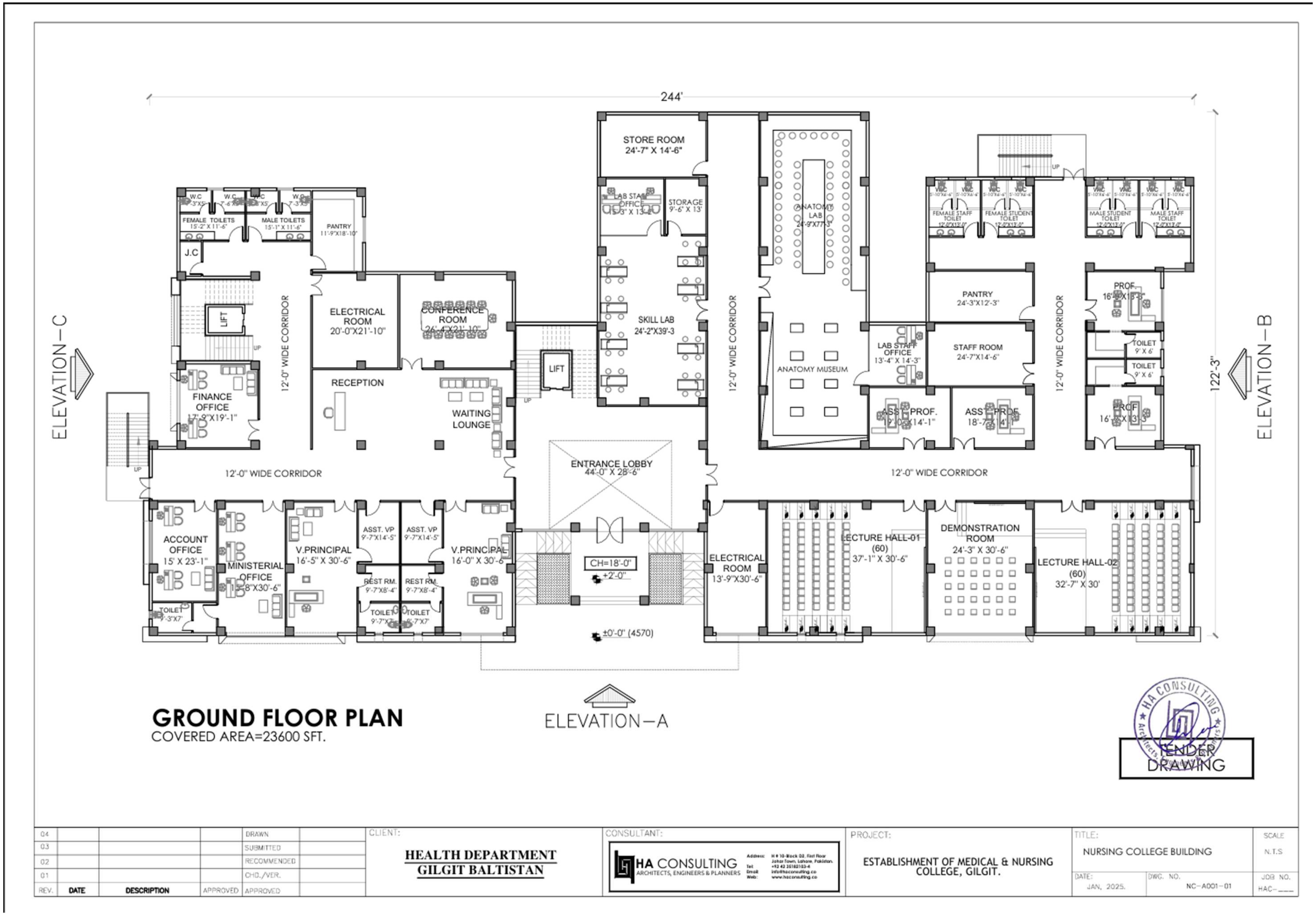
TITLE:
NURSING COLLEGE BUILDING

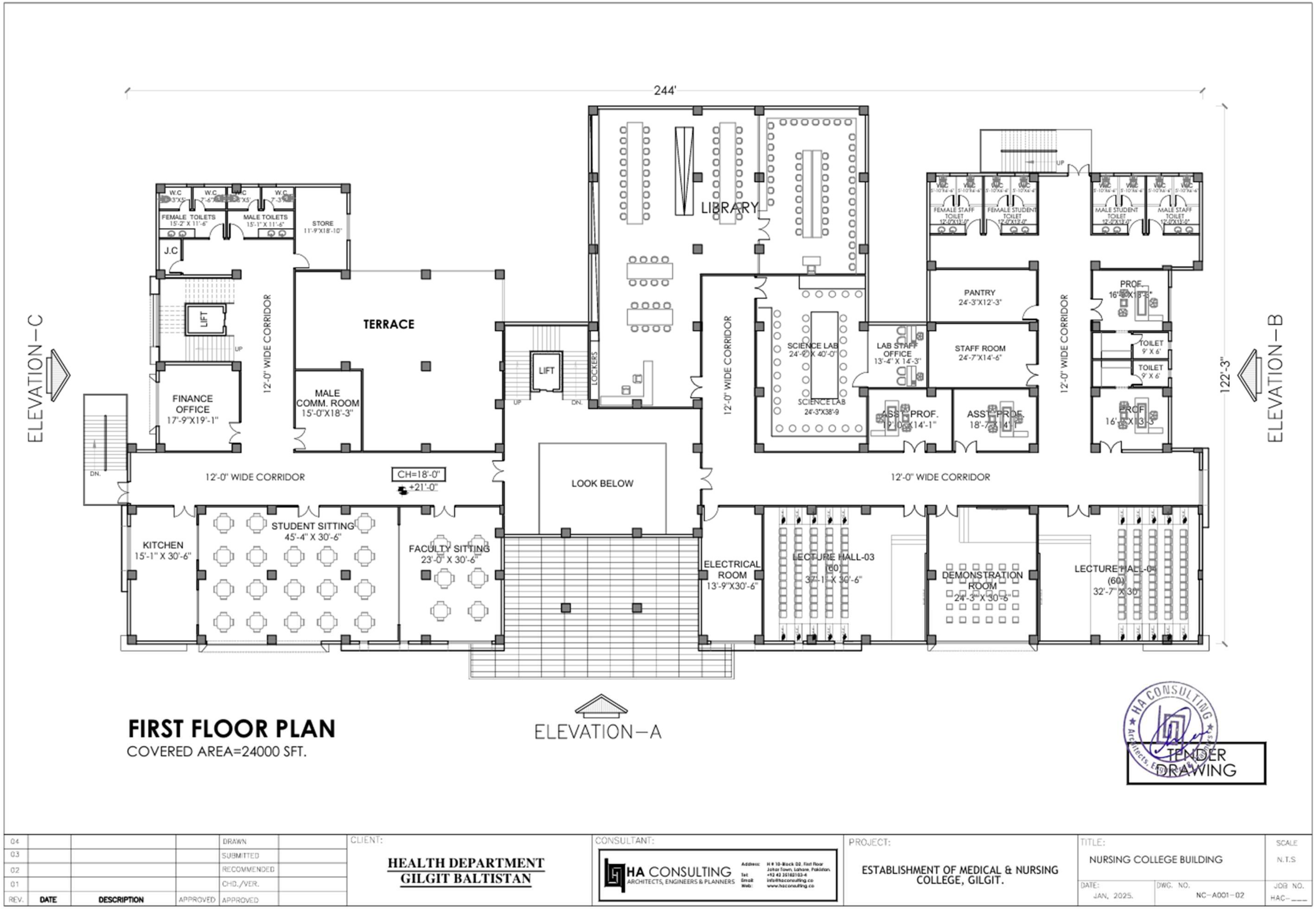
SCALE: N.T.S

DATE: JAN, 2025.

DWG. NO. NC-A001-00

JOB NO. HAC-___


GROUND FLOOR PLAN
COVERED AREA=23600 SFT.
244'
122'-3"
ELEVATION—A
ELEVATION—B
ELEVATION—C
STORE ROOM 24'-7" X 14'-6"
STORAGE 9'-6" X 13'
SKILL LAB 24'-2"X39'-3
ANATOMY MUSEUM
12'-0" WIDE CORRIDOR
PANTRY 24'-3"X12'-3"
STAFF ROOM 24'-7"X14'-6"
LAB STAFF OFFICE 13'-4" X 14'-3"
ASST. PROF.
PROF.
TOILET 9' X 6'
ELECTRICAL ROOM 20'-0"X21'-10"
RECEPTION
WAITING LOUNGE
LIFT
FINANCE OFFICE
J.C
PANTRY
FEMALE TOILETS
MALE TOILETS
ENTRANCE LOBBY 44'-0" X 28'-6"
CH=18'-0"
+2'-0"
±0'-0" (4570)
ACCOUNT OFFICE 15' X 23'-1"
MINISTERIAL OFFICE
V.PRINCIPAL 16'-5" X 30'-6"
ASST. VP 9'-7"X14'-5"
REST RM. 9'-7"X8'-4"
V.PRINCIPAL 16'-0" X 30'-6"
TOILET
ELECTRICAL ROOM 13'-9"X30'-6"
LECTURE HALL-01 (60) 37'-1" X 30'-6"
DEMONSTRATION ROOM 24'-3" X 30'-6"
LECTURE HALL-02 (60) 32'-7" X 30'
TENDER DRAWING
CLIENT:
HEALTH DEPARTMENT GILGIT BALTISTAN
CONSULTANT:
HA CONSULTING
ARCHITECTS, ENGINEERS & PLANNERS
PROJECT:
ESTABLISHMENT OF MEDICAL & NURSING COLLEGE, GILGIT.
TITLE:
NURSING COLLEGE BUILDING
DATE: JAN, 2025.
DWG. NO. NC-A001-01
SCALE N.T.S
JOB NO. HAC-
REV. DATE DESCRIPTION APPROVED
DRAWN
SUBMITTED
RECOMMENDED
CHD./VER.
APPROVED


244'
LIBRARY
TERRACE
J.C
STORE
LIFT
12'-0" WIDE CORRIDOR
FINANCE OFFICE 17'-9"X19'-1"
MALE COMM. ROOM 15'-0"X18'-3"
LOCKERS
PANTRY 24'-3"X12'-3"
STAFF ROOM 24'-7"X14'-6"
LAB STAFF OFFICE 13'-4" X 14'-3"
SCIENCE LAB
PROF.
TOILET 9' X 6'
ASST. PROF.
ELEVATION—C
ELEVATION—B
122'-3"
CH=18'-0"
+21'-0"
LOOK BELOW
KITCHEN 15'-1" X 30'-6"
STUDENT SITTING 45'-4" X 30'-6"
FACULTY SITTING 23'-0" X 30'-6"
ELECTRICAL ROOM 13'-9"X30'-6"
LECTURE HALL-03 (60)
DEMONSTRATION ROOM 24'-3" X 30'-6"
LECTURE HALL-04 (60) 32'-7" X 30'
FIRST FLOOR PLAN
COVERED AREA=24000 SFT.
ELEVATION—A
TENDER DRAWING
CLIENT:
HEALTH DEPARTMENT GILGIT BALTISTAN
CONSULTANT:
HA CONSULTING
ARCHITECTS, ENGINEERS & PLANNERS
PROJECT:
ESTABLISHMENT OF MEDICAL & NURSING COLLEGE, GILGIT.
TITLE:
NURSING COLLEGE BUILDING
SCALE
N.T.S
DATE:
JAN, 2025.
DWG. NO.
NC-A001-02
JOB NO.
REV.
DATE
DESCRIPTION
APPROVED
DRAWN
SUBMITTED
RECOMMENDED
CHD./VER.

Annexure 5 Water Quality Testing Report

EPA Certified Water Quality Laboratory
Karakorum International University
Gilgit Baltistan Pakistan

WATER QUALITY REPORT

Ref: WQL/2025/12 **18-04-2025**

Sample Details

Sampling Date: 16-04-2025
Samples Delivered by: Mr. Suhaib
Source: Supply Tank

No of samples: 1
Locality: Minawar Gilgit
Referred by: Medical and Nursing College (Consultant)

Laboratory Report

S.NO	Parameters	Sample	WHO/NEQS Limits
1	PH	7.4	6.5-8.5
2	Electrical conductivity (EC) µs	364	≤ 1000 µs
3	TDS	182	<400 ppm
4	Salinity	178	<600 mg/L
5	Turbidity	0.53	<5 NTU
6	Total Hardness (mg/L)	45	0 to <60 mg/L Soft 60 to <120 mg/L Medium Hard 120 to < 180 mg/L Hard
7	Ca-Hardness (mg/L)	27	0 to <60 mg/L Soft 60 to <120 mg/L Medium Hard 120 to < 180 mg/L Hard
8	Chlorides (mg/L)	2.1	<250 mg/L
9	Nitrite	0.1	<1 mg/L
10	Sulphate	1.8	< 250 mg/L
11	E-Coli	TNTC*	0 CFU/100mL
12	Fecal Enterococci	TNTC*	0 CFU/100mL

Note: This Report is only valid for the sample provided.
***TNTC:** Too Numerous to Count
Remarks: All the Physico-Chemical parameters are within permissible limits. Heavy Bacterial Contamination detected in sample, as per results the water is not fit for human consumption.

Saif-Ud-Din
Laboratory Analyst

Dr. Maisoor Ahmed Nafees
Assistant Professor/Lab Administrator
Water Quality Lab, KIU, GB

EPA Certified Water Quality Laboratory
Karakorum International University
Gilgit Baltistan Pakistan

WATER QUALITY REPORT

Ref: WQL/2025/11 **18-04-2025**

Sample Details

Sampling Date: 16-04-2025
Samples Delivered by: Mr. Suhaib
Source: Underground Water (Well)

No of samples: 1
Locality: Minawar Gilgit
Referred by: Medical and Nursing College (Consultant)

Laboratory Report			
S.NO	**Parameters**	**Sample**	**WHO/NEQS Limits**
1	PH	7.2	6.5-8.5
2	Electrical conductivity (EC) μs	254	≤ 1000 μs
3	TDS	130	<400 ppm
4	Salinity	131	<600 mg/L
5	Turbidity	0.91	<5 NTU
6	Total Hardness (mg/L)	23	0 to <60 mg/L Soft 60 to <120 mg/L Medium Hard 120 to < 180 mg/L Hard
7	Ca-Hardness (mg/L)	9	0 to <60 mg/L Soft 60 to <120 mg/L Medium Hard 120 to < 180 mg/L Hard
8	Chlorides (mg/L)	1.4	<250 mg/L
9	Nitrite	0.1	<1 mg/L
10	Sulphate	0.9	< 250 mg/L
11	E-Coli	0	0 CFU/100mL
12	Fecal Enterococci	0	0 CFU/100mL

Note: This Report is only valid for the sample provided.

Remarks: All the Physico-Chemical parameters are within permissible limits. No Bacterial Contamination detected in sample, as per results the water is fit for human consumption.

Saif-Ud-Din
Laboratory Analyst

Dr. Maisoor Ahmed Nafees
Assistant Professor/Lab Administrator
Water Quality Lab, KIU, GB

EPA Certified Water Quality Laboratory
Karakorum International University
Gilgit Baltistan Pakistan

WATER QUALITY REPORT

Ref: WQL/2025/15 **02-05-2025**

Sample Details

Sampling Date: 05-05-2025
Samples Delivered by: Mr. Suhaib
Source: River

No of samples: 1
Locality: Minawar Gilgit
Referred by: Medical and Nursing College (Consultant)

Laboratory Report			
S.NO	**Parameters**	**Sample**	**WHO/NEQS Limits**
1	PH	7.5	6.5-8.5
2	Electrical conductivity (EC) µs	401	≤ 1000 µs
3	TDS	199	<400 ppm
4	Salinity	196	<600 mg/L
5	Turbidity	401	<5 NTU
6	Total Hardness (mg/L)	60	0 to <60 mg/L Soft 60 to <120 mg/L Medium Hard 120 to < 180 mg/L Hard
7	Ca-Hardness (mg/L)	34	0 to <60 mg/L Soft 60 to <120 mg/L Medium Hard 120 to < 180 mg/L Hard
8	Chlorides (mg/L)	4.3	<250 mg/L
9	Nitrite	3.5	<1 mg/L
10	Sulphate	2.9	< 250 mg/L
11	E-Coli	TNTC*	0 CFU/100mL
12	Fecal Enterococci	TNTC*	0 CFU/100mL

Note: This Report is only valid for the sample provided.
*TNTC: Too Numerous to Count
Remarks: All the Physico-Chemical parameters are within permissible limits except Nitrite and turbidity. Heavy Bacterial Contamination detected in sample, as per results the water is not fit for human consumption. Recommended suitable treatment for the use of river water.

Saif-Ud-Din
Laboratory Analyst

Dr. Maisoor Ahmed Nafees
Assistant Professor/Lab Administrator
Water Quality Lab, KIU, GB