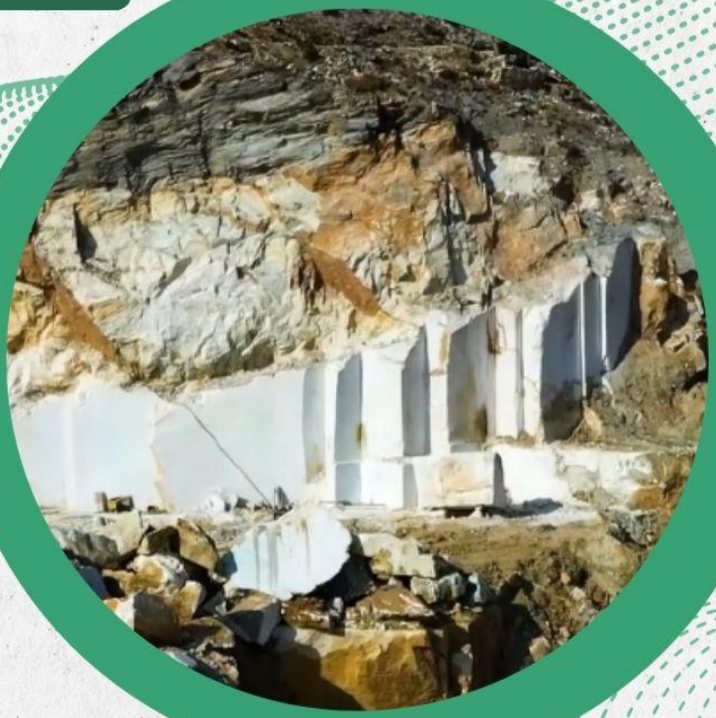
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DRAFT LAND USE PLAN

DISTRICT MOHMAND

January, 2026



District Land Use plans of 8 newly Merged Districts of Khyber Pakhtunkhwa

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LIST OF ACRONYMS

ADP	Annual Development Plan
KP	Khyber Pakhtunkhwa
LUBCA	Land Use and Building Contral Act
MDs	Merged Districts
NWFP	North-Western Frontier Province
P&DD	Planning and Development Department
PLUP	Provincial Land Use Plan
UPPU	Urban Planning and Policy Unit
MCDA	Multi Criteria Decision Analysis

1 CHAPTER I: INTRODUCTION & BACKGROUND

1.1 Project Overview and Background

The concept of scarcity is a fundamental principle in economics, and Land is considered an essential factor of production and a scarce resource. This means that its availability is limited in relation to the demand for it. With urbanization, the universal phenomena take place, and the population expands rapidly, the demand for land increases, while the total supply remains fixed. Keeping in view the fixed supply of land and its diminishing rate, the NWFP Housing Authority Act 2005, under Section 4, Sub-Section 2 (xv), established the NWFP Housing Authority (PHA) and was tasked with creating a provincial land use plan or policy. As a result, the PHA's Housing Department's Project Management Unit was established on April 1, 2010. The Provincial Land Use Plan was initiated in this regard. In 2013, on the instruction of the Honorable Chief Minister of Khyber Pakhtunkhwa, the Project Management Unit of the Land Use Plan was transferred to the Urban Policy Unit. Later, the Provincial Land Use Plan was used instead of the Project Management Unit for the Land Use Plans.

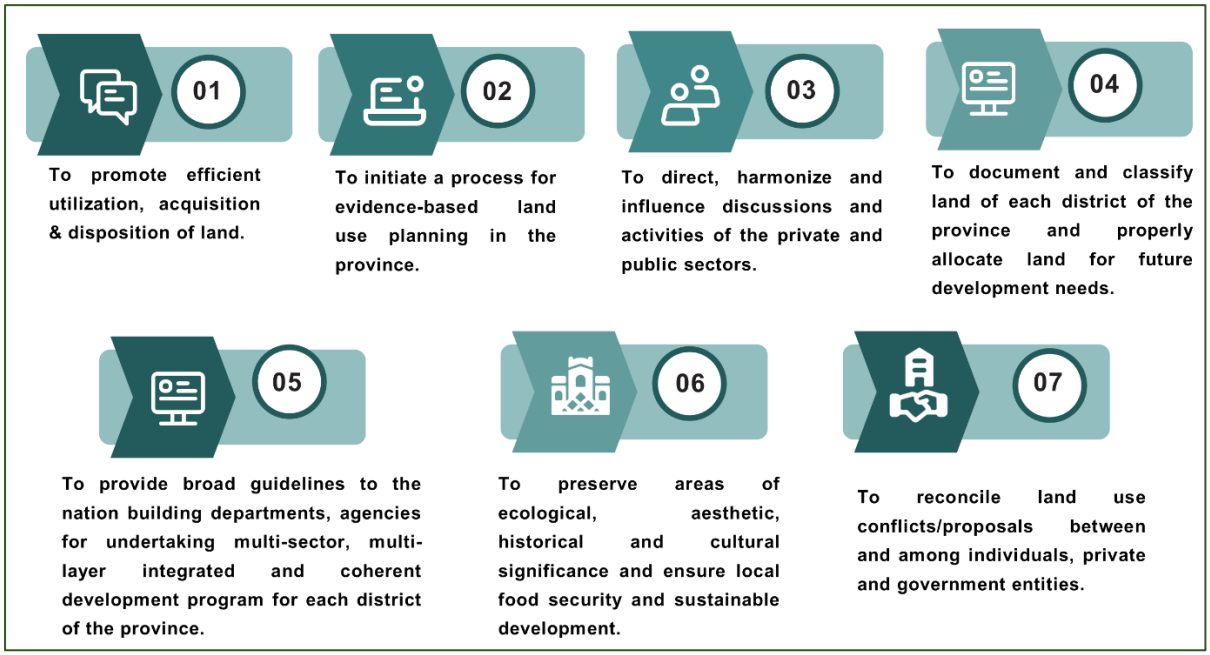
The land, which is in limited supply, must be used to meet the fundamental necessities of food, water, fuel, clothes, and shelter. The demand for resources increases as the population grows. The available Land must be utilized to satisfy the new needs brought on by the population growth. The amount of land that is accessible for farming and agriculture is dwindling daily because of additional housing projects.

The uncontrolled Urban sprawl over agricultural land is putting great pressure on the available resources of the province, and these resources shall be equally distributed among the population of the province. Planned towns & villages will be developed, and as a result of this planning, resources shall be equally distributed among the population of the province. The guided land use distribution will also result in a healthy living environment and better utilization of human resources. Proper sanitation, drinking water supply, and forestation will make the environment clean and healthy. It will also minimize the chances of epidemics and other man-made disasters and will contribute to upgrading the living standards of the area.

To develop an integrated land use plan for the province of KP the Urban Policy Unit of P&D Department organized consultative conferences for the development of Terms of Reference for the District Land Use Plan on May 29th, 2014, with various stakeholders including district administration, government officials, policy planners, academia, and civil society organizations. A Provincial land use plan is a planning and policy document for integrated, coordinated, evidence based and systematic planning. This successful completion of Land Use Plans will increase developmental activities, generate employment for the urban and rural areas. It aims at establishing hierarchy of settlements and developments of satellite, intermediate, Secondary, and existing towns/settlements as focal points for future development. This will help in increasing the standards of the people and optimum utilization of natural resources.

1.1.1 Project Objectives

The project aims to develop a comprehensive and enduring planning vision through a cooperative effort known as a "Land Use Plan." In shaping the future physical manifestation of Urban Centers, this framework will play a critical role. The objectives of the project include



1.1.2 Status of the Land Use and Master Plan Project in Khyber Pakhtunkhwa

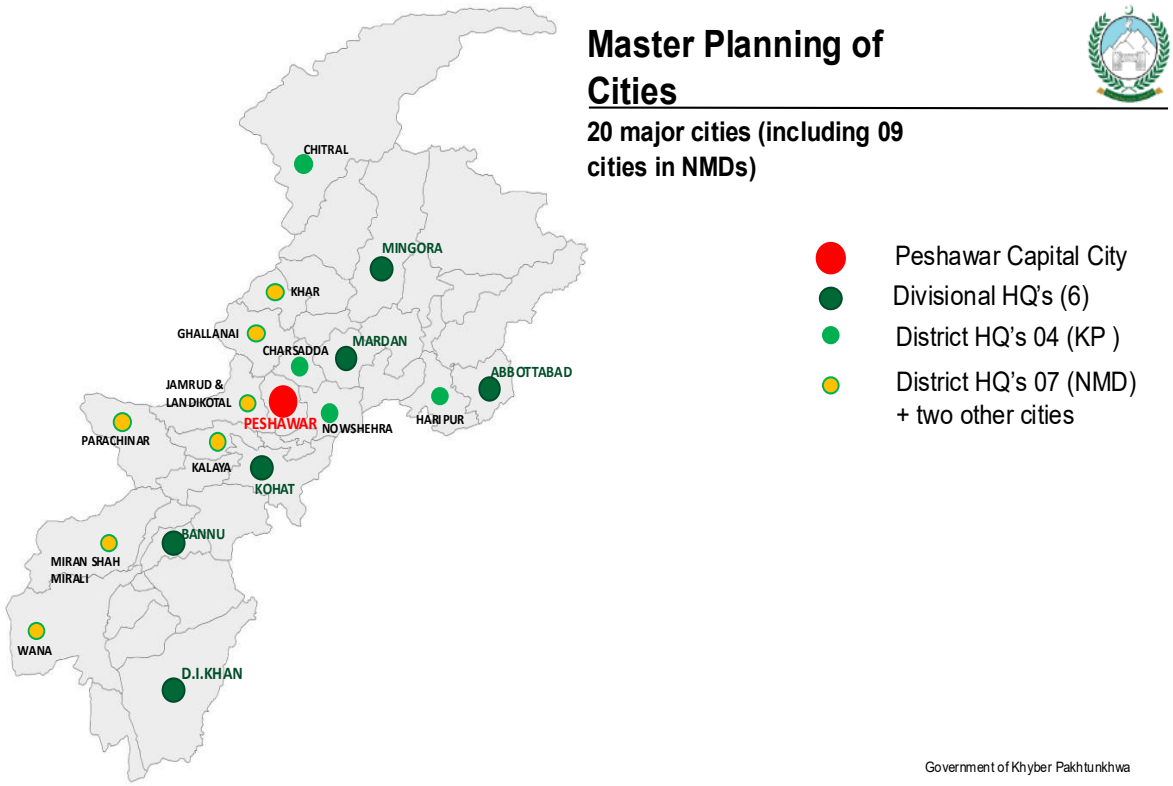
Urban Policy and Planning unit, of the planning and development department Khyber-Pakhtunkhwa is in the process of preparation of district land use plans of all the districts including MDs. Six (06) District Land Use Plans (Peshawar, Nowshera, Charsadda, Mardan, Swabi and Abbottabad) were completed in December 2018 and were handed over to LGE&RDD in December 2019 for further approval of the competent authority/forum. Later, in July 2022, all these six completed DLUPs were handed over to DG-LU&BCA for further processing and approval of the Provincial Land use and Building Control Council. Provincial Land Use and Building Control Council approved these six plans under Section 4 (f) of the Land Use and Building Control Authority Act, 2021. The approved district land use plans have been handed over to the concerned district administration for execution/implementation. For implementation/execution at district level, district land use planning and management committees have been notified under section-14 of the land use and building control act 2021, under the chairmanship of the concerned Deputy Commissioners.

1.1.3 Current status of Master plans

The urban centers in the Province of Khyber Pakhtunkhwa have been neglected in the past. This has resulted in unregulated urban growth, with less-than-optimal infrastructure, inefficient institutions and poor quality and outreach of civic services, which has led to low quality of life. Instantaneously, to the District Land Use Plan (DLUP) project, the Urban Policy Unit is also preparing long term Master Plans for all the divisional and district headquarter cities of Khyber Pakhtunkhwa including the provincial capital Peshawar, Divisional HQs

Mardan, Abbottabad, Kohat, Mingora, Bannu and DI Khan and other major cities of KPK including NMDs. The figure shows the detail of master plan.

Figure 1: Current Status of the Cities Master Plan in KP



Three (03) cities Master plan Plans (Mardan, Mir Ali/Miran Shah, District North Waziristan and Wana, District south Waziristan) were completed and approved from the Land Use and Building Control Council. Further the said plans were handed over to DG-LU&BCA and concerned DCs for implementation/Execution.

1.1.3.1 Status of Ghalanai Master Plan

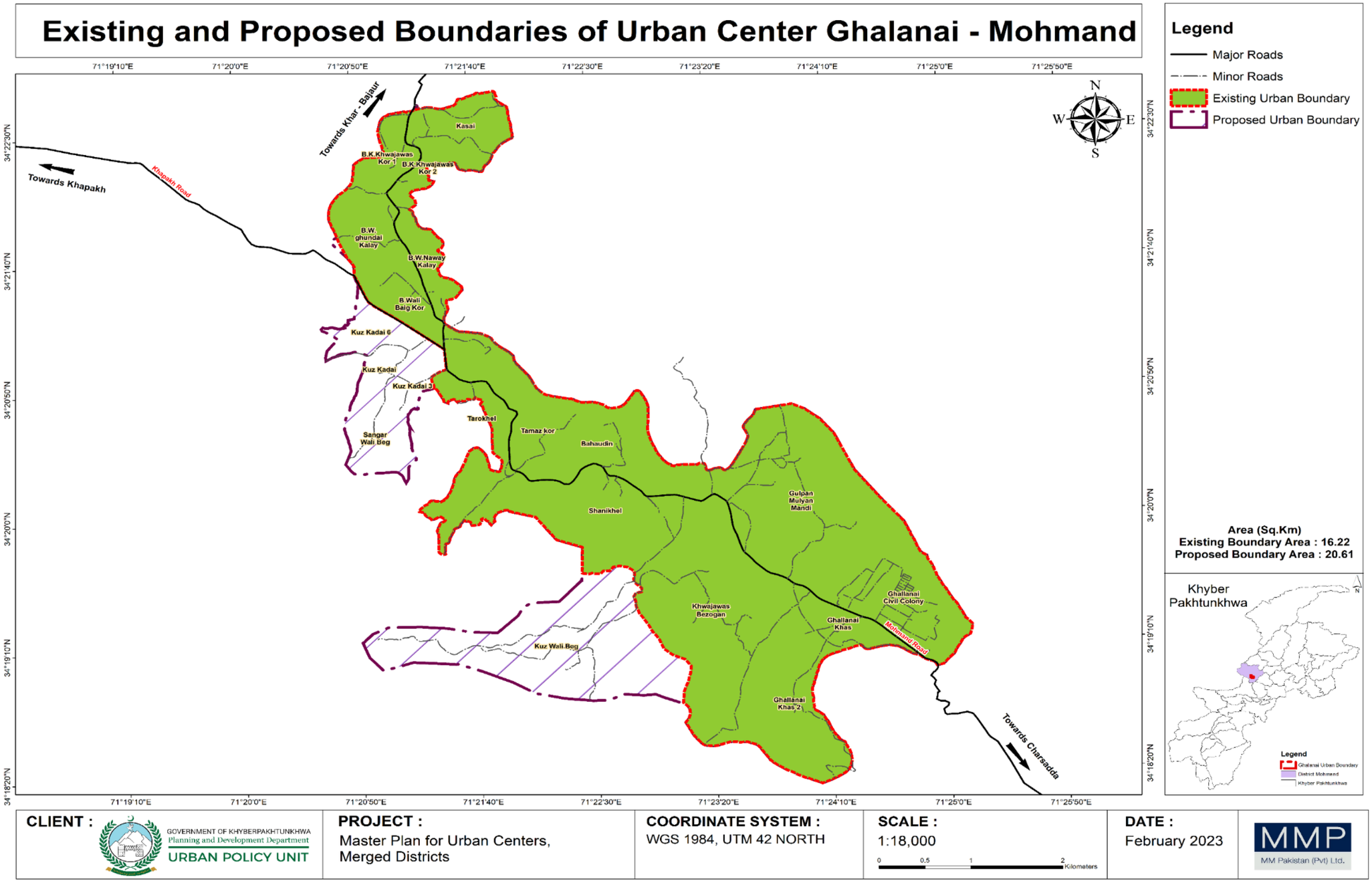
To ensure sustainable urban development, the Urban Policy, and Planning Unit (UPPU) of KP has initiated the preparation of a Master Plan for the Ghalanai urban center. The Master Plan aims to regulate and align existing infrastructure and provide a comprehensive and integrated guideline for the future development of the area. The Master Plan covers the period from 2022 to 2042.

The project of the Urban Center of Ghalanai, located in the Mohmand District at coordinates Lat: 34° 18' and 34° 23' North and Long: 71° 19' and 71° 25' East, has been selected as the project area for the preparation of the Master Plan. Ghalanai is a rapidly expanding urban community and the administrative hub of the Mohmand District. The urban center of Ghalanai is situated in the southern area of the district, covering an area of 20 square kilometers with a population density of 1,412 individuals per square kilometer (as per the 2017 Census). The area comprising Ghalanai NC and Durba Khel NC was designated as urban in 2020 by the local government authorities. The urban center of Ghalanai extends from the southeast of the main Ghalanai and civil colony towards the northwest of Mian Mandi and Shati Khel, encompassing

the areas of Babi Khel VC to NC Durba Khel and Chanda Bridge. The district administration is based in the urban center of Ghalanai, which serves as the primary town for the provision of services such as education, health, and business activities. The urban center is surrounded by scattered rural settlements and a hilly and rugged landscape.

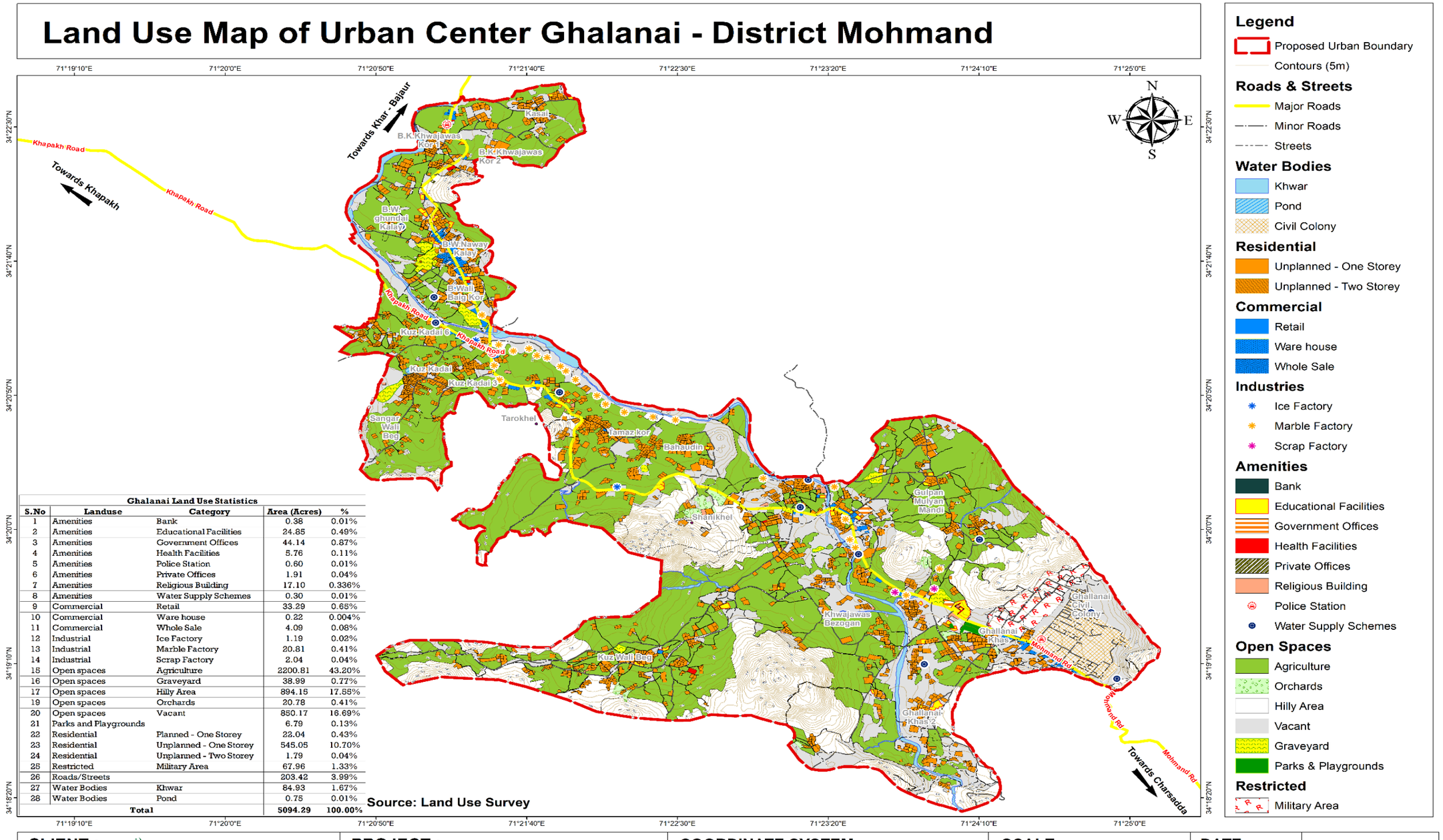
The location and extent of the existing urban boundary and proposed urban boundary for the plan period of 2040 of the project area is shown in the following maps.

Map 1: Existing and Proposed Boundary of Ghalanai Urban Center



Source: Website: Urban Policy & Planning Unit, Govt, of Khyber Pakhtunkhwa 2024

Map 2: Land Use Map of Ghalanai



Ghalanai Land Use Statistics

S.No	Landuse	Category	Area (Acres)	%
1	Amenities	Bank	0.38	0.01%
2	Amenities	Educational Facilities	24.85	0.49%
3	Amenities	Government Offices	44.14	0.87%
4	Amenities	Health Facilities	5.76	0.11%
5	Amenities	Police Station	0.60	0.01%
6	Amenities	Private Offices	1.91	0.04%
7	Amenities	Religious Building	17.10	0.336%
8	Amenities	Water Supply Schemes	0.30	0.01%
9	Commercial	Retail	33.29	0.65%
10	Commercial	Ware house	0.22	0.004%
11	Commercial	Whole Sale	4.09	0.08%
12	Industrial	Ice Factory	1.19	0.02%
13	Industrial	Marble Factory	20.81	0.41%
14	Industrial	Scrap Factory	2.04	0.04%
15	Open spaces	Agriculture	2200.81	43.20%
16	Open spaces	Graveyard	38.99	0.77%
17	Open spaces	Hilly Area	894.15	17.55%
19	Open spaces	Orchards	20.78	0.41%
20	Open spaces	Vacant	850.17	16.69%
21	Parks and Playgrounds		6.79	0.13%
22	Residential	Planned - One Storey	22.04	0.43%
23	Residential	Unplanned - One Storey	545.05	10.70%
24	Residential	Unplanned - Two Storey	1.79	0.04%
25	Restricted	Military Area	67.96	1.33%
26	Roads/Streets		203.42	3.99%
27	Water Bodies	Khwar	84.93	1.67%
28	Water Bodies	Pond	0.75	0.01%
	Total		**5094.29**	**100.00%**

CLIENT :	PROJECT :	COORDINATE SYSTEM :	SCALE :	DATE :
GOVERNMENT OF KHYBERPAKHTUNKHWA Planning and Development Department URBAN POLICY UNIT	MASTER PLAN FOR URBAN CENTERS, MERGED DISTRICTS	GCS WGS 1984 Datum: WGS 1984 Units: Degree	1:17,800 (0 0.375 0.75 1.5 Kilometers)	May 2022

MM Pakistan (Pvt) Ltd.

Source: Website of Urban Policy & Planning Unit, Govt, of Khyber Pakhtunkhwa 2024

1.2 Introduction of the Region

1.2.1 Background

Khyber Pakhtunkhwa, Pakistan's northwestern province, is divided into thirty-four districts, with Peshawar as its capital and most populous city. In 2018, the province's administrative landscape significantly changed when the Federally Administered Tribal Areas (FATA) were merged into Khyber Pakhtunkhwa under the 31st amendment. These areas were then integrated into the nearby existing divisions.

Historically, the province was organized into larger administrative units called divisions. The Peshawar Division, once dissolved, has since been re-established. Before Pakistan's independence, the region was divided into just two divisions, with the Peshawar Division covering a larger area than it does today. Over time, districts were promoted to divisional status, shaping the current administrative structure. The Peshawar Division includes five districts: Peshawar, Charsadda, Nowshera, Khyber, and Mohmand.

1.2.2 Study Area Profile

Formerly a part of the Federally Administered Tribal Areas, Mohmand District is now integral to Khyber Pakhtunkhwa Province. Situated within the Peshawar Division, it spans an area of 2,296 square kilometers and is home to a population exceeding 550,000, with Pashto as the predominant language.

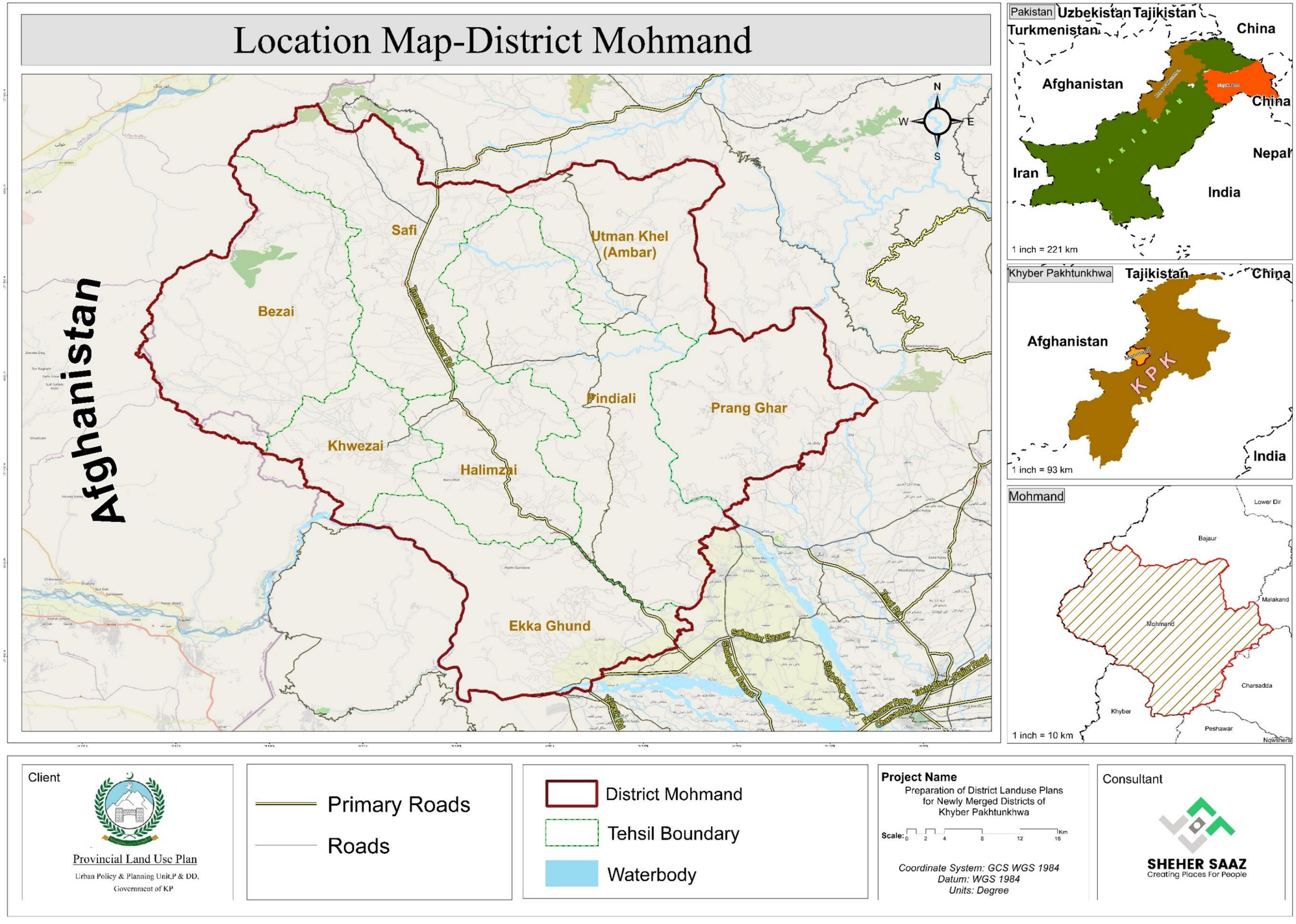
The district's administrative framework is divided into seven tehsils: Ambar Utman Khel, Halim Zai, Pindiali, Prang Ghar, Safi, Upper Mohmand, and Yake Ghund. A hierarchical governance structure operates, with Deputy Commissioners overseeing the district and Assistant Commissioners managing tehsils, complemented by Village and Neighborhood Councils.

The agency takes its name from the Mohmand tribe which inhabits its area. The region has a rich history and is inhabited by the Mohmand tribe, a proud Pashtun community known for its distinct cultural heritage.

1.2.2.1 Geographic Location

District Mohmand is in the northwestern part of Pakistan within the Khyber Pakhtunkhwa province. It is situated between latitude 34° 14' to 34° 49' north and longitude 71° 01' to 71° 30' east. The district shares borders with Afghanistan to the west, Bajaur District to the north, Khyber District to the east, and Peshawar District to the south. The map below shows the district boundary of the District Mohmand.

Map 3: Location Map of the Project Area



Source: Consultant, 2024

1.2.2.2 Topographic Overview

District Mohmand is characterized by diverse terrains, comprising mountains, valleys, and plains. The district is part of the larger Sulaiman Range, which extends from Afghanistan into Pakistan. The landscape is dominated by rugged mountains, with peaks reaching elevations of over 3,000 meters (9,800 feet) above sea level. The highest point in the district is Mount Sikaram, standing at an elevation of approximately 3,366 meters (11,040 feet).

Several rivers flow through District Mohmand, including the Mohmand River, which originates from Afghanistan and traverses the district. The river serves as a vital water source for irrigation and agriculture, contributing to the fertility of the land.

The district is known for its picturesque valleys, including the scenic Prang Ghar Valley and Pandyalai Valley. These valleys are surrounded by mountains and offer breathtaking natural beauty. The district is endowed with natural resources, including mineral deposits such as limestone, marble, and chromite. These resources have the potential to contribute to the economic development of the region.

1.2.2.3 Physiography and Geology

District Mohmand, with a population of approximately 553,933 as of 2023 census and covering an area of about 2,296 square kilometers, represents around 10% of the total area of the Merged Districts (MDs) of Khyber Pakhtunkhwa. The district's physiography is characterized by rugged mountains and hilly terrain, with barren slopes dominating the landscape. The general slope of the district is from the northeast, with an average elevation of over 1,450 meters. Among the notable peaks is Ilazai, the highest peak in the district, standing at 2,716 meters near the Pakistan-Afghanistan border. Other significant peaks include Yarisar at 1,929 meters and Silai of Mohmand Agency. The district's valleys and glens, such as those of Shilman, Gandab, and Pindiali, extend from the mountains of Tartarra, located south of the Kabul River, to Ilazai, north of the river. These areas are characterized by dry and arid watercourses that transform into raging torrents during heavy rain. The beds of these watercourses are typically stony and shingled, with barren ground slopes leading up to the rocky spurs and ranges that flank them.

Agriculture and minerals are the prominent sectors within the district, although cultivated land comprises only about 9% of the total area. Water availability remains a significant challenge across much of the district, limiting agricultural productivity. Despite these challenges, Mohmand is rich in mineral resources, including reserves of marble, chromite, dolomite, manganese, quartz, emerald, nephrite, and feldspar. To capitalize on its marble reserves and promote industrialization, the Mohmand Economic Zone, also known as Mohmand Marble City, was established near Mamud Gat, covering an area of 350 acres. This area has been declared a Special Economic Zone (SEZ), with proposals to expand the zone by an additional 2,000 acres to further enhance its industrial potential.

Mohmand District’s mineral wealth including marble, chromite as well as emerald serves as a substantial economic resource base without providing beneficial extraction frameworks. Uncontrolled mining leads to major environmental degradation because it causes forests to

be destroyed and water becomes polluted, and the soil suffers degradation. The district must establish environmental regulation through compulsory Environmental Impact Assessments that combine it with low-impact mining techniques and complete land rehabilitation plans. The protection of water courses requires sedimentation ponds together with strict waste disposal procedures. Locals should participate in monitoring activities because this oversight method helps both miners and residents build confidence through enforcement of compliance standards.

The development of Mohmand Economic Zone as a Special Economic Zone requires planned sequential improvements to roads and utility networks including electricity, water recycling along with digital communication infrastructure that connects the SEZ to regional trading routes. The economic advantages generated by value-added industries will benefit residents when the government implements tax incentives together with employment quota requirements for district residents. The establishment of an independent SEZ authority must provide streamlined permit issuance while carrying out labor regulation and blocking speculations of land purchases. The SEZ will remain underutilized when appropriate measures are not implemented, which prevents its transformation into an effective industrial hub.

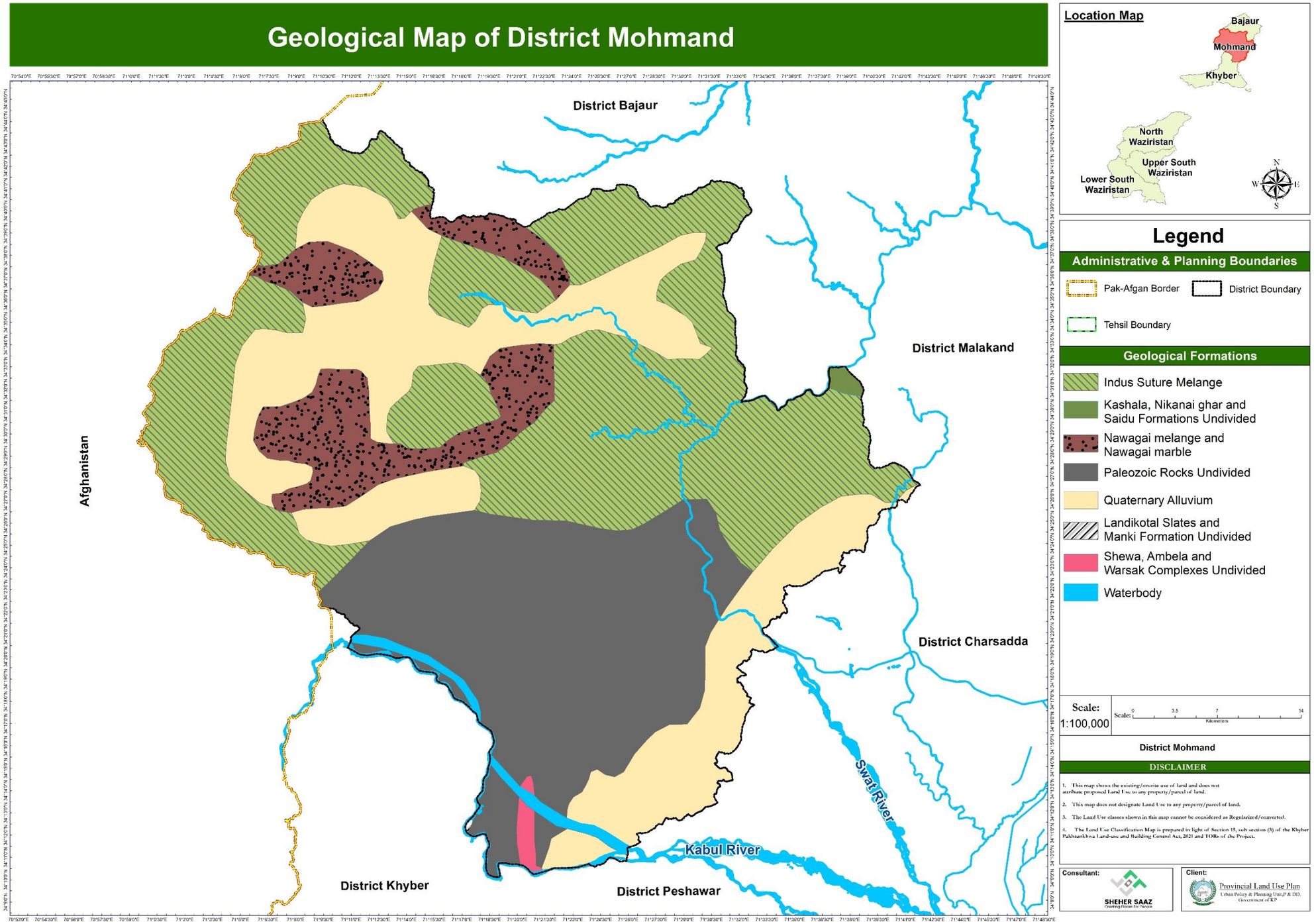
The geological composition of Mohmand District is both diverse and complex. In the southern region, the rock assemblage includes the northwestern marginal mass of the Indo-Pakistan plate, indicating the district's position on the edge of this significant tectonic structure. Moving toward the central part of the district, geology is dominated by an abducted ophiolite, a remnant of ancient oceanic crust and upper mantle that has been thrust onto the continental crust. In the northern part of the district, the rock formations bear a striking resemblance to those found in the Kohistan Island arc, suggesting a geological continuity with this well-known tectonic feature. The general geological sequence is given below in the table:

Table 1: Geology of Mohmand District

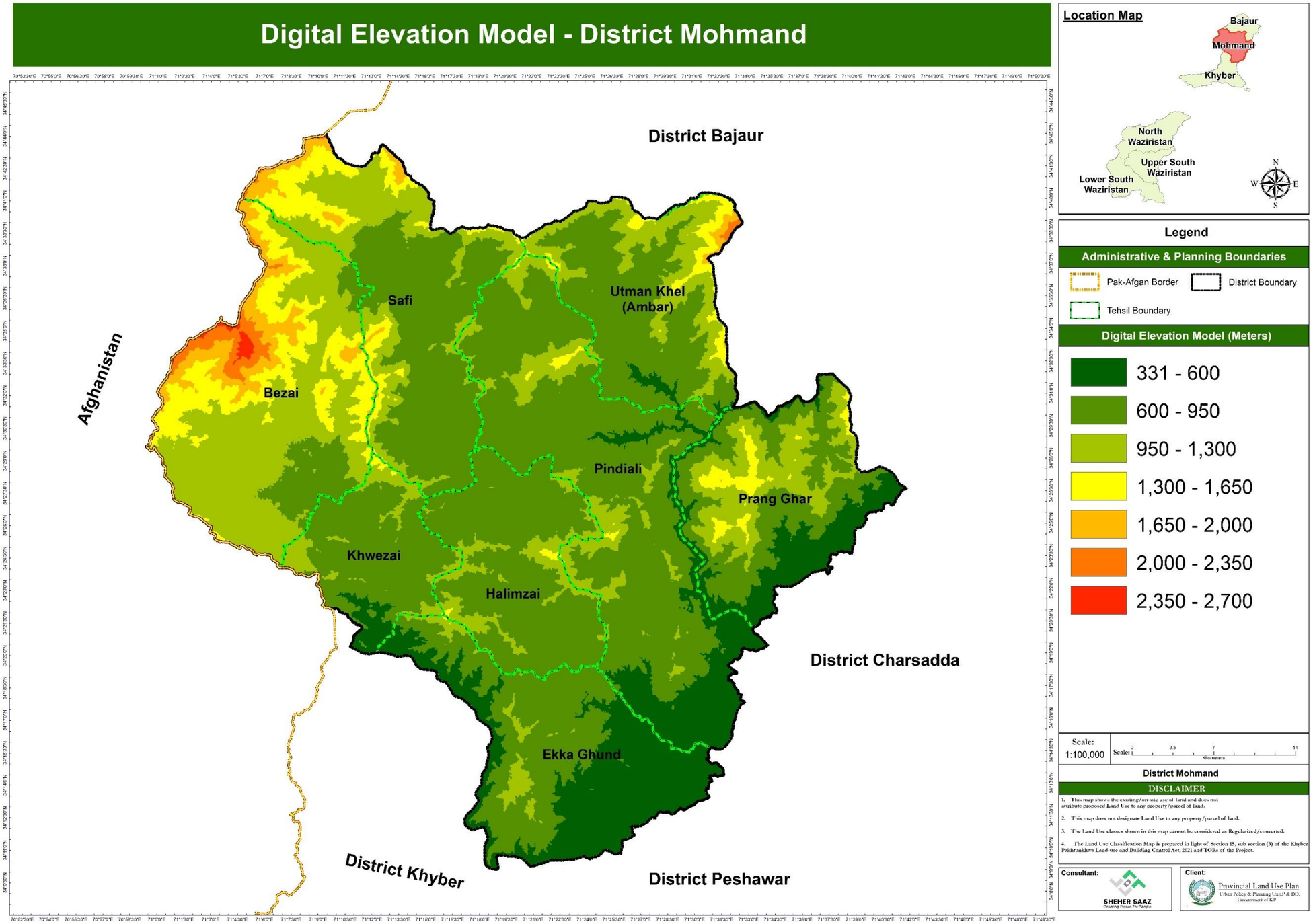
Sr. No	Alluvium, Gravels, and Terrace Deposits (Rock)	Recent-sub recent Age
1	Fossiliferous limestone.	Eocene
2	Ophiolite with layer 1 serpentinized	Cretaceous
3	Ultrabasic, layer-2 volcanic, and layer-3 cherts.	Paleocene
4	Marbleized limestone	Jurassic
5	Dolomite & silica sand	Siluro-Devonian
6	Schists phyllites with numerous intrusive	Paleozoic

Source: Initial Environmental Examination Report for Madar Irrigation Sub-Project, District Mohmand

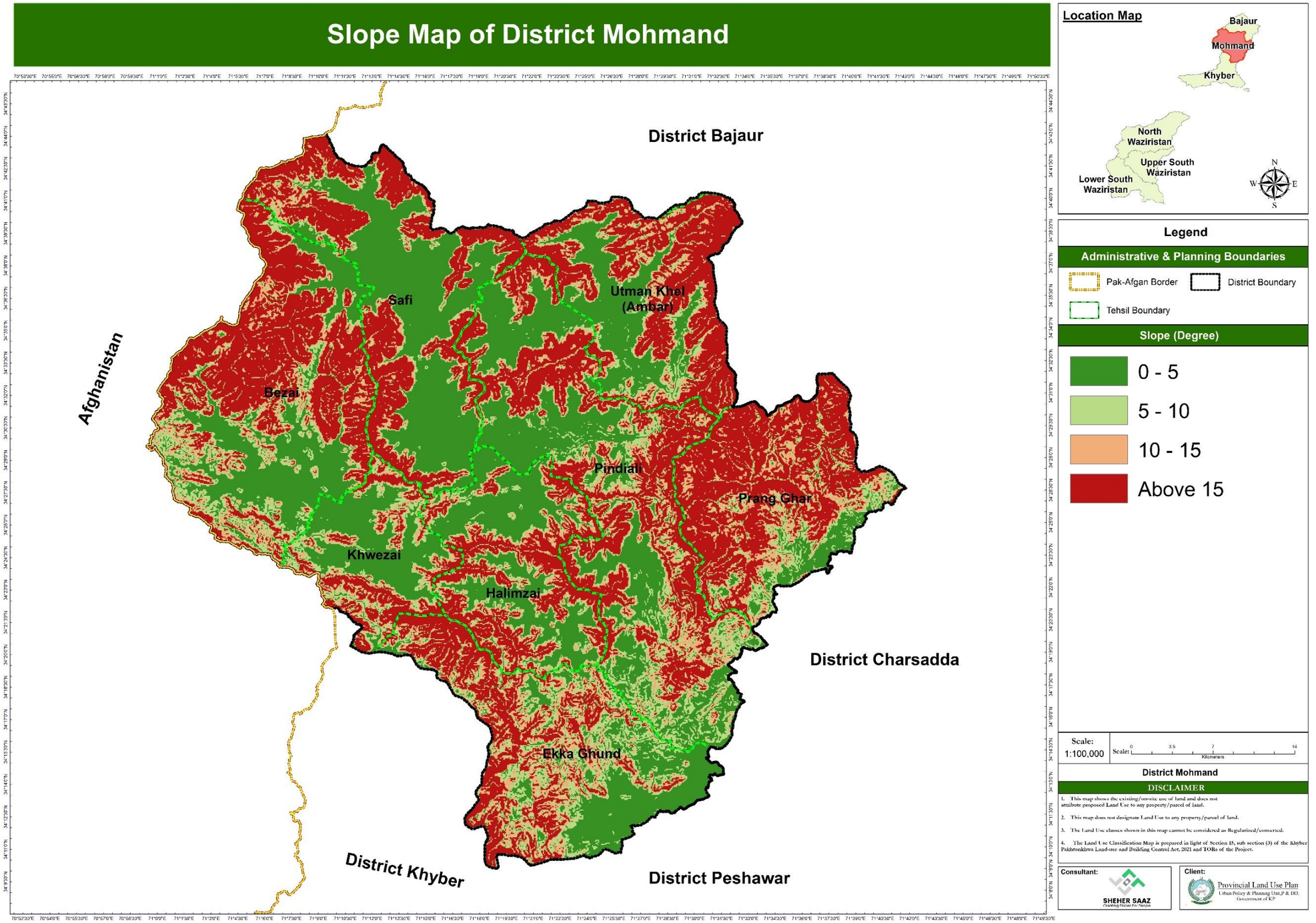
Map 4: Geological Map - District Mohmand



Map 5: Digital Elevation Model - District Mohmand



Map 6: Slope Map - District Mohmand

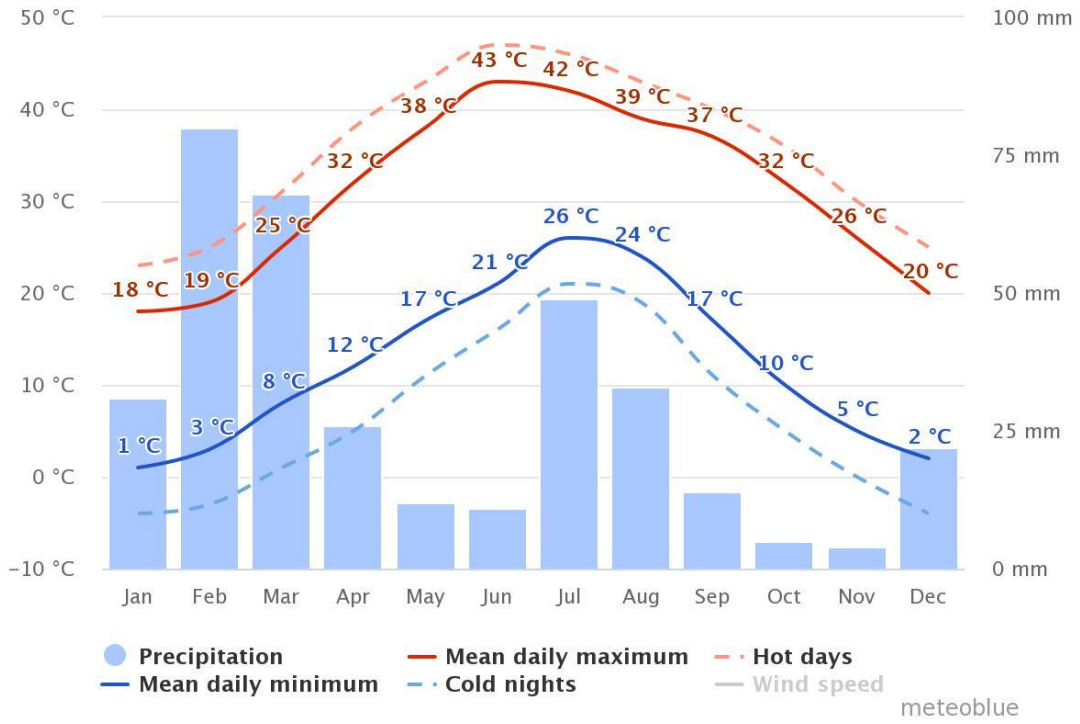


1.2.2.4 Climate

The climate of District Mohmand is generally characterized as arid to semi-arid, with hot summers and cold winters. The summers are hot and dry, with temperatures often exceeding 40°C (104°F). The winters are cold, with temperatures dropping below freezing point, and the region occasionally experiences snowfall.

Extreme changes in temperature during the year due to a combination of semi-arid and sub-tropical climates describe the Mohmand District, found in Khyber Pakhtunkhwa. For a long time, summers in Asia (May to September) have been very hot, with temperatures frequently reaching between 35°C and 45°C, rising to a peak in June and July, when heatwaves might bring extremely high temperatures in dry areas. From November through February, winters are cool with temperatures as low as 0°C, but January can drop below freezing point, mostly near the Hindu Kush foothills. Spring is slowly replaced by the pre-monsoon season from March until April, with highs around 30–34°C in April. During May and June, temperatures and dryness reach their highest, but once July and August come, there is a bit of relief thanks to monsoon showers, although there is more humidity. While September experiences residual heat, the temperature drops as autumn approaches and October nights are descending into cool temperatures. By December, it's noticeably colder and drier outside, with daytime highs dropping to 18–20°C.

Figure 2: Average temperatures and precipitation



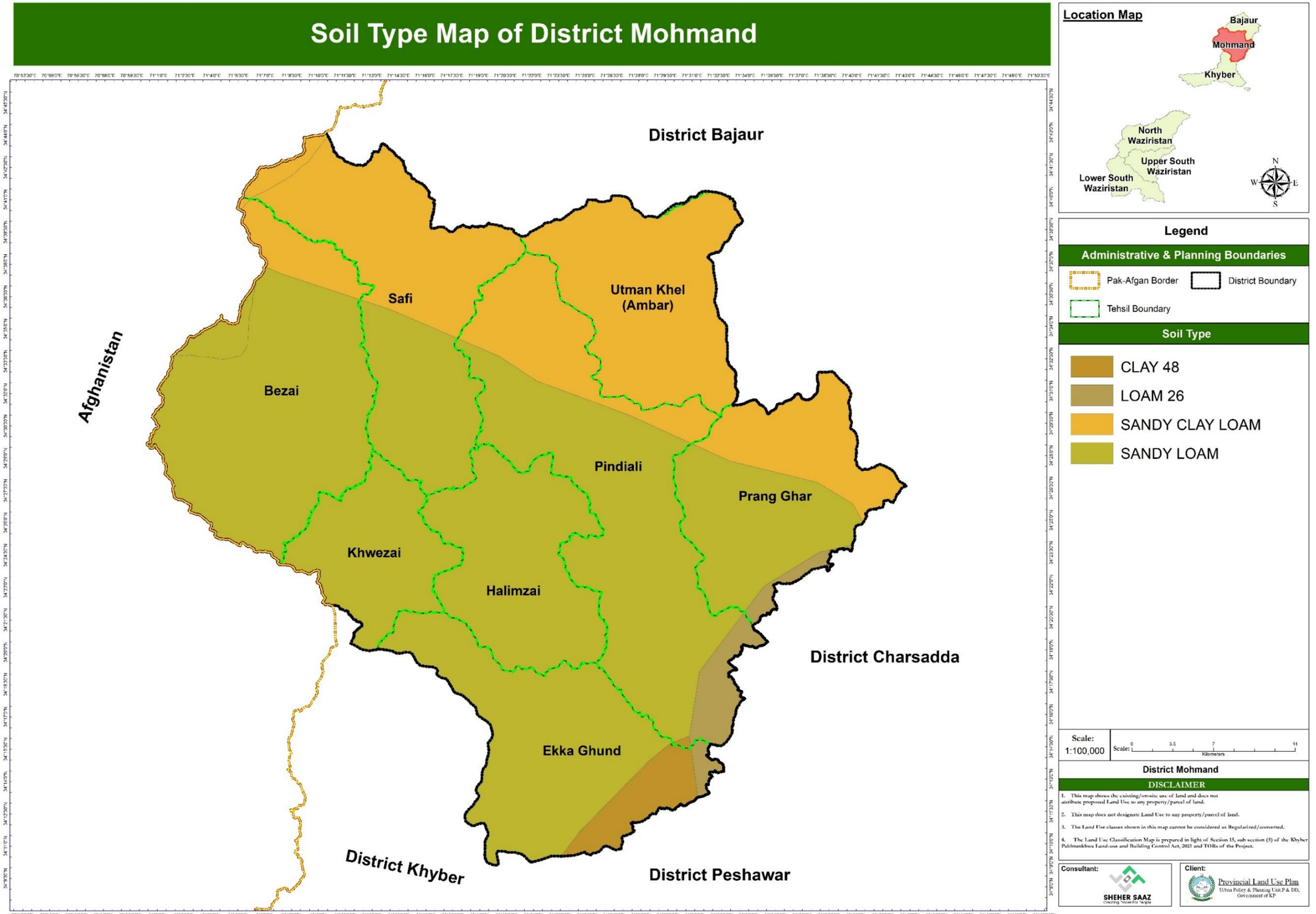
Source: Meteoblue

1.2.2.5 Soil

The soils in Mohmand District are primarily derived from residuum and colluvium originating from schist and slate parent materials. These soils vary from shallow to moderately deep, with good to somewhat excessive drainage. They are slightly to moderately calcareous and possess a coarse texture, ranging from sand, loamy sand, sandy loam, fine sandy loam to loam. The soil is slightly eroded and is typically found on the lower mountain slopes, as well as on piedmont alluvial plains and water-reworked loess plains, which occupy nearly level to gently sloping areas. These areas feature soils that are moderately deep, well-drained, and moderately calcareous, with slight erosion.

The district experiences a semi-arid, subtropical continental climate, contributing to the fertility of the soils, which are well-suited for the cultivation of a wide range of cereal crops, vegetables, and fruits, including off-season vegetables. The district is particularly known for the cultivation of tomatoes and chilies, especially in frost-free pockets. Key crops grown in the region include wheat, maize, and oilseeds, benefiting from the fertile soil conditions.

Map 7: Soil Map – District Mohmand



1.2.2.6 Hydrology and Water Resource

Mohmand District, characterized by its rugged mountains with barren slopes and expansive valleys along the banks of the Kabul River, relies primarily on surface water for its agricultural needs. The district's limited income sources are primarily derived from agriculture and some trade or business activities, with a significant portion of the population earning their livelihood abroad, particularly in the Gulf States[1].

Despite its high potential for farming, spate irrigation has received minimal investment in the District Mohmand. There has been a lack of significant efforts to develop sustainable spate irrigation systems, which could help recharge groundwater and mitigate the impact of floods. As a result, flash floods continue to damage infrastructure and agriculture in the region.

1.2.2.6.1 Surface Water

The surface water in Mohmand District, while crucial, remains underutilized for irrigation and agricultural purposes. The Kabul River, flowing along the district's boundary, is a significant source of water. However, the district lacks extensive development in sustainable irrigation systems, which could help manage and utilize the available water resources more effectively. This has led to a dependency on seasonal streams and floodwater, with minimal investment in infrastructure to harness these resources fully. The district's agricultural potential is thus hampered by the inadequate use of available surface water, which is vital for sustaining the local economy.

1.2.2.6.2 Ground Water

Groundwater is a critical resource for drinking water in Mohmand District, with open wells being the primary source, supplying 67% of households. The reliance on open wells underscores the challenges in accessing safe and reliable water, especially in areas where public infrastructure is less developed. The second most common source of drinking water is tapping water, provided through pipelines by the public health engineering department in major towns. In more remote areas, many households depend on ponds for their drinking water, reflecting the scarcity of accessible and clean water sources. Additionally, a small percentage of households (4%) use hand pumps, while the remaining 8% rely on alternative sources such as stream water, rainwater harvesting, or perennial water sources.

The district faces significant challenges in water resource management, with a declining water table due to uncontrolled groundwater extraction. This has caused many existing waters supply schemes to become non-functional, leading to increased reliance on shared wells in communities. The ongoing ecological changes, combined with regional instability, have further exacerbated these issues, reduced aquifer recharge and drying up many natural watercourses. Without the development of alternative water sources or sustainable groundwater management practices, the district's water scarcity will likely worsen, impacting both domestic and agricultural water availability.

[1] Technical Studies of Water Resources in FATA, IUCN Pakistan, SDC and FATA Environment Cell, https://pcrwr.gov.pk/wp-content/uploads/2020/Water-Management-Reports/FATA-water-studies.pdf

1.2.2.7 Forestry and Ecological Profile

The district has about 10,006 hectares of forest land, which covers about 4.4% of the total area of the district.

Some of the major forest types and products in the Mohmand district are:

- **Riverine forests:** These are forests that grow along the banks of the Kabul River and its tributaries. They are composed of various tree species, such as poplar, willow, acacia, tamarisk, and mulberry. They provide timber, fuelwood, fodder, honey, and medicinal plants to the local people. They also help in stabilizing the riverbanks and preventing soil erosion.
- **Scrub forests:** These are forests that grow on the hilly areas of the district. They are composed of various shrub species, such as oleander, pistachio, almond, wild olive, ziziphus, and berberis. They provide fuelwood, fodder, nuts, fruits, and medicinal plants to the local people. They also help in conserving soil and water resources and providing habitat for wildlife.
- **Plantation forests:** These are forests that are artificially established on degraded or barren lands for various purposes, such as reclamation, rehabilitation, or production. They are composed of various tree species, such as eucalyptus, pine, chilgoza, walnut, apricot, and apple. They provide timber, fuelwood, fodder, nuts, fruits, and ornamental plants to the local people. They also help in improving the microclimate and aesthetics of the area.

1.2.2.7.1 Ecological profile

Forests are ecological linchpins, providing indispensable ecosystem services. They act as natural sponges, safeguarding watersheds and ensuring a consistent supply of clean water. Additionally, forests play a crucial role in climate regulation by absorbing carbon dioxide and stabilizing local climates. Biodiversity thrives within their lush canopies, essential for ecological balance and resilience against environmental disruptions.

The economic significance of forests is equally paramount. Timber from forests is a fundamental resource for construction and manufacturing industries. Fuel wood and fodder cater to daily energy and livestock needs, supporting livelihoods. Furthermore, forests stimulate the local economy through tourism and recreation, attracting visitors with their scenic beauty and providing opportunities for outdoor activities, thus fostering sustainable economic growth. Balancing the ecological and economic importance of forests is key to ensuring their long-term vitality and the well-being of both ecosystems and communities.

1.2.2.7.2 Sustainable forest management

In the Mohmand District, sustainable forest management will open promising avenues. Community-based Forest management fosters local involvement, while ecotourism harnesses natural beauty, attracting visitors. Agroforestry integrates trees with agriculture, optimizing land use. These strategies align conservation with development, paving a sustainable path for

the district's forests and communities. All the planning will be done considering the sustainable development goals with addition to IPCCC recommendations.

1.2.2.8 Regional History

District Mohmand boasts a rich and ancient history intertwined with the Mohmand tribe, a branch of the Ghani Khel Afghan. Historically, the Mohmand tribe resided near the Tarmak and Oxyus rivers in central Afghanistan before migrating to their current settlements between the 13th and 15th centuries. This migration involved the expulsion and subjugation of the native Hindus and other non-Afghan races in the area.

During the British colonial era, the Mohmand territory was part of the larger tribal belt known as the Mohmand Agency. When Peshawar was formally annexed by the British, the present Mohmand Agency was ruled by local tribesmen and was under the influence of the Khan of Lalpura. Despite periodic assurances of non-interference in British territory, these promises from the Mohmand tribes were often short-lived. Under the Durand Agreement of 1894, several eastern clans, including the Tarakzai, Halimzais of Gundhab and Kamali, Burhan Khel, Isa Khel, Dawezai, and Utmanzai, fell on the British side of the border and became known as the Assured Clans. In 1896, the Jirgas of these clans formally submitted to the Lieutenant Governor of Punjab and were granted allowances previously received from Kabul and Lalpura. By 1902, more sections of the Mohmand tribe, such as the Musa Khel of Mittai, aligned with the British government.

The British administration established the Khasadars, a local paramilitary force, to maintain law and order in the region. Despite British efforts to establish control and governance, the Mohmand tribe maintained a distinct cultural identity and played a significant role in local politics and administration.

Significant changes occurred in recent years, particularly with the 25th Amendment to the Constitution of Pakistan in 2018, which aimed to integrate the tribal areas into the mainstream administrative system. As a result, the Mohmand Agency merged with the Khyber Pakhtunkhwa province, establishing District Mohmand. This merger marked a new chapter in the region's history, aiming to bring the tribal areas into the fold of settled district governance and development.

1.3 The Administrative Structure of the Region

Khyber Pakhtunkhwa (KP) Province operates under a hierarchical administrative structure, Khyber Pakhtunkhwa (KP) Province operates under a hierarchical administrative structure, subordinate to the federal government. At the apex of provincial governance is the Chief Minister, elected by the Provincial Assembly. The Chief Minister heads the executive branch and is assisted by a cabinet of ministers overseeing various departments.

The bureaucratic machinery is led by the Chief Secretary, who coordinates and supervises departmental activities. The Additional Chief Secretary heads the Planning & Development Department, reporting directly to the Chief Secretary. A tiered structure of Additional Secretaries, Deputy Secretaries, Section Officers, and other staff supports the departments. Additionally, various attached departments and autonomous bodies operate under the provincial government.

The province is divided into 38 districts, each with its administrative hierarchy. Local government is overseen by the Secretary of the Local Council Board, under the purview of the Local Government Establishment and Rural Development Department. This department is responsible for administration, planning, and development at the local level. Its structure includes five key sections: Planning & Development, Estate, Administration/Establishment, Finance, and Local Governance. An Additional Secretary heads the Litigation, Monitoring & Evaluation, and Smart City wings. The Deputy Secretary for Administration and Establishment oversee municipal administration across KP, including 7 Regional Municipal Officers (RMOs) and 93 Tehsil Municipal Officers (TMOs).

The land use regulations governing development in Pakistan, including national and provincial laws, acts, and policies, are implemented by the local government department and development authorities.

1.4 Legal & Policy Framework (Federal, Provincial, Local)

1.4.1 Existing Legal Framework

1.4.1.1 The North-West Frontier Province Urban Planning Ordinance, 1978

The North-West Frontier Province Urban Planning Ordinance of 1978 was enacted to establish a comprehensive urban planning system for the province. Its primary goals are to integrate physical planning with economic and social planning at all levels of government and to establish an institutional framework for the effective implementation of these plans. Ordinance makes the Provincial Urban Development Board (Board) as the primary governing body. The Board is responsible for formulating and implementing urban development policies, coordinating with federal and local planning agencies, and ensuring proper consideration of economic and social planning factors.
Established by the Board with government approval, detailed planning and implementation are mandated in specific local areas under Section 15. The Board defines the boundaries of these local areas as per Section 15(2). Additionally, the Board has the authority to delegate

all or any of its functions related to the local area to the Local Area Authority (LAA), as specified in Section 16.

The functions of LAAs are comprehensive and include engaging in a continuous planning process that outlines land development, public facilities, housing, open spaces, and more. They are also responsible for conducting studies, making projections, and analyzing existing conditions under Section 17(3). Furthermore, LAAs are tasked with implementing approved plans, which require the necessary resources and powers, as stated in Section 17(4). They must prepare documents like Local Area Plans (LAPs) and others as needed, according to Section 17(5), and follow directions from the Board under Section 17(6).

Local Area Plans (LAPs) are defined by the LAA with titles approved by the Board, as outlined in Section 18(1). These plans include written summaries of findings, recommendations, and proposed plans. They also specify territorial and time dimensions, subject matter, and the level of detail required. Moreover, LAPs identify provisions to be included in Land Development Regulations or adhered to by government agencies, as noted in Section 18(4).
Land Development Regulations (LDRs) can be adopted by LAAs if authorized by the Board, as outlined in Section 21. These regulations govern various aspects of land development within the local area, as specified in Sections 31(1) and (2).

The implementation of the approved plans is a key responsibility of LAAs, who must carry out this task directly or through other government agencies, as stated in Section 22. The Board has the authority to modify delegation terms, dissolve LAAs, or merge them with other planning agencies, according to Section 23. Once local area development is complete, the Board can dissolve the LAA and transfer the area to a local council, as outlined in Section 24.
The ordinance outlines the procedures for land acquisition for urban planning purposes. The process begins with the identification of required land, where the Board identifies the necessary land and publishes a notification in the official gazette. Authorized officers are then allowed to survey, mark boundaries, and assess land suitability, with compensation provided for any damage caused during this process. Compensation is determined based on factors such as market value, damages, and relocation expenses, while excluding factors like urgency or potential land value increases due to the project.

1.4.1.2 North-West Frontier Province Local Government Ordinance, 2001

In line with the objectives of decentralization and devolution of power, the *North-West Frontier Province Local Government Ordinance, 2001* (the "NWFP LGO 2001") was promulgated under the Devolution Plan 2001 to restructure the local government system in the then North-West Frontier Province, now Khyber Pakhtunkhwa. The Ordinance aimed to devolve political, administrative, and financial authority to the district, tehsil, and union levels, thereby strengthening grassroots governance and improving service delivery.
The NWFP LGO 2001 applied to the entire province, excluding cantonment areas and any other areas notified by the government. The Ordinance defined key institutional terms such as district, tehsil, union, local government, and local council, and established a **three-tier local government structure** comprising District Governments, Tehsil Municipal Administrations (TMAs), and Union Administrations. Each tier was assigned specific functions and

responsibilities to ensure administrative decentralization and local participation in governance.

Under the Ordinance, a **District Government** was established in each district, headed by a directly elected *Nazim*, with executive authority supported by the District Coordination Officer and district line departments. The District Government was responsible for overall district-level planning, coordination, and management of devolved sectors, including education, health, infrastructure, and spatial planning. The District Nazim provided leadership for district development, approved development strategies, and coordinated with provincial departments.

At the tehsil level, the Ordinance established **Tehsil Municipal Administrations (TMAs)**, headed by a Tehsil Nazim. TMAs were assigned municipal and regulatory functions, including land use control, building regulations, water supply, sanitation, solid waste management, local roads, markets, and spatial planning. The TMAs were responsible for preparing tehsil-level development plans and managing municipal services in both urban and rural settlements within their jurisdiction, subject to provincial policies.

The **Union Administration**, headed by a Union Nazim, functioned as the lowest tier of local government. Union Councils were responsible for identifying local development needs, maintaining communal infrastructure, assisting in data collection, monitoring service delivery, and facilitating community participation. They also played a role in dispute resolution, registration of vital events, and implementation of small-scale development schemes.

The NWFP LGO 2001 also established **elected councils** at each tier—District Council, Tehsil Council, and Union Council—which exercised legislative and oversight functions. These councils approved budgets, development plans, local taxes, fees, and bylaws, and held the respective Nazims accountable for administrative and financial performance through committees and council proceedings.

Although the NWFP LGO 2001 introduced an extensive framework for devolution and local-level planning, its implementation faced challenges related to administrative capacity, fiscal dependence on the province, and limited continuity. The Ordinance remained in force until it was repealed and replaced by subsequent local government legislation, including the *Khyber Pakhtunkhwa Local Government Act, 2012* and later the *Khyber Pakhtunkhwa Local Government Act, 2013*. Nevertheless, the NWFP LGO 2001 remains a foundational legal instrument that shaped the evolution of local governance and planning institutions in Khyber Pakhtunkhwa.

1.4.1.3 The Khyber Pakhtunkhwa Establishment of District Development Advisory Committees Act, 1989

With a District Development Advisory Committee for each district, the KP Establishment of District Development Advisory Committees Act, 1989 was established to provide appropriate planning and oversight of local-level development operations throughout the province. The heads of any district-level Attached Departments, the District Nazim, the City District Nazim, the Tehsil Nazim/Town Nazim, and any other elected representatives that the Government may designate as co-opted members comprise the Committees, in addition to all the

members of the Provincial Assembly from that District. Voting rights are not granted to co-opted members.

1.4.1.4 The Khyber Pakhtunkhwa Local Government Act, 2013

In accordance with Article 140A of the Constitution of the Islamic Republic of Pakistan, 1973 (the "Constitution"), which mandates the establishment of local government systems (in all provinces) and the devolution of political, administrative, and financial responsibility authority to the elected representatives of such local governments, the province's local government system has been reorganized and consolidated thanks to the Khyber Pakhtunkhwa Local Government Act, 2013 (the "LGA").

The Khyber Pakhtunkhwa Local Government Act, 2013, applies throughout the entire Khyber Pakhtunkhwa Province, excluding designated cantonments and any other areas excluded by official government notification. The Act defines key terms like district, local government, local council (including Tehsil, Village, and Neighborhood Councils), and tehsil. It establishes local areas for the formation of local governments, including villages, neighborhoods, and later additions like tehsils. Finally, the Act outlines the structure of local governments, which will consist of City Local Governments, Tehsil Local Governments, Village Councils, and Neighborhood Councils.

The Khyber Pakhtunkhwa Local Government Act, 2013 establishes a Tehsil Local Government (TLG) in each tehsil. Each TLG has a directly elected Chairman with executive authority and a Tehsil Local Administration for support. The Chairman is responsible for ensuring the TLG functions according to the Act and oversees a range of duties. These include providing vision and leadership for the tehsil's development, formulating development strategies, and coordinating with the District Administration. The TLG itself manages devolved government departments within the tehsil, following general government policies. They are accountable to both the public and the provincial government for improving governance and service delivery within their devolved authority. The Chairman has a wide range of powers to fulfill these responsibilities. They can propose budgets and development plans, oversee implementation of devolved functions, and regulate markets and services within the tehsil. Additionally, the Chairman monitors government officials, coordinates with village and neighborhood councils, and represents the TLG in official capacities.

The Khyber Pakhtunkhwa Local Government Act, 2013 also establishes a Tehsil Council in each tehsil. The council's composition is detailed in Part-I of the Eleventh Schedule of the Act. This council plays an important oversight role by approving taxes, fines, and bylaws proposed by the Chairman. Additionally, they have final say on the annual budget and development plans for the Tehsil Local Government. To ensure an effective delivery service, the council elects Standing Committees to oversee various aspects of TLG's operations. These committees cover areas like municipal offices, devolved functions, finances, accounts, and ensuring smooth council proceedings and ethical conduct amongst members. Finally, the Tehsil Council reviews report from the Accounts Committee and performance reports from the Chairman, holding them accountable for their actions.

The Khyber Pakhtunkhwa Local Government Act, 2013 establishes Village Councils in rural areas and Neighborhood Councils in urban areas. After their boundaries are finalized by the

Election Commission, the government officially forms these councils. Both types of councils play a crucial role in local development and service delivery.

Their shared responsibilities include implementing and monitoring village-level development projects (for Village Councils), handling village sanitation (Village Councils only), identifying local development needs, registering vital events, approving annual budgets and development plans, organizing local sports and cultural events, and overseeing watch and ward programs. Village Councils additionally organize cattle fairs and shows.

Furthermore, both councils play a vital role in monitoring service providers like education, health, agriculture, and sanitation. They achieve this through a dedicated Monitoring Committee that reports to the Tehsil Local Government. Data collection on social indicators is another important function. The councils also collaborate with the Tehsil Local Government by assisting with surveys, data collection, and selecting locations for public facilities. Finally, they can be assigned additional tasks by the government or the Tehsil Local Government. The Khyber Pakhtunkhwa Local Government Act, 2013, outlines the process for delimiting village and neighborhood councils within the province.

- **Number of Councils:** The total number of councils per district is specified in the Ninth Schedule of the Act.
- **Delimitation Authority:** The Election Commission of Pakistan is responsible for delimiting village and neighborhood councils.
- **Village Council Areas:** A village council covers one or more muaziaat (land revenue units) or census villages.
- **Neighborhood Council Areas:** In urban areas, a neighborhood council covers whole census blocks or a combination of blocks and muaziaat.
- **Delimitation Considerations:** Delimitation considers factors like population distribution, geographic compactness, existing administrative boundaries, communication facilities, public convenience, and ensuring homogeneity in council creation.
- **Population Range:** The population range for councils within a district is 5,000 to 15,000 based on the latest official census data. If the official census results are not available, provisional results from the 2017 national population census can be used for delimitation.

1.4.1.5 Khyber Pakhtunkhwa Planning and Development Guidelines for Local Governments 2015

The Planning and Development (P&D) Guidelines 2015 for the devolved tiers of local governments in Khyber Pakhtunkhwa (KP) were developed to operationalize the provisions of the Local Government Act (LGA) 2013. These guidelines provide a structured approach for the planning, execution, and monitoring of development projects at the district, tehsil, and village/neighborhood levels. The guidelines underscore the importance of decentralized and participatory planning to ensure that development initiatives are responsive to the specific needs of local communities. It advocates for a decentralized planning system where local governments have the authority and responsibility to plan and execute development projects.

This approach aims to bring decision-making closer to the community level, promoting more effective and context-sensitive interventions.

Local governments are required to prepare a Medium-Term District Development Plan (DDP) and an Annual Development Program (ADP). The DDP outlines the strategic development priorities for a multi-year period, while the ADP details the specific projects and budget allocations for each fiscal year. The planning cycle is designed to ensure alignment between the medium-term and annual plans, facilitating continuity and coherence in development efforts.

A key feature of the guidelines is the emphasis on inclusive and evidence-based planning. Local governments must conduct thorough needs assessments, involving extensive data collection and stakeholder consultations to identify service delivery gaps and prioritize projects. Special attention is given to engaging marginalized groups, including women, minorities, and the disabled, to ensure that development interventions are equitable and address the needs of all community members.

The guidelines specify the allocation of development funds across various sectors, such as education, health, infrastructure, and water supply. There are also earmarked funds for gender-responsive projects, youth, and marginalized groups. This structured allocation is intended to ensure that critical areas receive adequate funding and that development efforts are balanced and comprehensive.

The guidelines outline clear procedures for project identification, approval, and implementation, with an emphasis on transparency and accountability. Various committees at the district, tehsil, and village/neighborhood levels are responsible for overseeing these processes. Furthermore, monitoring and evaluation mechanisms are established to track project progress, assess outcomes, and ensure the proper utilization of funds. Recognizing the need for effective implementation, the guidelines highlight the importance of capacity building for local government officials. This includes training on technical aspects of project planning, financial management, and community engagement.

The P&D Guidelines 2015 for devolved local governments in KP represent a significant step towards achieving a decentralized and participatory development planning framework. The guidelines are comprehensive, detailing every aspect of the planning, execution, and monitoring process. The Khyber Pakhtunkhwa Urban Areas Development Authorities Act, 2020.

The Khyber Pakhtunkhwa Urban Areas Development Authorities Act of 2020 represents a significant step towards the regulated and sustainable development of urban centers within the province. The legislation establishes a framework for the creation and operation of Urban Areas Development Authorities, empowering them to play a pivotal role in shaping the future of the province's cities.

The primary objective of the Act is to enhance the quality of life for urban residents. It seeks to achieve this by promoting planned and sustainable urban growth. To this end, the Act grants Urban Development Authorities broad powers to formulate and implement comprehensive land use plans and zoning regulations. These authorities are also entrusted with the responsibility of developing and maintaining essential urban infrastructure, including transportation networks, water supply, and sanitation systems.

One of the notable features of the Act is its provision for granting autonomous status to specific development authorities. This decentralization approach empowers local authorities to make decisions tailored to the unique needs and challenges of their respective areas. The Kohat Development Authority is a prime example of this, serving as a model for other potential autonomous development authorities.

To ensure alignment with broader development objectives, the Act establishes an Urban Development Authority's Board. This body oversees the approval of development schemes and can initiate modifications as needed.

While the Act presents a promising framework for urban development, its successful implementation hinges on several factors. Effective coordination and monitoring mechanisms are essential to ensure that the authorities operate efficiently and harmoniously. Moreover, fostering meaningful public participation in decision-making is crucial for creating inclusive and responsive urban environments. Adequate financial resources are also indispensable for the development and maintenance of necessary infrastructure.

The Khyber Pakhtunkhwa Urban Areas Development Authorities Act of 2020 offers a solid foundation for urban transformation. By empowering local authorities, promoting sustainable practices, and emphasizing the importance of public engagement, the Act has the potential to significantly improve the lives of urban residents in the province. However, its full potential can only be realized through effective implementation, ongoing evaluation, and adaptation to emerging challenges and opportunities.

1.4.1.6 Khyber Pakhtunkhwa Land Use and Building Control Act, 2019

The *Khyber Pakhtunkhwa Land Use and Building Control Act, 2019* provides the legal framework for regulating land use, urban development, and building construction across the province. Its primary objective is to ensure planned, safe, and sustainable urban growth, while controlling unauthorized construction and unplanned settlement expansion.

The Act applies throughout the province in **notified urban areas, towns, and cities**, excluding cantonments unless specifically notified by the government. It defines key terms such as land use, development, building, zoning, planning authority, and local authority. The Act also establishes the legal basis for preparation, approval, and enforcement of land use plans, zoning schemes, and building regulations at provincial and local levels.

Under the Act, designated **Local Authorities**, including City Local Governments, Tehsil Local Governments, Development Authorities, and other notified agencies, are empowered to regulate land use and building activities within their jurisdiction. Their responsibilities include approving land use plans, granting building permissions, regulating changes in land use, enforcing zoning compliance, and overseeing all construction activity to ensure conformity with approved plans.

The Act mandates the preparation of **zoning and land use plans**, classifying areas into residential, commercial, industrial, institutional, mixed-use, and other designated zones. Any land subdivision, change of land use, or building construction requires prior approval from the relevant authority according to the rules and standards set forth in the Act.

It also outlines **building control provisions**, including plot coverage, building height, structural safety, setbacks, parking, access, and provision of essential services. Local Authorities are

authorized to inspect buildings, issue notices, impose penalties, seal unauthorized constructions, and order demolition of structures violating approved plans.

To ensure effective implementation, the Act provides mechanisms for appeals, penalties, and enforcement, ensuring accountability of developers and landowners. The provincial government is empowered to issue detailed rules, regulations, and guidelines to operationalize the Act and adapt it to local needs.

The *Khyber Pakhtunkhwa Land Use and Building Control Act, 2019* thus serves as a **key legal instrument** for guiding orderly urban development, promoting efficient land utilization, regulating housing density and vertical expansion, and supporting sustainable urban planning across the province.

1.4.1.7 Khyber Pakhtunkhwa Land Acquisition Rules, 2020

The KP Land Acquisition Rules, 2020 are a comprehensive framework governing land acquisition in Khyber Pakhtunkhwa, Pakistan, published by the Board of Revenue and available on their official website. These rules outline the procedures for land acquisition, including the determination and payment of compensation. Their primary objective is to establish a clear and transparent process that ensures fairness and equity for all parties involved, particularly by providing adequate compensation to landowners whose properties are acquired for public purposes. The rules detail a step-by-step procedure for land acquisition, clarify the criteria and methodology for determining compensation, and establish a mechanism for timely payment to eligible landowners. Additionally, they designate the role of a Land Acquisition Collector, responsible for the effective implementation of these regulations. However, the enforcement and monitoring of these rules can present challenges, necessitating robust mechanisms to address non-compliance. Ensuring local compliance and raising awareness among stakeholders may also be difficult, especially when resources for monitoring and corrective actions are limited. Furthermore, the policy may require periodic updates to remain aligned with evolving local development needs and changing circumstances.

1.4.1.8 Khyber Pakhtunkhwa Local Government (Private Housing Schemes Management and Regulation) Rules 2021

The KP Local Government (Private Housing Schemes Management and Regulation) Rules 2021 are designed to oversee the management and regulation of private housing schemes in Khyber Pakhtunkhwa, Pakistan. Promulgated by the Government of Khyber Pakhtunkhwa under Section 112 of the Khyber Pakhtunkhwa Local Government Act, 2013, these rules establish a regulatory framework aimed at ensuring that private housing schemes are developed in a sustainable and planned manner while protecting the rights of all stakeholders involved. They promote transparency and accountability in the management of these schemes. The rules provide a structured mechanism for overseeing private housing projects, ensuring compliance with established guidelines and standards in planning, execution, and ongoing management.

They also prioritize community interests by encouraging the development of inclusive and safe housing schemes with well-planned infrastructure. Additionally, the rules establish transparent processes for the approval, monitoring, and management of private housing

schemes, thereby enhancing accountability and trust among stakeholders while promoting the integration of environmental considerations and sustainable practices. However, the enforcement of these rules presents challenges, including the complexity of effective monitoring and the need for robust mechanisms to address non-compliance. Ensuring local-level compliance and raising awareness among stakeholders can be difficult, especially given the limited resources available for monitoring and corrective actions. Furthermore, the policy may require periodic updates to adapt to evolving local development needs and changing circumstances.

1.4.1.9 Khyber Pakhtunkhwa Urban Policy 2022-2030

The Khyber Pakhtunkhwa (KP) Urban Policy (2022-2030) is a comprehensive blueprint designed to steer the growth and management of the province's urban areas. It acknowledges the province's diverse urban landscape by categorizing cities based on population and administrative factors, recognizing the unique challenges and opportunities presented by the Northern, Central, and Southern regions. This zonal differentiation allows for flexible and tailored strategies while maintaining a unified policy framework.

At its core, the policy envisions cities as engines of social and economic progress, aiming to create inclusive and prosperous urban spaces. It emphasizes adaptability, inclusivity, and collaboration as guiding principles. The policy seeks to create cities that are responsive to changing needs, where all residents feel valued and empowered, and where government, the private sector, and civil society work together towards shared goals.

To achieve this vision, the policy outlines three primary objectives: fostering sustainable cities, promoting social mobility and livability, and driving youth-focused economic development. Sustainable cities are envisioned as balanced ecosystems where economic growth coexists with environmental protection and social well-being. The policy emphasizes green spaces, clean air, and efficient resource management as crucial elements of this vision.

Social mobility and livability are central to creating inclusive and equitable cities. The policy aims to improve the quality of life for all residents, particularly vulnerable groups such as women, children, and people with disabilities. By enhancing access to essential services, creating inclusive public spaces, and fostering a sense of community, the policy seeks to build vibrant and resilient urban environments.

Recognizing the potential of young people, the policy places a strong emphasis on youth-focused economic development. By creating an environment that supports entrepreneurship, job creation, and skill development, the policy aims to empower young people to contribute to the province's economic growth and innovation.

Beyond these primary objectives, the policy integrates gender equality, technology, and sustainability into all aspects of urban development. By mainstreaming these cross-cutting themes, the policy aims to create cities that are just, efficient, and resilient.

A significant aspect of the policy is the introduction of Strategic City Management Plans (SCMPs). These plans are to be developed for each city on a rolling three-year basis, prioritizing local interventions and sustainable solutions in various sectors including urban governance, land use, mobility, urban design, local economic development, environmental sustainability, financial stability, and communication. The development of SCMPs involves a

participatory process of public engagement, ensuring that the plans are user-friendly and reflect the community's needs. Additionally, the SCMPs include a disaster risk management response and coordination mechanism.

The policy also includes several annexures providing additional guidelines and frameworks. Annexure 1 lists the cities and tehsils by zone, while Annexure 2 details the implementation framework for the policy, emphasizing the need for periodic reviews and updates. Annexure 3 presents a linkages matrix that connects the goals, indicators, and policy clauses. Annexure 4 provides guidelines for the preparation of SCMPs, and Annexures 5 and 6 offer public space design and community participation guidelines, respectively. Finally, Annexure 7 includes an urban sector diagnostic to inform policy decisions.

The KP Urban Policy (2022-2030) aims to create a balanced and inclusive urban development framework that addresses the diverse needs of the province. It seeks to promote sustainability, enhance social mobility, and drive economic development through comprehensive planning, public participation, and the use of technology. The policy's success will depend on effective implementation, continuous adaptation, and genuine engagement with the communities it serves.

1.4.1.10Merged District's Annual Development Plan 2022-23

The Merged Areas Development Plan 2022-23 for Khyber Pakhtunkhwa is a detailed and comprehensive framework aimed at integrating the formerly Federally Administered Tribal Areas (FATA), and now Merged Districts, into the province. The document addresses various sectors, including agriculture, education, health, infrastructure, governance, and social welfare, each with specific projects, financial allocations, and expected impacts. The agricultural sector is a significant focus, with projects aimed at enhancing productivity through modern farming techniques, establishing soil and water testing labs, promoting indigenous crops, and developing fisheries. These initiatives aim to create a sustainable agricultural framework that supports local economies and food security.

In education, the plan includes scholarships to encourage higher education and numerous projects for constructing and rehabilitating schools in remote areas, addressing the literacy gap, and promoting education accessibility. The health sector focuses on improving healthcare infrastructure, expanding essential medical services, and combating prevalent diseases such as tuberculosis and hepatitis. Key initiatives include constructing new hospitals, upgrading existing facilities, and enhancing maternal and child health services, which are critical for improving the overall health standards of the population.

Infrastructure development is a cornerstone of the plan, with significant projects aimed at improving road connectivity, water supply, and energy infrastructure. This includes the construction and upgrading of roads to enhance connectivity within the merged areas and with the rest of KP, and the implementation of new water supply schemes to ensure access to clean drinking water. These projects are designed to facilitate economic activities, improve living standards, and create a robust infrastructure framework that supports sustainable urban development.

Governance and social welfare projects within the plan focus on strengthening local governance institutions and providing social safety nets for vulnerable populations. Initiatives for capacity building aim to improve service delivery, while social welfare programs provide

financial assistance and skill development opportunities, fostering social cohesion and supporting economic mobility. The urban planning components emphasize creating sustainable and resilient urban environments by integrating economic, social, and environmental considerations. Projects aim to develop urban areas through infrastructure improvements, enhanced public services, and the promotion of economic activities, while sustainable practices such as efficient water management and renewable energy projects are highlighted.

The document also stresses the importance of community engagement in the planning process, ensuring that development meets local needs and preferences. Financial allocations are detailed, highlighting the investment required for each sector and the sources of funding, which include a mix of local and foreign resources. Effective implementation mechanisms are crucial, and the plan discusses coordination among various government departments and stakeholders to ensure smooth execution.

However, potential challenges and issues may affect the successful implementation of the plan. These include the capacity for effective implementation, requiring robust administrative capabilities, resource allocation, and coordination. Establishing strong monitoring and evaluation mechanisms is essential to track progress and address bottlenecks promptly. Ensuring the long-term sustainability of projects, especially in infrastructure and agriculture, requires continuous support and maintenance. Security concerns, given the region's history of conflict, could also pose significant challenges to implementing development projects.

1.5 Context & Rationale for Land Use Planning

Historical planning of Master Plans of Cities/Towns in Khyber Pakhtunkhwa involved drawing plans in isolation from their hinterland, which was a piecemeal and isolated procedure, and consequently did not yield results. Recognizing the situation, the Provincial Government has rightly opted to adopt an integrated and holistic Land Use Planning approach for the development of all parts of the province. The Land Use Plan will serve as a policy document meant for the integrated, coordinated, systematic planning and uniform spread of development activities. It also aims to generate employment for the rural and suburban populations, thereby reducing rural-urban migration. It would help establish a hierarchy of settlements and the development of satellite, intermediate, secondary, and industrial towns as focal points for the future, catering to rural areas and small towns.

The plan will focus on creating, inducing, and facilitating sustainable development, optimizing land and other physical resource use, enhancing provincial income, increasing overall activity, and ensuring a balanced distribution of infrastructure and services. The Land Use Plan must serve as a guide for all the Provincial Government, Urban Policy Unit, District Governments, and TMAs to run integrated as well as coherent development programs.

2 CHAPTER II: POPULATION

2.1 Population Distribution

Mohmand District, with a population of approximately 553,933, is divided into seven tehsils and is a significant hub for marble extraction. Despite its size, the district has only one urban center, Ghalanai, located in Halim Zai Tehsil. Although Pindiali and Safi Tehsils have larger populations, Halim Zai's strategic location makes it the focal point for the district's sole urban center. Ghalanai also serves as the district headquarters of Mohmand.

Table 2: Percentage of Division Population

Area	Pop. 2023	Percentage of Division Population
Ambar Utman Khel Tehsil	79,455	14%
Halim Zai Tehsil	89,149	16%
Pindiali Tehsil	112,247	20%
Prang Ghar Tehsil	36,046	7%
Safi Tehsil	109,620	20%
Upper Mohmand Tehsil	63,659	11%
Yake Ghund Tehsil	63,757	12%
Mohmand District	553,933	100%

Source: Pakistan Bureau of Statistics (PBS) Census 2023

2.2 Migration

Mohmand District, with a population of 553,933, is entirely rural, as evidenced by the absence of urban migration in the data. Of the 4,284 total migrants, most (3,453) moved within Khyber Pakhtunkhwa, 455 came from other provinces, and 376 returned from abroad. The primary reasons for migration include moving with family (1,897), unspecified reasons (932), marriage (870), job/business (475), returning home (91), and education (19). This low migration rate (~0.77%) reflects Mohmand's rural stability, with family ties and economic factors driving most movement, likely linked to its marble industry and past conflict-related displacement

Table 3: Indicator and Reason for Migration in Mohmand

Indicators	Total	Rural	Urban
Population	553,933	553,933	-
Migration	4,284	4,284	-
Intra Provisional Migration	3,453	3,453	-
Inter-Provincial Migration	455	455	-
Migration from Abroad	376	376	-
Reason for Migration			
Job/ Business	475	475	-
Education	19	19	-
Marriage	870	870	-
With Family	1,897	1,897	-

Back to Home	91	91	-
Other	932	932	-

Source: Pakistan Bureau of Statistics (PBS) Census 2023

2.3 Density Pattern

Density patterns are vital for understanding how people, resources, and infrastructure are spread across a city. It reveals where populations are concentrated, guiding the efficient placement of essential services like schools, hospitals, and transit hubs to ensure they're accessible without overloading certain areas.

Table 4: Population Density

District/ Tehsil	Area (Sq.km)	Density 2017	Density 2023	Density 2025	Density 2030	Density 2035	Density 2040	Density 2045
Mohmand District	2,296	207	241	253	285	320	357	397
Ambar Utman Khel Tehsil	273	227	291	314	376	445	522	609
Halim Zai Tehsil	211	373	423	439	483	527	573	621
Pindiali Tehsil	454	198	247	265	312	364	420	483
Prang Ghar Tehsil	257	142	140	139	137	135	133	130
Safi Tehsil	322	306	340	352	382	412	443	474
Upper Mohmand Tehsil	513	100	124	133	156	181	209	239
Yake Ghund Tehsil	266	217	240	247	267	286	306	326

Source: Derived by the Consultant 2025

2.4 Growth Rate

From 2017 to 2023, Mohmand District's overall annual population growth rate rose from 1.85% to 2.63%, reflecting a district-wide increase to 553,933 residents (up from 474,345), driven by post-merger stability after FATA's 2018 integration into Khyber Pakhtunkhwa, repatriation of displaced families, and economic boosts from marble mining. Tehsil-level variations highlight uneven trends: Ambar Utman Khel (3.75% to 4.25%) and Pindiali (2.98% to 3.82%) saw accelerating growth, likely from improved infrastructure and agriculture; Safi (1.7% to 1.80%) remained stable amid its mining focus; while Halim Zai (2.59% to 2.10%) and Yake Ghund (2.87% to 1.67%) decelerated, possibly due to out-migration for education or jobs. Prang Ghar's sharp shift from 3.61% to -0.24% indicates net population loss, potentially from climate-induced water scarcity and droughts displacing rural communities; Upper Mohmand rebounded dramatically from -2.33% (early conflict outflows) to 3.72%, signaling recovery through security gains and return migration. These changes underscore Mohmand's transition from conflict-affected tribal area to a more stable, resource-driven region, though environmental challenges persist in some tehsils.

Table 5: Growth Rate Comparison of 2017 and 2023- District Mohmand

Area	Growth Rate 2017	Growth Rate 2023
Mohmand District	1.85	2.63
Ambar Utman Khel Tehsil	3.75	4.25
Halim Zai Tehsil	2.59	2.10
Pindiali Tehsil	2.98	3.82
Prang Ghar Tehsil	3.61	-0.24
Safi Tehsil	1.7	1.80
Upper Mohmand Tehsil	-2.33	3.72
Yake Ghund Tehsil	2.87	1.67

Source: Pakistan Bureau of Statistics (PBS) Census 2027 and 2023

2.5 Population Projection

Population projections are a big deal for city planning because they give a heads-up on how many people will be living in a place, how fast it's growing, and what kind of folks are moving in. Knowing this helps make sure there's enough housing, roads, buses, schools, and hospitals to keep everyone happy and comfortable. Taking places like Mohmand District, seeing how its population is shifting, helps figure out where to put resources so the area can grow without falling apart. Accurate projections also inform policy decisions, ensuring cities remain resilient, equitable, and capable of supporting residents' quality of life over time.

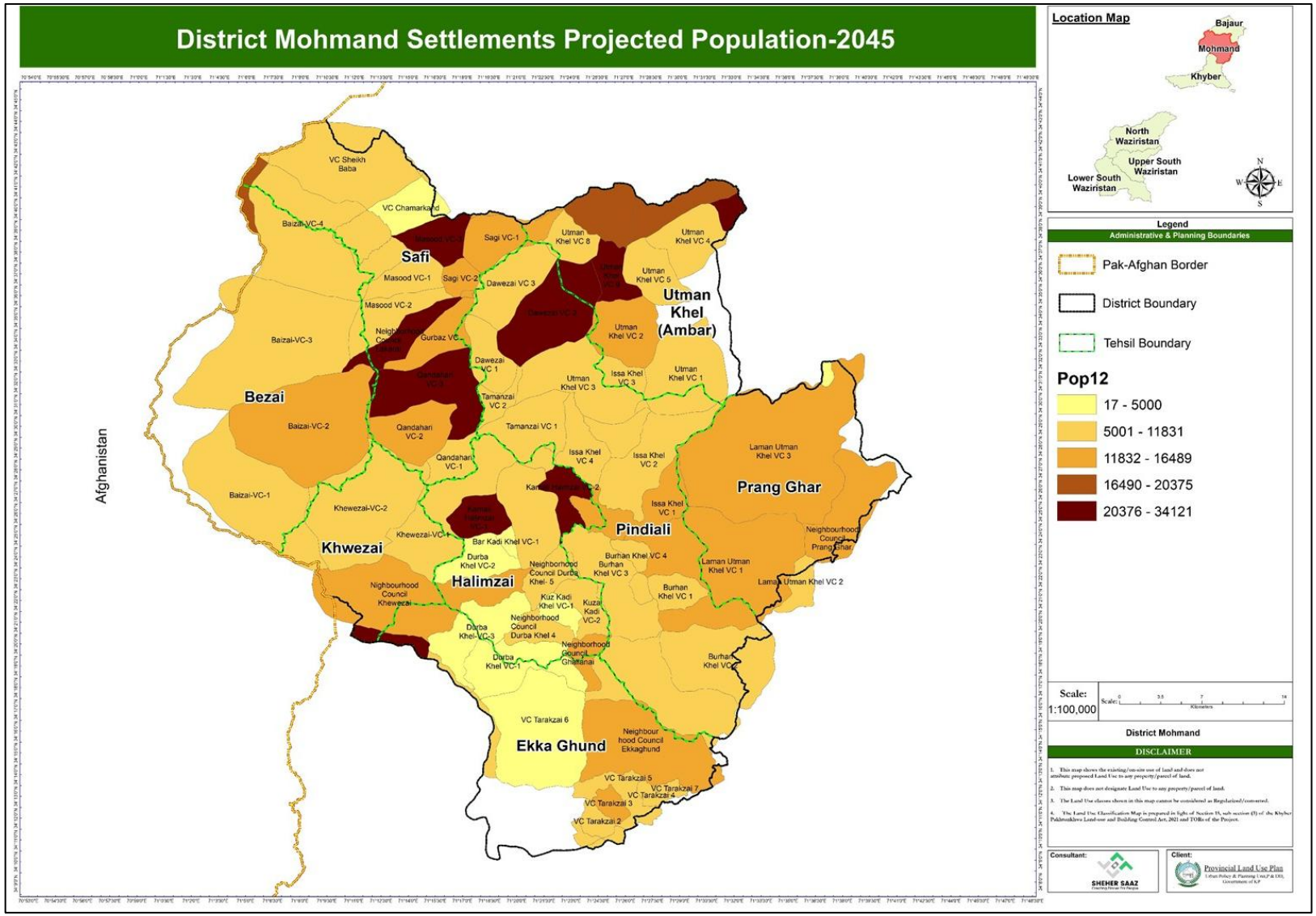
Table 6: Population Projection of Mohmand

Area	Method	2025	2030	2035	2040	2045
District Mohmand						
Mohmand District	Arithmetic	580462	646786	713109	779432	845756
	Geometric	583326	663815	755411	859644	978261
	Average	581894	655301	734260	819538	912008
District Mohmand (Tehsils)						
AMBAR UTMAN KHEL TEHSIL	Arithmetic	85290	99876	114463	129050	143636
	Geometric	86220	105483	128576	156171	189042
	Average	85755	102679	121519	142610	166339
HALIM ZAI TEHSIL	Arithmetic	92630	101334	110037	118740	127444
	Geometric	92815	102382	112522	123229	134494
	Average	92723	101858	111279	120984	130969
PINDIALI TEHSIL	Arithmetic	119759	138539	157319	176099	194879
	Geometric	120804	144777	172872	205689	243903
	Average	120281	141658	165096	190894	219391
PRANG GHAR TEHSIL	Arithmetic	35872	35436	35000	34564	34128
	Geometric	35829	35199	34454	33605	32665
	Average	35850	35318	34727	34085	33397

SAFI TEHSIL	Arithmetic	113326	122592	131858	141124	150390
	Geometric	113458	123326	133561	144134	155015
	Average	113392	122959	132710	142629	152702
UPPER MOHMAND TEHSIL	Arithmetic	67827	78248	88669	99090	109511
	Geometric	68388	81591	96987	114879	135609
	Average	68108	79920	92828	106985	122560
YAKE GHUND TEHSIL	Arithmetic	65758	70761	75763	80766	85768
	Geometric	65812	71057	76438	81937	87532
	Average	65785	70909	76101	81351	86650

Source: Derived by the Consultant 2025

Map 8: Population Projection 2045



3 CHAPTER III: ANALYSIS OF EXISITING LAND USE DISTRIBUTION

3.1 District Mohmand Land Use Classification

District Mohmand spans a total area of 554,628.25 acres, characterized predominantly by its rural and resource-based landscape. The district's land use pattern underscores its dependence on natural resources, with rangelands covering the majority, approximately 409,654.86 acres serving as crucial grazing grounds that support the livelihood of the local population engaged in livestock farming.

Agricultural land occupies around 121,385.96 acres, forming the backbone of the district's subsistence economy. Despite the arid climate and limited irrigation sources, farming remains a key livelihood activity, largely dependent on traditional practices and seasonal water availability.

The urban footprint of District Mohmand remains compact, with 8,935.26 acres under residential use. Commercial and industrial areas together occupy a relatively small portion, totaling about 587.95 acres (commercial: 282.96 acres, scattered industry: 304.99 acres), reflecting the district's early stage of urbanization and industrial development.

Public infrastructure, while modest in scale, plays a pivotal role in shaping socio-economic progress. Land allocated for education facilities covers 234.43 acres, whereas health facilities account for only 15.30 acres, signaling a need for greater investment in public welfare infrastructure. Transportation networks extend over 4,285.69 acres, facilitating regional connectivity and trade movement within and beyond the district.

Additional land uses include public buildings and civic amenities (104.78 acres) and religious sites (26.54 acres), which contribute to the administrative and cultural fabric of the community. The district also includes parks and playgrounds (44.34 acres) and orchards (390.01 acres), though their share remains limited and underscores potential for enhancing recreational and green spaces.

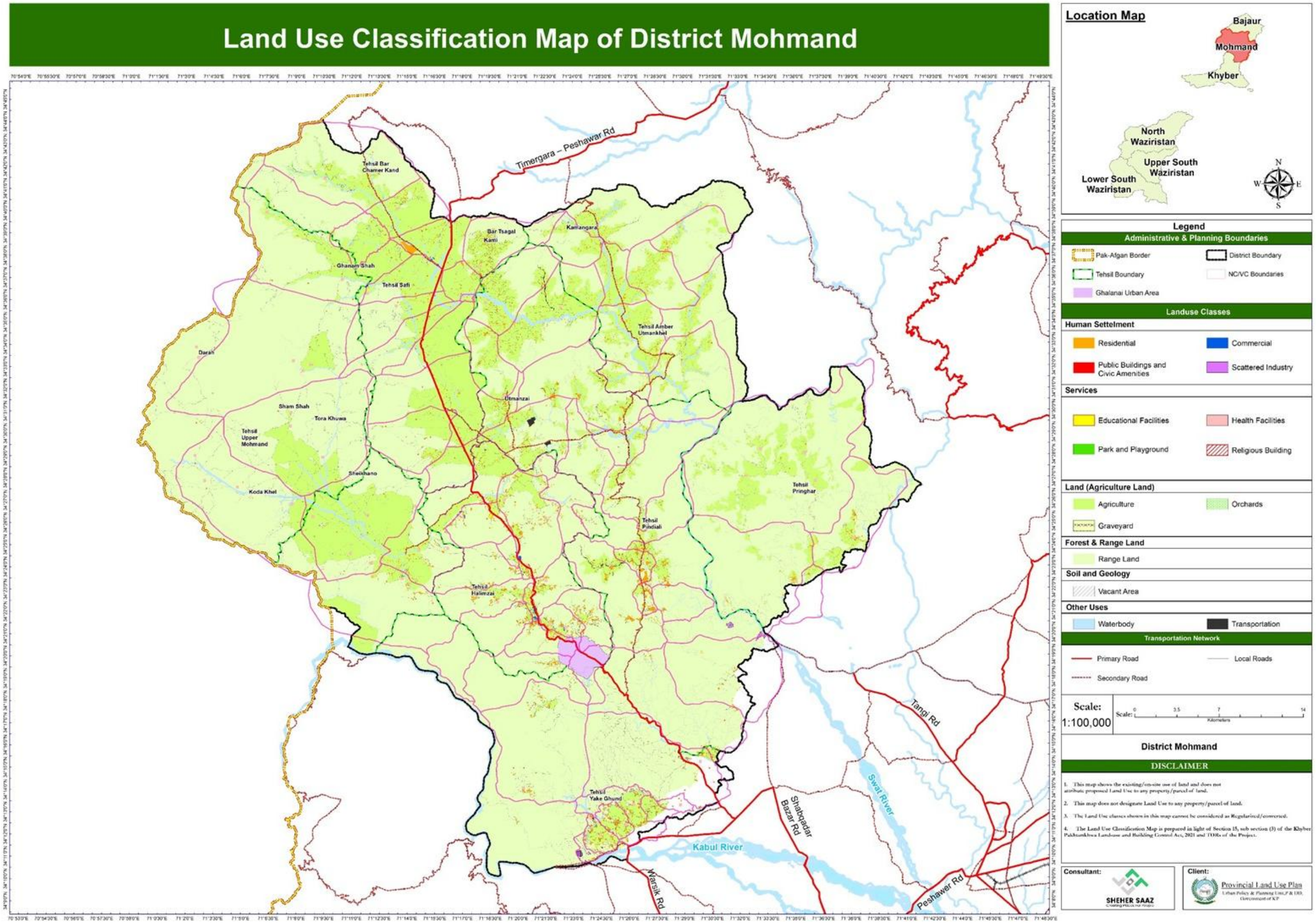
A significant portion of vacant land (1,765.68 acres) and waterbodies (6,821.81 acres) presents opportunities for sustainable development initiatives, particularly in water management, reforestation, and eco-agriculture. The presence of army and military lands (273.69 acres) also influences spatial development patterns and access to certain areas.

Overall, District Mohmand's land use pattern reflects a predominantly rural character, where rangelands and agriculture dominate the terrain, while urban and infrastructural development continues to evolve gradually. Strengthening public services, expanding irrigation networks, and promoting balanced land utilization will be essential for achieving long-term socio-economic sustainability in the district.

Table 7: Existing Land use Division of Mohmand District

Existing Land use	Area (Acres)	Percentage %
Residential	8935.26	1.61%
Commercial	282.96	0.05%
Scattered Industry	304.99	0.05%
Public Buildings and Civic Amenities	104.78	0.02%
Religious Building	26.54	0.00%
Education Facilities	234.43	0.04%
Health Facilities	15.30	0.00%
Park and Playground	44.34	0.01%
Graveyard	101.97	0.02%
Range Land	409654.86	73.86%
Agriculture	121385.96	21.89%
Orchards	390.01	0.07%
Transportation	4285.69	0.77%
Army land	51.42	0.01%
Military Land	222.27	0.04%
Vacant Area	1765.68	0.32%
Waterbody	6821.81	1.23%
Total	554628.27	100.00%

Map 9: Existing Land use Map - District Mohmand



3.2 Tehsil-wise Land Use Classification

3.2.1 Tehsil Upper Mohmand

The tehsil upper mohmand under assessment covers a total of 116,636.14 acres and is predominantly characterized by rural and natural land uses. Rangeland forms the largest share, extending over 79,545.72 acres (68.20%), indicating a strong dependence on grazing and livestock-based livelihoods. This is followed by agricultural land, which occupies 32,598.67 acres (27.95%), highlighting the importance of farming as a major economic activity alongside pastoral practices.

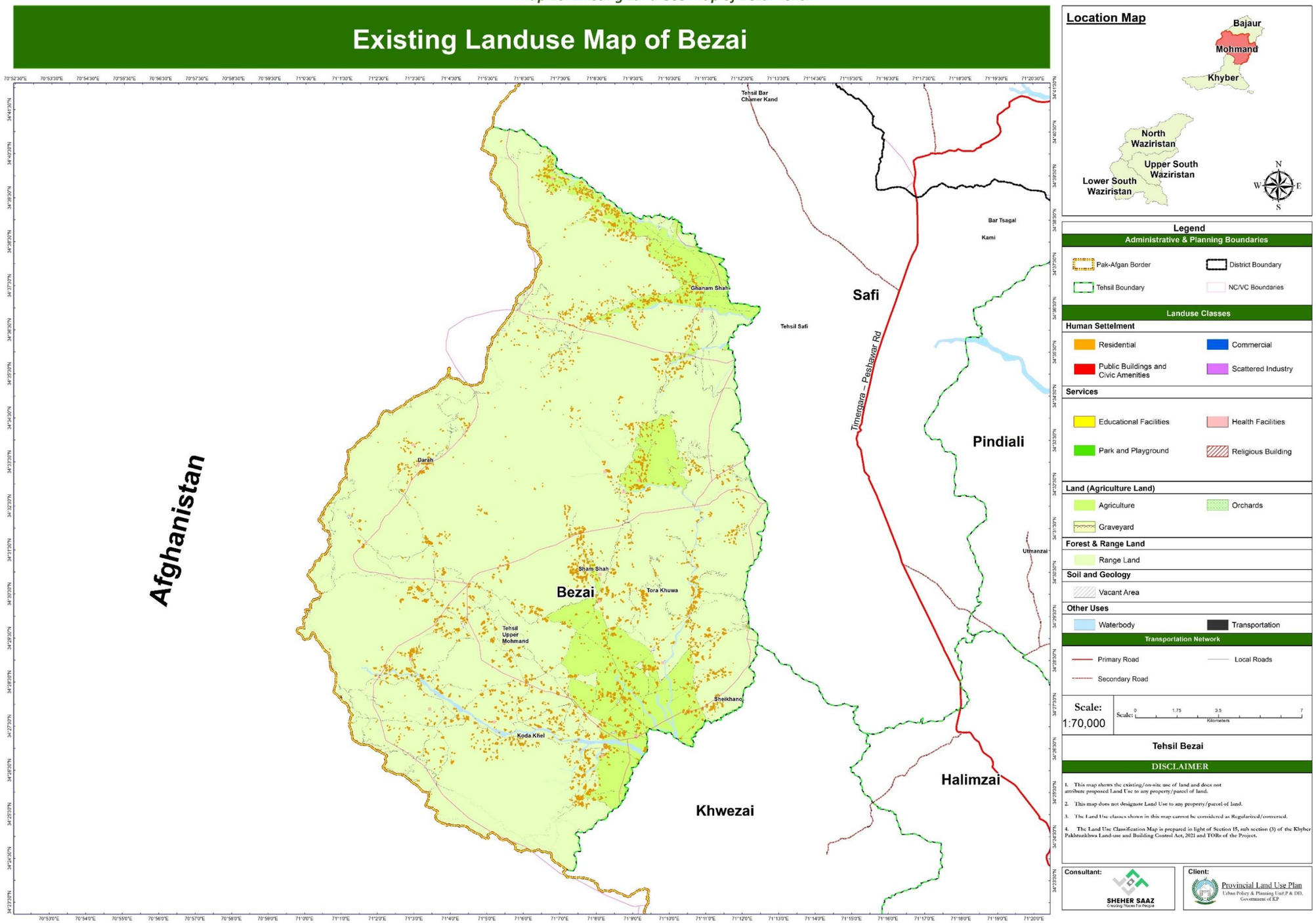
Built-up and urban land uses constitute a very small proportion of the total area. Residential land accounts for 1,716.82 acres (1.47%), reflecting a dispersed and low-density rural settlement pattern. Transportation infrastructure covers 841.80 acres (0.72%), providing basic connectivity across agricultural fields, rangelands, and settlements. Water bodies, occupying 1,481.36 acres (1.27%), play a vital role in supporting agriculture, livestock, and domestic water needs.

Social, institutional, and economic land uses are limited in extent. Education facilities (0.01%), health facilities (0.01%), public buildings and civic amenities (0.02%), and religious buildings (0.00%) together occupy a negligible share, indicating limited access to social services. Economic activities such as commercial areas (0.02%), scattered industry (0.02%), and orchards (0.05%) remain minimal, while military lands/cantonment (0.05%) and graveyards (0.08%) serve specific functional needs. Vacant land (0.13%) represents limited but potential space for future development.

Table 8: Upper Mohmand Existing Land Use

Existing Land uses	Area (acres)	Percentages %
Residential	1716.816	1.47%
Commercial	27.114	0.02%
Scattered Industry	18.634	0.02%
Public Buildings and Civic Amenities	24.794	0.02%
Religious Building	5.631	0.00%
Education Facilities	8.783	0.01%
Health Facilities	6.740	0.01%
Park and Playground	9.756	0.01%
Graveyard	88.536	0.08%
Range Land	79545.722	68.20%
Agriculture	32598.671	27.95%
Orchards	52.915	0.05%
Military Lands/Cantonment	57.071	0.05%
Transportation	841.800	0.72%
Vacant Area	151.802	0.13%
Waterbody	1481.359	1.27%
Total	116636.143	100.00%

Map 10: Existing Land Use Map of Bezai Tehsil



3.2.2 Tehsil Yake Ghund

Yake Ghund covers a total area of 70,724.49 acres, with land use overwhelmingly dominated by natural and rural activities. Rangeland is the most prominent category, occupying 59,593.80 acres (84.26%), clearly indicating that livestock rearing and grazing form the backbone of local livelihoods. Agriculture covers 5,599.25 acres (7.92%), supplemented by orchards on 497.82 acres (0.70%), reflecting a primarily subsistence-based agrarian economy with limited commercial farming.

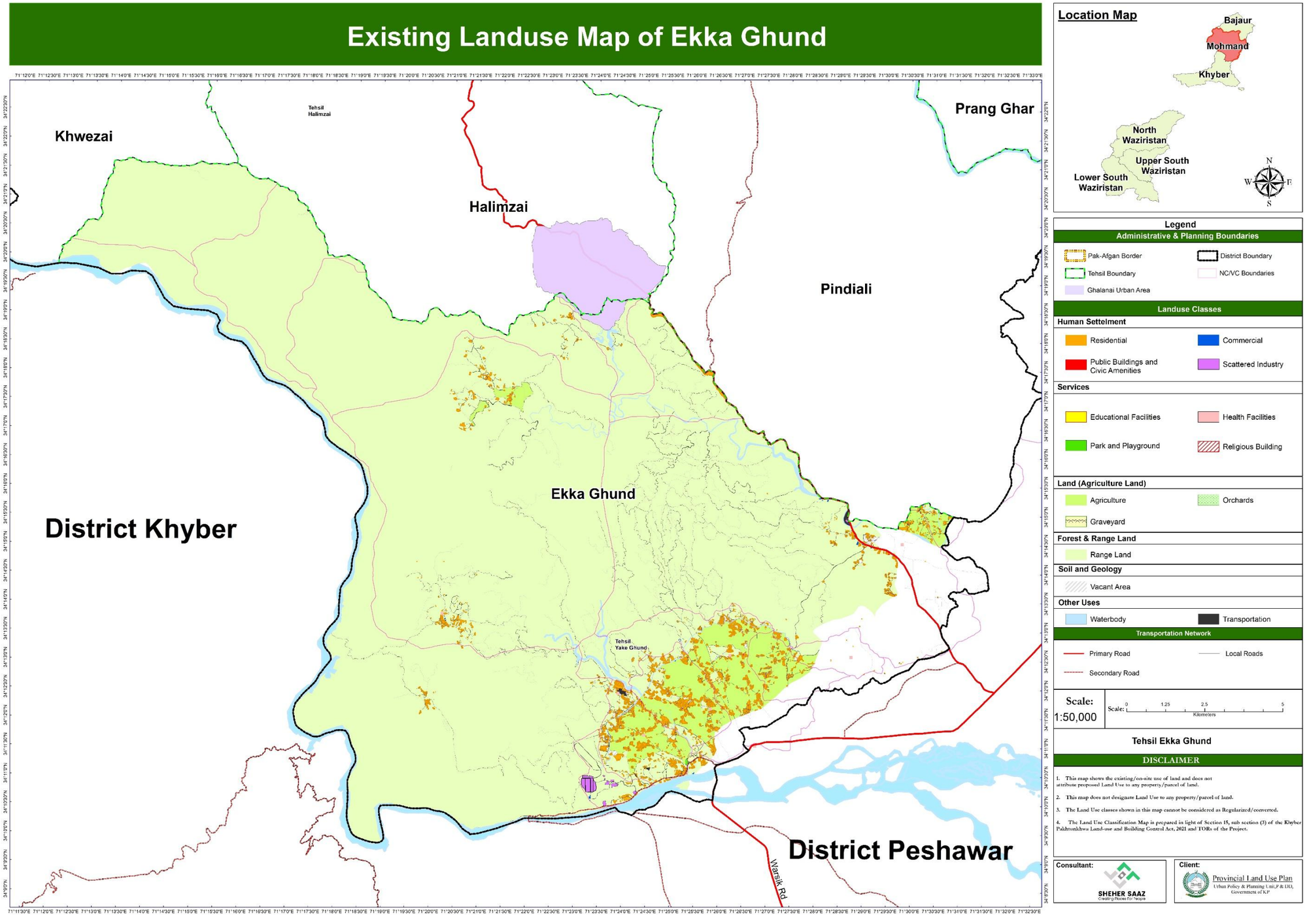
Built-up and urban land uses constitute a very small share of the total area. Residential land extends over 1,784.81 acres (2.52%), exhibiting a dispersed, rural settlement pattern. Transportation infrastructure occupies 799.99 acres (1.13%), providing essential connectivity between settlements, grazing lands, and agricultural fields. Water bodies, covering 1,485.36 acres (2.10%), play a critical role in supporting farming, livestock, and domestic needs.

Institutional and social infrastructure remains limited, with education facilities (67.20 acres; 0.10%), health facilities (7.56 acres; 0.01%), and public buildings and civic amenities (19.73 acres; 0.03%), indicating basic but insufficient service provision. Economic land uses such as commercial areas (0.13%), scattered industry (0.55%), and mining areas (0.13%) are present but minor in scale. Community-supporting uses including graveyards (0.07%) and parks/playgrounds (0.04%) occupy negligible areas, while vacant land (0.30%) offers limited scope for future development or conservation.

Table 9: Yake Ghund Existing Land Use

Existing Land uses	Area (acres)	Percentages %
Residential	1784.810	2.52%
Commercial	92.712	0.13%
Scattered Industry	392.064	0.55%
Public Buildings and Civic Amenities	19.726	0.03%
Religious Building	10.863	0.02%
Education Facilities	67.204	0.10%
Health Facilities	7.562	0.01%
Park and Playground	24.780	0.04%
Graveyard	48.593	0.07%
Range Land	59593.798	84.26%
Agriculture	5599.245	7.92%
Orchards	497.818	0.70%
Minning Area	90.413	0.13%
Transportation	799.998	1.13%
Vacant Area	209.548	0.30%
Waterbody	1485.356	2.10%
Total	70724.491	100.00%

Map 11: Existing Map of Yake Ghund Tehsil



3.2.3 Tehsil Halimzai

The tehsil Halimzai covers 52,233.87 acres and is largely defined by rural and natural land uses. Rangeland is the dominant category, occupying 30,569.66 acres (58.52%), indicating a strong reliance on grazing and livestock-related activities. This is followed by agriculture, which covers 17,200.19 acres (32.93%), underscoring farming as a major component of the local economy. Together, these two uses account for over 91% of the total area.

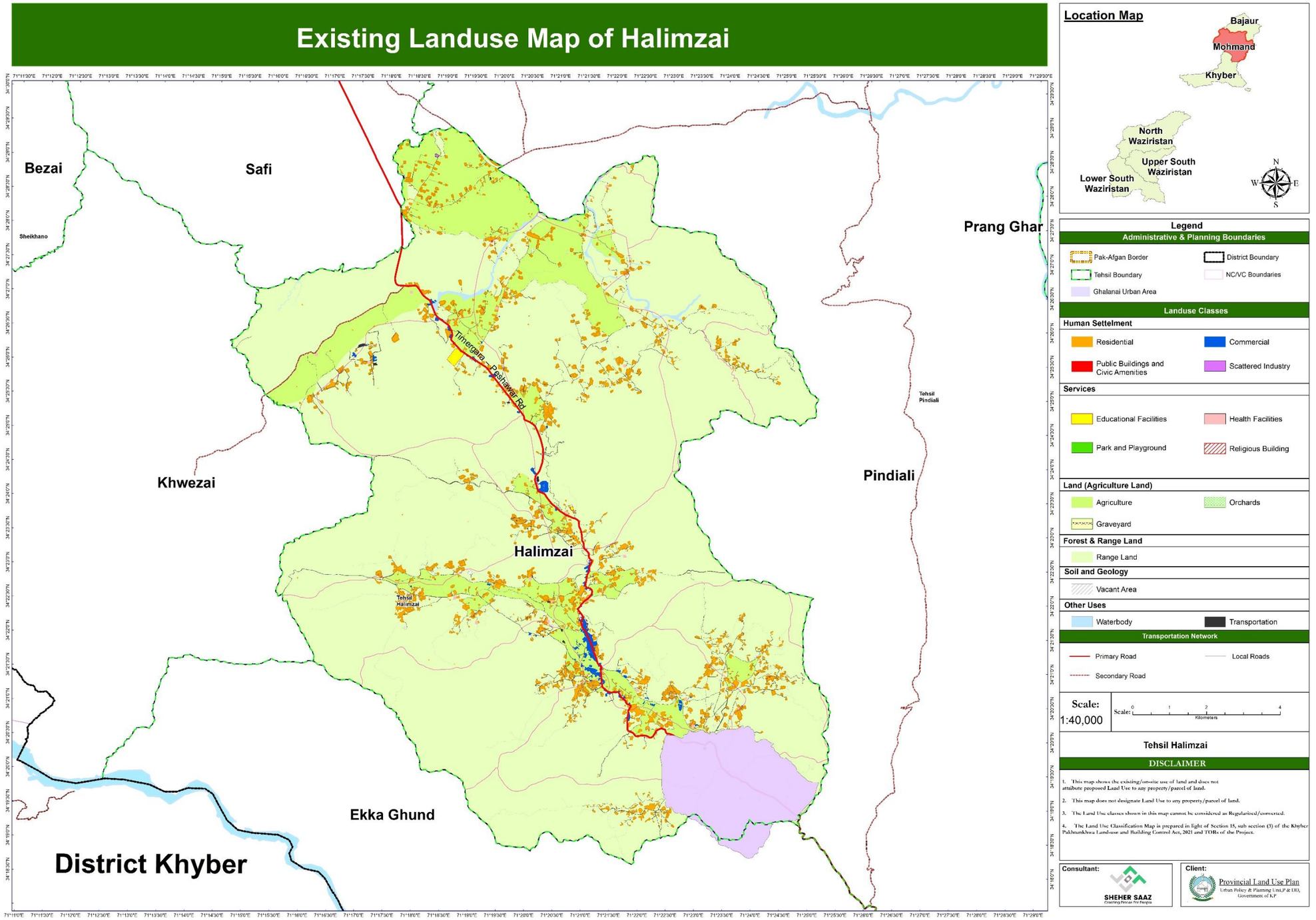
Built-up land uses form a relatively small share. Residential areas extend over 2,095.17 acres (4.01%), reflecting low-density and dispersed settlements. Transportation infrastructure occupies 728.50 acres (1.39%), facilitating connectivity between settlements, agricultural lands, and rangelands. Water bodies cover 568.43 acres (1.09%), supporting irrigation, livestock, and domestic water needs.

Institutional, social, and economic land uses remain limited in extent. Commercial areas (0.25%), scattered industry (0.18%), and orchards (0.12%) indicate modest economic activity. Social infrastructure including education facilities (0.11%), health facilities (0.03%), public buildings and civic amenities (0.12%), religious buildings (0.03%), and parks/playgrounds (0.05%) occupies a very small proportion of land, suggesting limited-service provision. Graveyards (0.25%), military lands/cantonment (0.46%), and vacant land (0.45%) serve specific functional needs, while water tanks (0.00%) occupy a negligible area.

Table 10: Halimzai Existing Land Use

Existing Land uses	Area (acres)	Percentages %
Residential	2095.174	4.01%
Commercial	131.062	0.25%
Scattered Industry	92.622	0.18%
Public Buildings and Civic Amenities	63.428	0.12%
Religious Building	16.243	0.03%
Education Facilities	58.870	0.11%
Health Facilities	16.453	0.03%
Park and Playground	25.353	0.05%
Graveyard	132.697	0.25%
Orchards	60.788	0.12%
Range Land	30569.656	58.52%
Agriculture	17200.188	32.93%
Transportation	728.497	1.39%
Military Lands/Cantonment	238.830	0.46%
Vacant Area	235.502	0.45%
Water Tank	0.075	0.00%
Waterbody	568.432	1.09%
Total	52233.870	100.00%

Map 12: Existing Map of Halimzai Tehsil



3.2.4 Tehsil Pindiali

Pindiali covers a total area of 113,200.04 acres and is predominantly characterized by natural and rural land uses. Rangeland forms the largest share, occupying 86,195.48 acres (76.14%), indicating a strong reliance on grazing and livestock-based activities. Agricultural land accounts for 21,646.44 acres (19.12%), highlighting farming as the second major land use and an important contributor to the local economy.

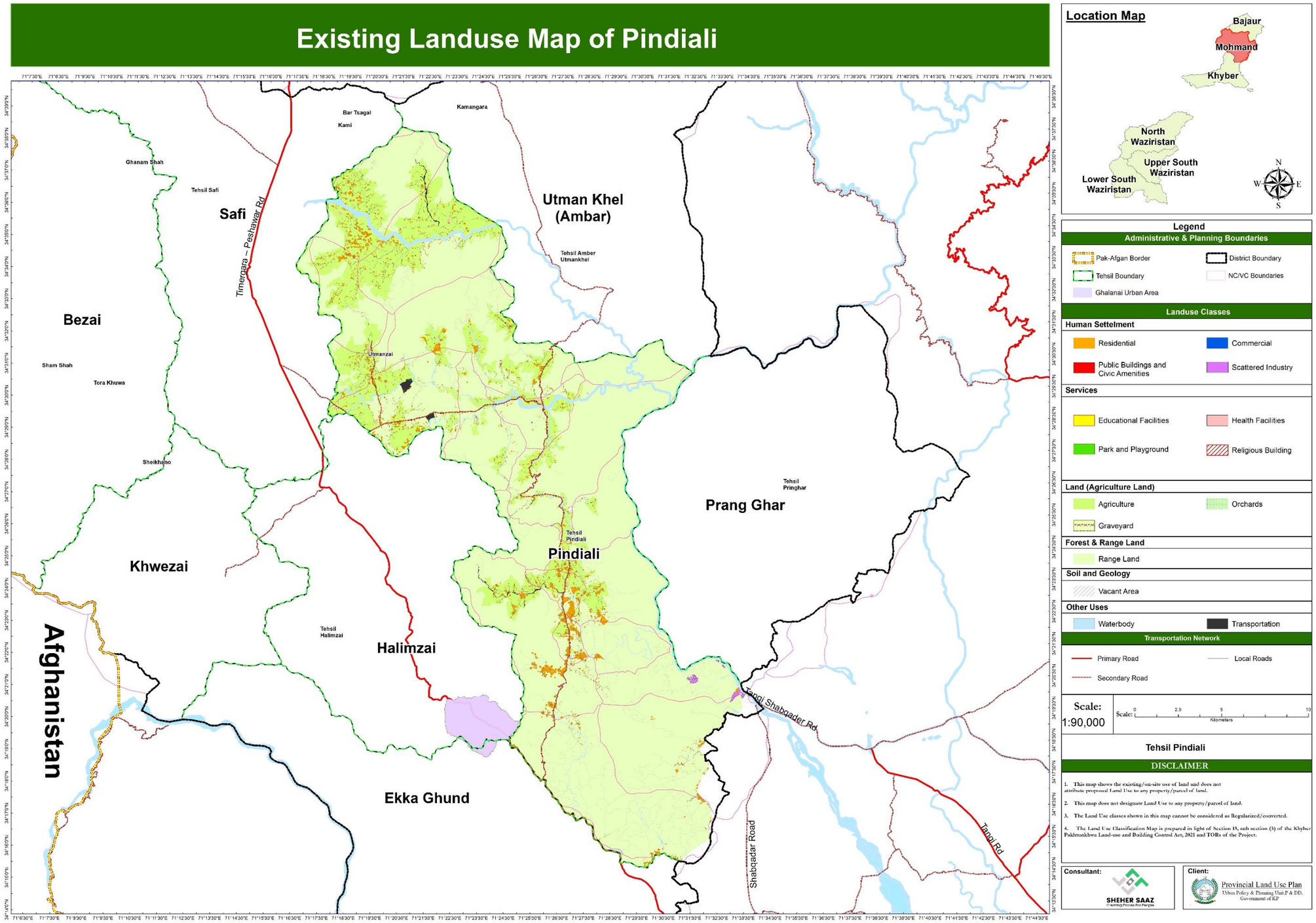
Built-up land uses occupy a very small proportion of the total area. Residential areas extend over 2,317.37 acres (2.05%), reflecting a dispersed and low-density settlement pattern. Transportation infrastructure covers 929.74 acres (0.82%), providing essential connectivity across rangelands and agricultural areas. Water bodies, occupying 1,714.38 acres (1.51%), play a vital role in supporting agriculture, livestock, and domestic water needs.

Institutional, social, and economic land uses are extremely limited. Public buildings and civic amenities account for 208.41 acres (0.18%), while education facilities (0.01%), health facilities (0.00%), religious buildings (0.00%), and parks/playgrounds (0.01%) occupy negligible areas, indicating limited access to social infrastructure. Economic uses such as commercial areas (0.01%) and scattered industry (0.00%) are minimal. Graveyards (0.03%), vacant land (0.11%), and military lands/cantonment (0.00%) serve specific functional needs.

Table 11: Pindiali Existing Land Use

Existing Land uses	Area (acres)	Percentages %
Residential	2317.370	2.05%
Commercial	11.826	0.01%
Scattered Industry	0.356	0.00%
Public Buildings and Civic Amenities	208.409	0.18%
Religious Building	3.541	0.00%
Education Facilities	7.626	0.01%
Health Facilities	0.418	0.00%
Park and Playground	8.965	0.01%
Graveyard	30.255	0.03%
Range Land	86195.479	76.14%
Agriculture	21646.439	19.12%
Orchards	1.820	0.00%
Transportation	929.737	0.82%
Military Lands/Cantonment	2.961	0.00%
Vacant Area	120.454	0.11%
Waterbody	1714.384	1.51%
Total	113200.039	100.00%

Map 13: Existing Land Use Map of Pindiali Tehsil



3.2.5 Tehsil Prang Ghar

Prang Ghar covers a total area of 60,308.47 acres and is predominantly characterized by natural and rural land uses. Rangeland is the dominant category, occupying 50,011.12 acres (82.93%), which indicates a strong reliance on grazing and livestock-based activities. Agricultural land accounts for 9,100.89 acres (15.09%), highlighting farming as the secondary land use and an important component of the local rural economy.

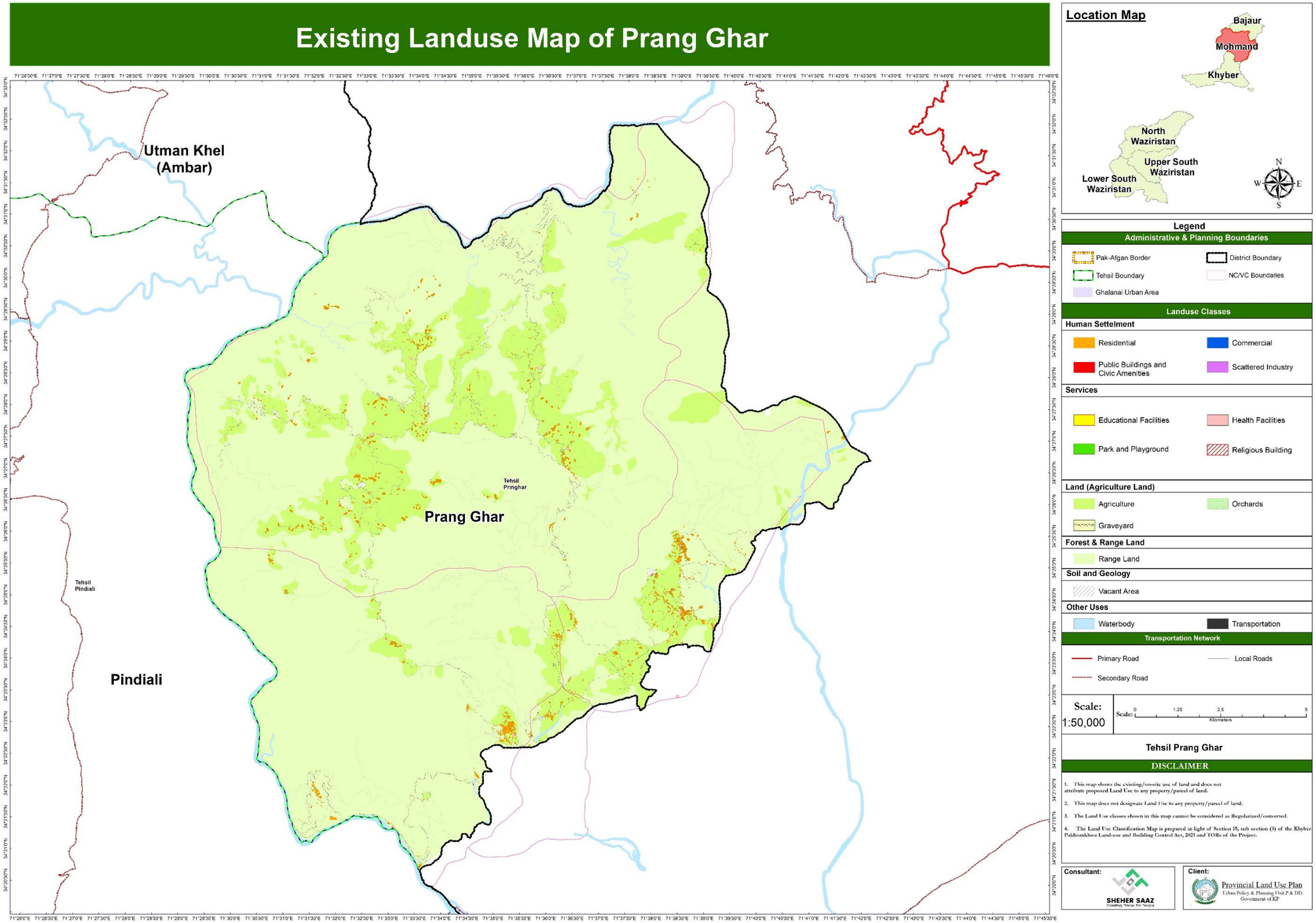
Built-up and urban land uses occupy a very small proportion of the total area. Residential areas extend over 293.66 acres (0.49%), reflecting a highly dispersed and low-density settlement pattern. Transportation infrastructure covers 182.83 acres (0.30%), providing basic connectivity across rangeland and agricultural areas. Water bodies, occupying 561.84 acres (0.93%), support irrigation, livestock, and domestic water requirements.

Social, institutional, and economic land uses are extremely limited. Public buildings and civic amenities account for 73.48 acres (0.12%), while education facilities (0.01%), health facilities (0.00%), religious buildings (0.00%), and commercial areas (0.06%) occupy negligible shares, indicating limited access to services. Graveyards (0.01%) and vacant land (0.06%) serve specific functional needs but remain minimal in extent.

Table 12: Prang Ghar Existing Land Use

Existing Land uses	Area (acres)	Percentages %
Residential	293.662	0.49%
Commercial	36.705	0.06%
Public Buildings and Civic Amenities	73.479	0.12%
Religious Building	0.352	0.00%
Education Facilities	4.735	0.01%
Health Facilities	0.810	0.00%
Graveyard	8.471	0.01%
Range Land	50011.118	82.93%
Agriculture	9100.894	15.09%
Transportation	182.834	0.30%
Vacant Area	33.572	0.06%
Waterbody	561.842	0.93%
Total	60308.474	100.00%

Map 14: Existing Land Uses Map of Prang Ghar



3.2.6 Tehsil Safi

Safi covers a total area of 78,749.12 acres, with land use dominated by rangeland and agriculture, which together account for over 93% of the total area. Rangeland occupies 36,971.23 acres (46.95%), indicating a significant reliance on livestock grazing, while agricultural land spans 36,510.11 acres (46.36%), highlighting the importance of farming as a key livelihood activity. Orchards are minimal, covering just 8.67 acres (0.01%).

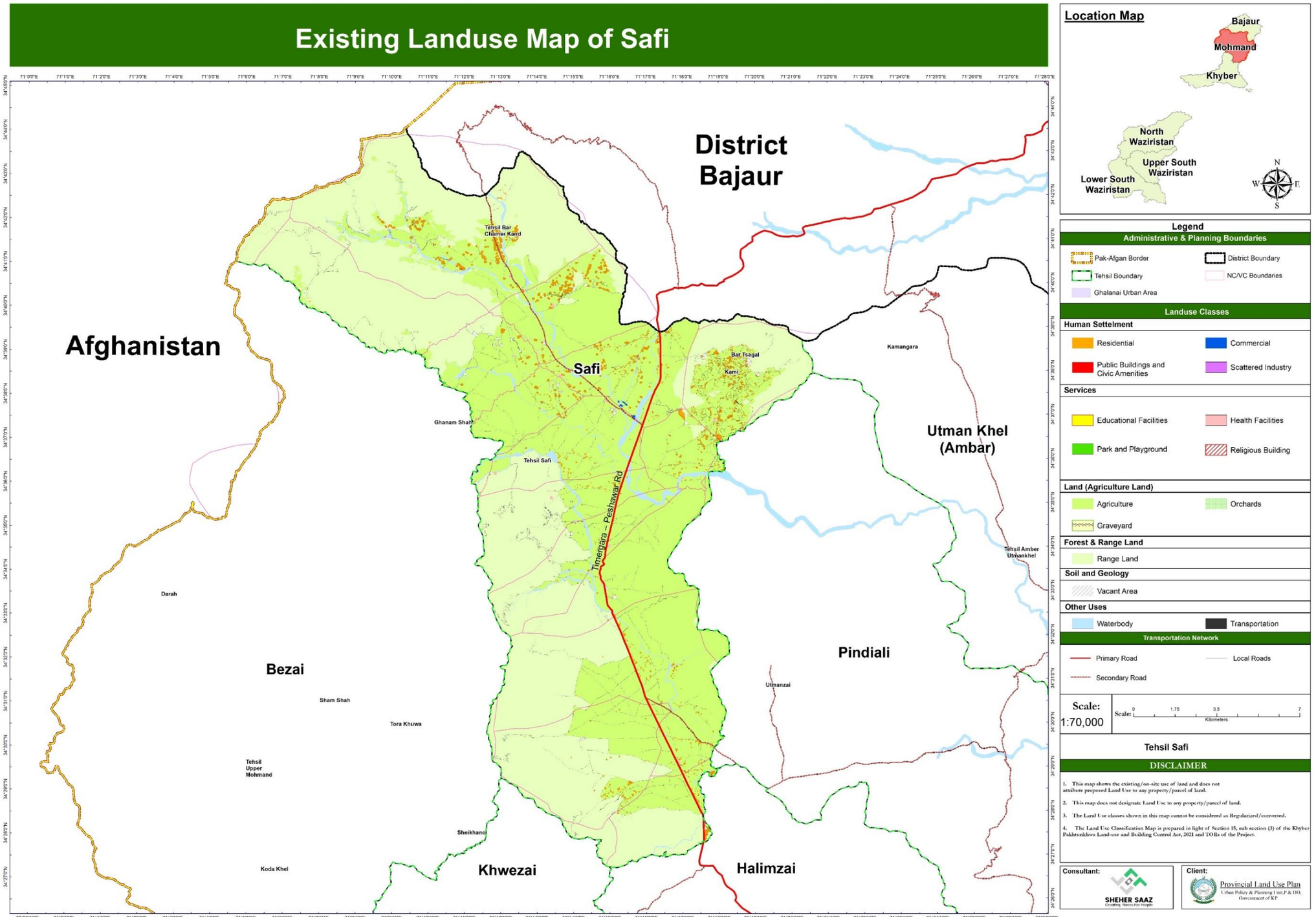
Residential areas cover 2,553.93 acres (3.24%), reflecting dispersed, low-density settlements. Transportation infrastructure accounts for 714.27 acres (0.91%), providing connectivity between communities, agricultural lands, and rangelands. Water bodies occupy 1,268.59 acres (1.61%), supporting irrigation, livestock, and domestic needs.

Social, institutional, and economic land uses remain limited. Education facilities (0.17%), health facilities (0.01%), public buildings and civic amenities (0.11%), religious buildings (0.01%), parks/playgrounds (0.01%), commercial areas (0.06%), and scattered industry (0.08%) together occupy a small fraction of land, indicating minimal urban and social infrastructure. Graveyards (0.16%), military lands (0.02%), vacant land (0.28%), and water tanks (0.00%) serve specific functional needs.

Table 13: Safi Existing Land Use

Existing Land uses	Area (acres)	Percentages %
Residential	2553.931	3.24%
Commercial	47.926	0.06%
Scattered Industry	63.450	0.08%
Public Buildings and Civic Amenities	85.372	0.11%
Religious Building	8.376	0.01%
Education Facilities	133.789	0.17%
Health Facilities	8.673	0.01%
Park and Playground	9.236	0.01%
Graveyard	125.269	0.16%
Range Land	36971.229	46.95%
Agriculture	36510.105	46.36%
Orchards	8.674	0.01%
Transportation	714.266	0.91%
Military Lands/Cantonment	19.245	0.02%
Vacant Area	220.487	0.28%
Water Tank	0.511	0.00%
Waterbody	1268.585	1.61%
Total	78749.122	100.00%

Map 15: Existing Land use Map of Safi Tehsil



3.2.7 Tehsil Utman Khel (Ambar)

Utman Khel (Ambar) spans a total area of 56,469.33 acres, with land use largely dominated by rangeland and agriculture. Rangeland covers 38,238.54 acres (67.72%), highlighting a strong reliance on livestock grazing and pastoral activities. Agricultural land occupies 16,107.04 acres (28.52%), reflecting the importance of farming as a primary livelihood. Orchards are minimal, covering just 0.70 acres (0.00%).

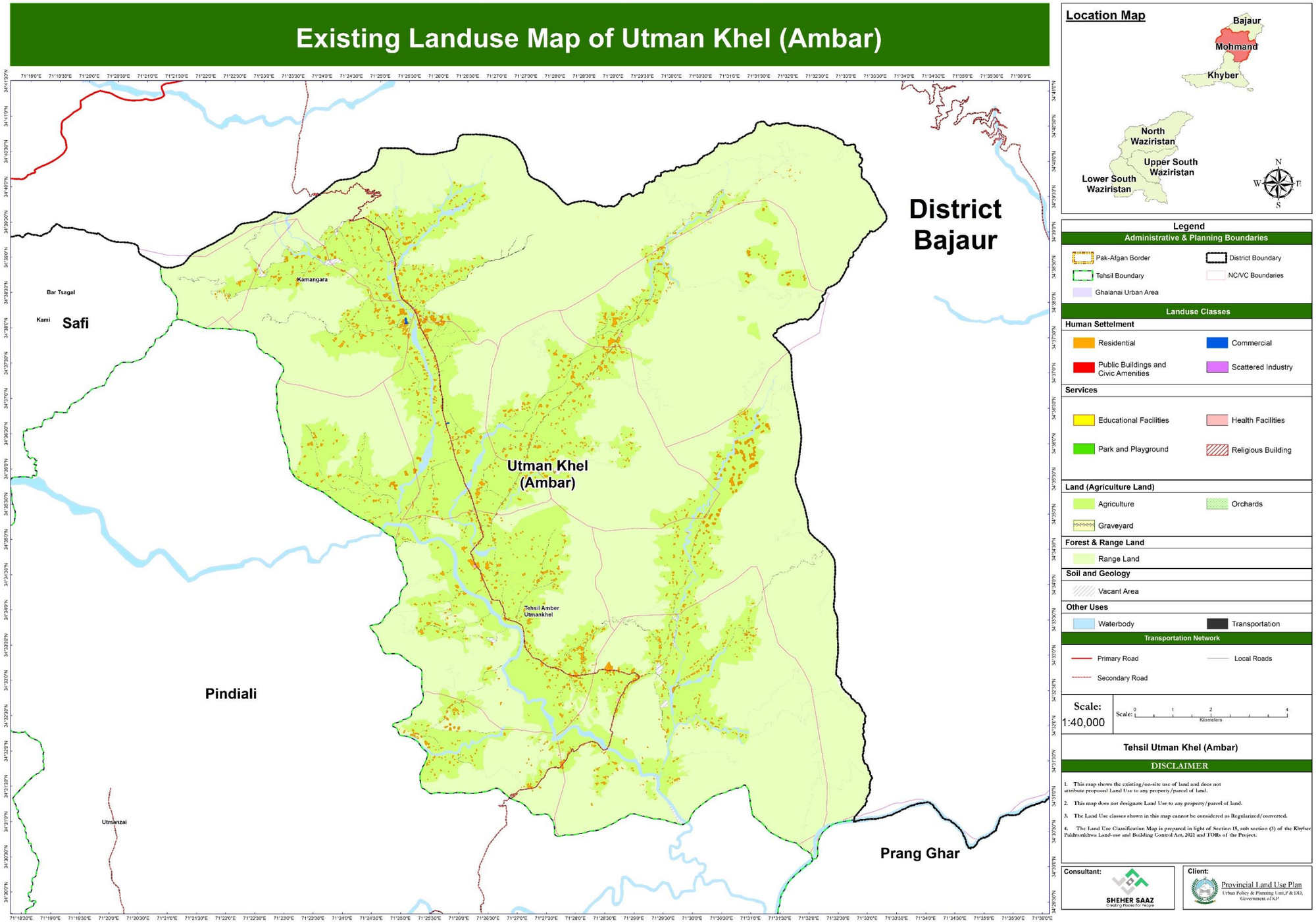
Residential areas account for 1,153.59 acres (2.04%), indicating low-density and dispersed settlements. Transportation infrastructure spans 179.93 acres (0.32%), supporting connectivity between communities and productive lands. Water bodies cover 625.04 acres (1.11%), essential for irrigation, livestock, and domestic use.

Urban, social, and institutional uses are limited. Education facilities (0.01%), health facilities (0.00%), public buildings and civic amenities (0.02%), religious buildings (0.00%), commercial areas (0.01%), and scattered industry (0.00%) occupy negligible portions of land. Graveyards (0.08%), military lands (0.01%), and vacant areas (0.16%) serve specific functional purposes.

Table 14: Utman Khel (Ambar) Existing Land Use

Existing Land uses	Area (acres)	Percentages %
Residential	1153.585	2.04%
Commercial	6.663	0.01%
Scattered Industry	0.423	0.00%
Public Buildings and Civic Amenities	9.162	0.02%
Religious Building	1.335	0.00%
Education Facilities	2.830	0.01%
Health Facilities	0.354	0.00%
Graveyard	45.362	0.08%
Military Lands/Cantonment	6.415	0.01%
Orchards	0.701	0.00%
Range Land	38238.542	67.72%
Agriculture	16107.044	28.52%
Transportation	179.929	0.32%
Vacant Area	91.942	0.16%
Waterbody	625.044	1.11%
Total	56469.333	100.00%

Map 16: Existing Land Use Map of Utman Khel (Ambar) Tehsil



3.3 Urban Center

3.3.1 Ghalanai

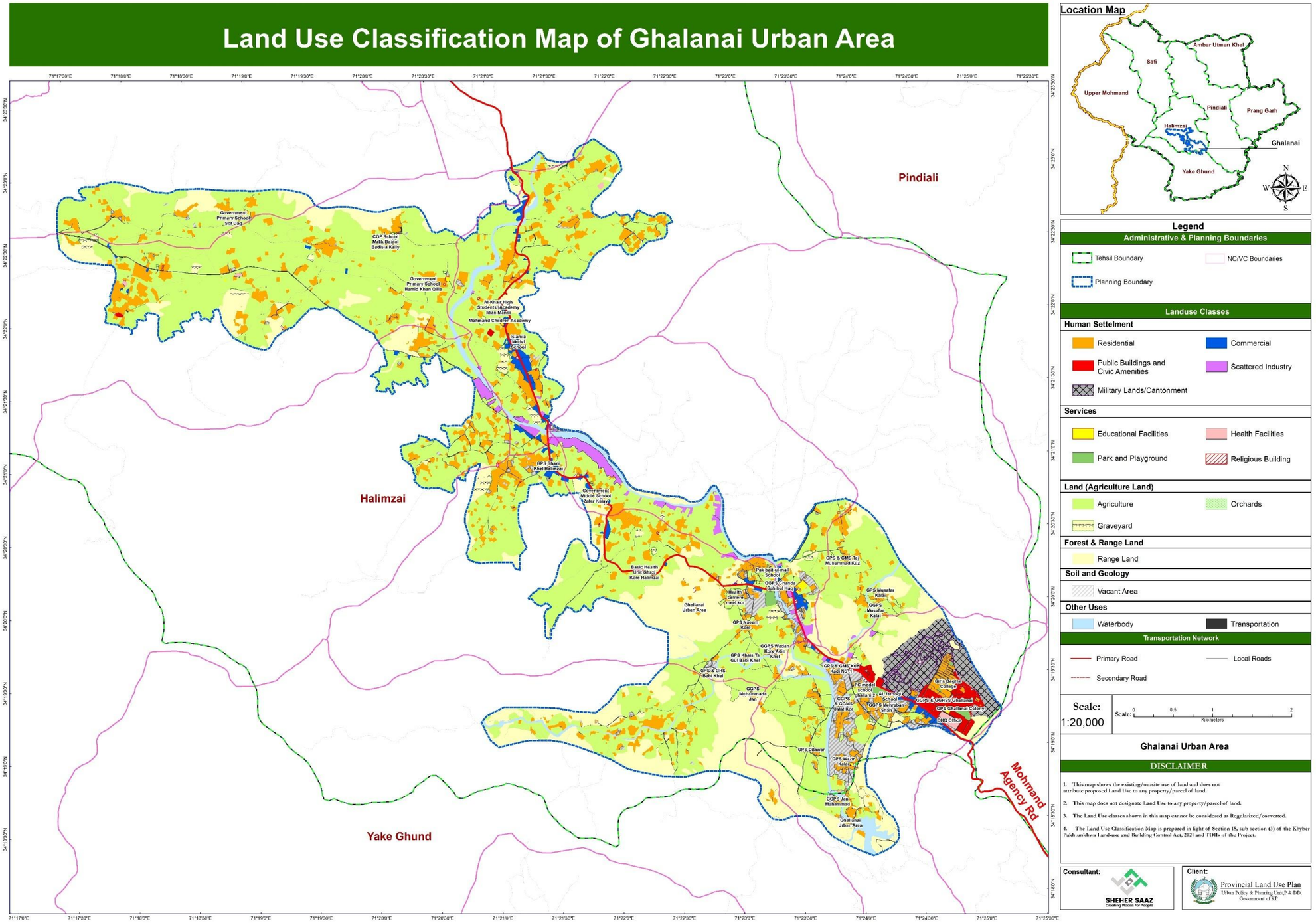
Urban Center Ghalanai covers a total area of 7,596.01 acres and is predominantly characterized by agricultural land use, which occupies 4,036.73 acres (53.14%), followed by rangeland at 1,437.36 acres (18.92%). The residential area extends over 932.21 acres (12.27%), indicating a relatively compact urban footprint within a largely rural setting.

Commercial (86.18 acres; 1.13%) and scattered industrial uses (72.50 acres; 0.95%) remain limited, reflecting modest economic activity. Social and institutional uses including public buildings (0.82%), education (0.31%), health (0.18%), and religious facilities (0.19%) occupy a small share of land. Transportation infrastructure accounts for 294.60 acres (3.88%), while vacant land (185.80 acres; 2.45%) provides potential for future development. Overall, the land use pattern reflects low-density urban development surrounded by extensive agricultural and open lands, highlighting opportunities for planned growth and improved service provision.

Table 15: Existing Land use distribution of Ghalanai

Existing Land use	Area (Acre)	Percentage %
Residential	968.86	12.75%
Commercial	87.80	1.16%
Scattered Industry	87.42	1.15%
Public Buildings and Civic Amenities	63.26	0.83%
Religious Building	15.11	0.20%
Education Facilities	23.89	0.31%
Health Facilities	13.46	0.18%
Park and Playground	19.62	0.26%
Graveyard	82.51	1.09%
Military Lands/Cantonment	178.36	2.35%
Range Land	1431.05	18.84%
Agriculture	3995.24	52.60%
Transportation	294.16	3.87%
Vacant Area	174.23	2.29%
Waterbody	160.96	2.12%
Total	7596.01	100.00%

Map 17: Existing Land use Classification of Ghalanai Urban Area



3.4 Potential Urban Center

3.4.1 Yake Ghund

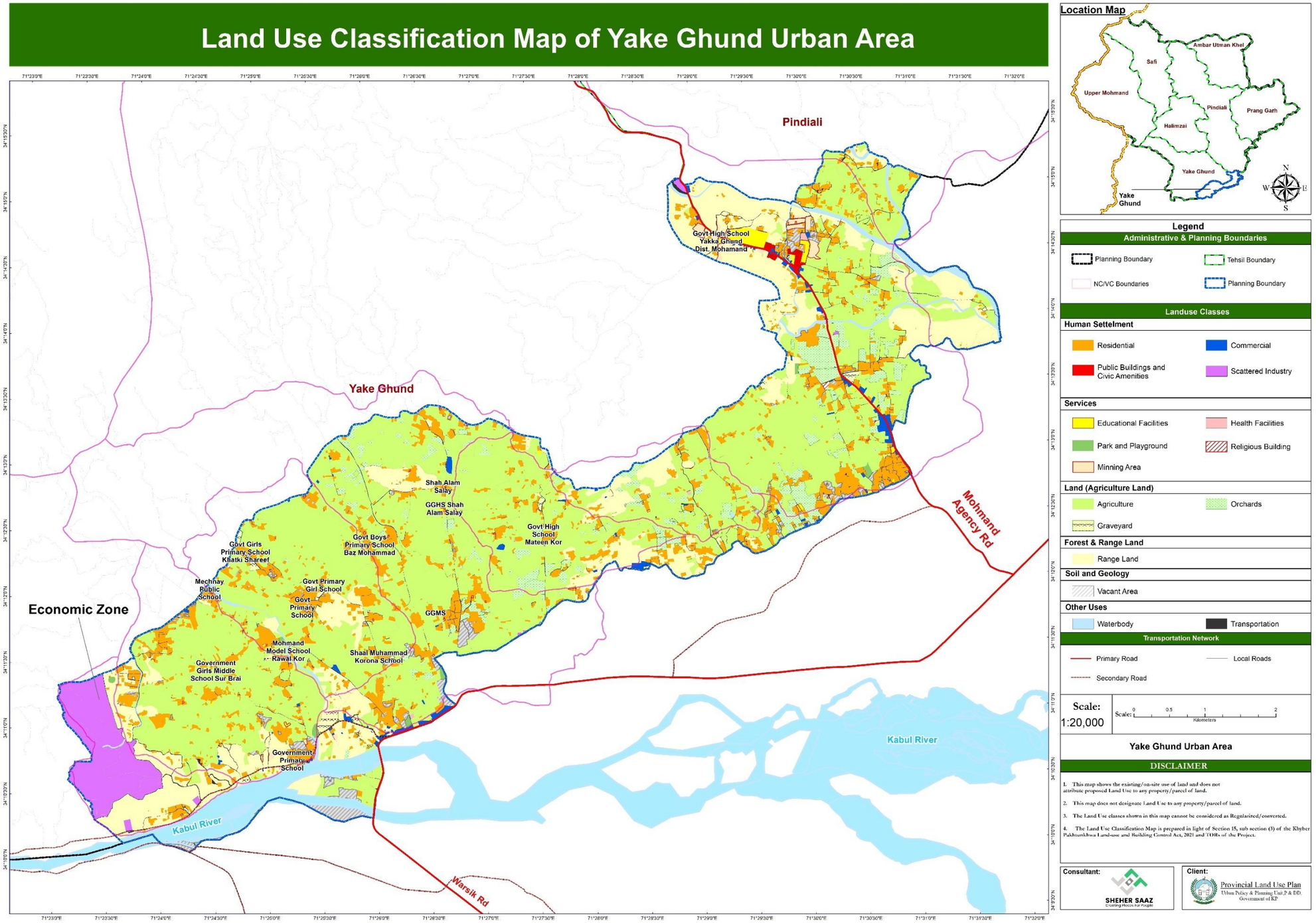
Yake Ghund covers 10,436.54 acres, with land use dominated by agriculture at 5,290.28 acres (50.69%), followed by rangeland (1,619.57 acres; 15.52%) and residential areas (1,407.68 acres; 13.49%), indicating a largely rural settlement pattern. Orchards and water bodies account for 4.70% and 4.15%, respectively, contributing to the local agrarian and environmental landscape.

Urban and economic uses remain limited, with scattered industry (3.53%), transportation (3.42%), and commercial areas (0.79%) occupying small shares. Social infrastructure including education (0.60%), health (0.07%), and public amenities (0.14%) is minimal. Overall, the land use pattern reflects a predominantly agricultural and low-density development character, with some vacant land (1.79%) offering scope for future planned growth.

Table 16: Existing Land use distribution of Yake Ghund

Existing Land use	Area (Acre)	Percentage %
Residential	1407.68	13.49%
Commercial	82.40	0.79%
Scattered Industry	368.61	3.53%
Public Buildings and Civic Amenities	14.31	0.14%
Religious Building	9.02	0.09%
Education Facilities	63.05	0.60%
Health Facilities	7.20	0.07%
Park and Playground	18.97	0.18%
Graveyard	39.56	0.38%
Agriculture	5290.28	50.69%
Range Land	1619.57	15.52%
Orchards	490.78	4.70%
Transportation	356.45	3.42%
Minning Area	49.16	0.47%
Vacant Area	186.69	1.79%
Waterbody	432.80	4.15%
Total	10436.54	100.00%

Map 18: Existing Land use Classification of Yake Ghund



3.4.2 Pindiali

Pindiali covers a total area of 5,219.20 acres and is overwhelmingly characterized by agricultural land use, which occupies 3,262.94 acres (62.52%), highlighting its strong rural and agrarian nature. Rangeland forms the second-largest category at 1,109.02 acres (21.25%), further reinforcing the dominance of open and natural land uses.

The residential area extends over 509.95 acres (9.77%), indicating a relatively small and dispersed settlement pattern. Urban and institutional land uses are extremely limited, with commercial activities (0.04%), education facilities (0.05%), health facilities (0.00%), and public buildings and civic amenities (0.00%) occupying negligible proportions of land. Parks and playgrounds and orchards together account for less than 0.11%, reflecting a shortage of designated recreational and green spaces.

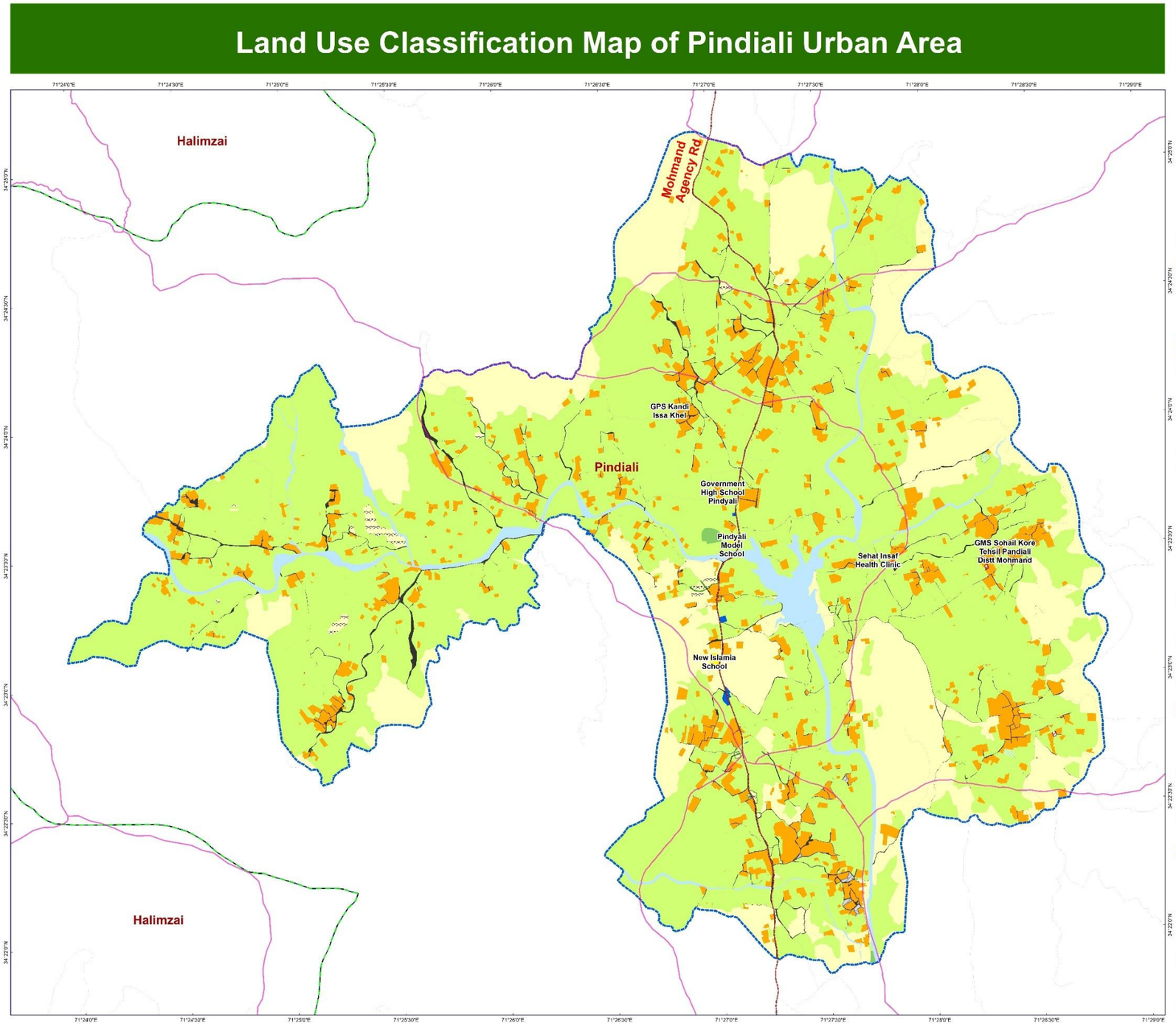
Supporting land uses include transportation infrastructure, covering 152.37 acres (2.92%), and water bodies, occupying 151.32 acres (2.90%), which contribute to connectivity and environmental functions. Overall, the land use distribution of Pindiali reflects a predominantly agricultural and low-density rural settlement, with minimal urban development and limited social infrastructure, indicating significant scope for planned service provision in the future.

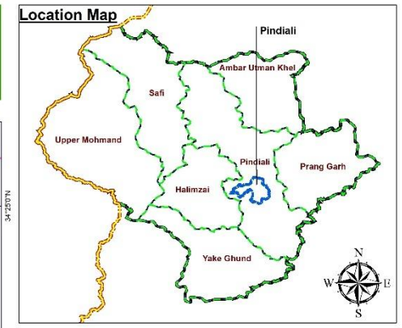
Table 17: Existing Land use distribution of Pindiali

Existing Land use	Area (Acre)	Percentage %
Residential	509.95	9.77%
Commercial	1.91	0.04%
Public Buildings and Civic Amenities	0.13	0.00%
Religious Building	0.51	0.01%
Education Facilities	2.68	0.05%
Health Facilities	0.12	0.00%
Park and Playground	4.16	0.08%
Graveyard	20.01	0.38%
Range Land	1109.02	21.25%
Agriculture	3262.94	62.52%
Orchards	1.82	0.03%
Transportation	152.37	2.92%
Vacant Area	2.25	0.04%
Waterbody	151.32	2.90%
Total	5219.20	100.00%

Map 19: Existing Land use Classification of Pindiali

Land Use Classification Map of Pindiali Urban Area





Legend

Administrative & Planning Boundaries
- Tehsil Boundary
- NC/VC Boundaries
- Planning Boundary

Landuse Classes

Human Settelment
- Residential
- Commercial
- Public Buildings and Civic Amenities

Services
- Educational Facilities
- Health Facilities
- Park and Playground
- Religious Building

Land (Agriculture Land)
- Agriculture
- Orchards
- Graveyard

Forest & Range Land
- Range Land

Soil and Geology
- Vacant Area

Other Uses
- Waterbody
- Transportation

Transportation Network
- Secondary Road
- Local Roads

Scale: 1:10,000

Scale: 0 0.325 0.65 1.3 Kilometers

Pindiali Urban Area

DISCLAIMER

1. This map shows the existing/on-site use of land and does not attribute proposed Land Use to any property/parcel of land.
2. This map does not designate Land Use to any property/parcel of land.
3. The Land Use classes shown in this map cannot be considered as Regularized/converted.
4. The Land Use Classification Map is prepared in light of Section 15, sub section (3) of the Khyber Pakhtunkhwa Land-use and Building Control Act, 2021 and TORs of the Project.

Consultant: SHEHER SAAZ Creating Places For People

Client: Provincial Land Use Plan, Urban Policy & Planning Unit,P & DD, Government of KP

3.4.3 Utman Khel Vc-2&9

Utman Khel (VC-2 & 9) spans 4,251.30 acres, with land use dominated by agriculture, covering 3,670.42 acres (86.34%), which underscores the strongly rural and agrarian character of the area. Residential land occupies 279.80 acres (6.58%), indicating a small, dispersed settlement pattern, while rangeland accounts for only 105.25 acres (2.48%), reflecting limited open grazing areas.

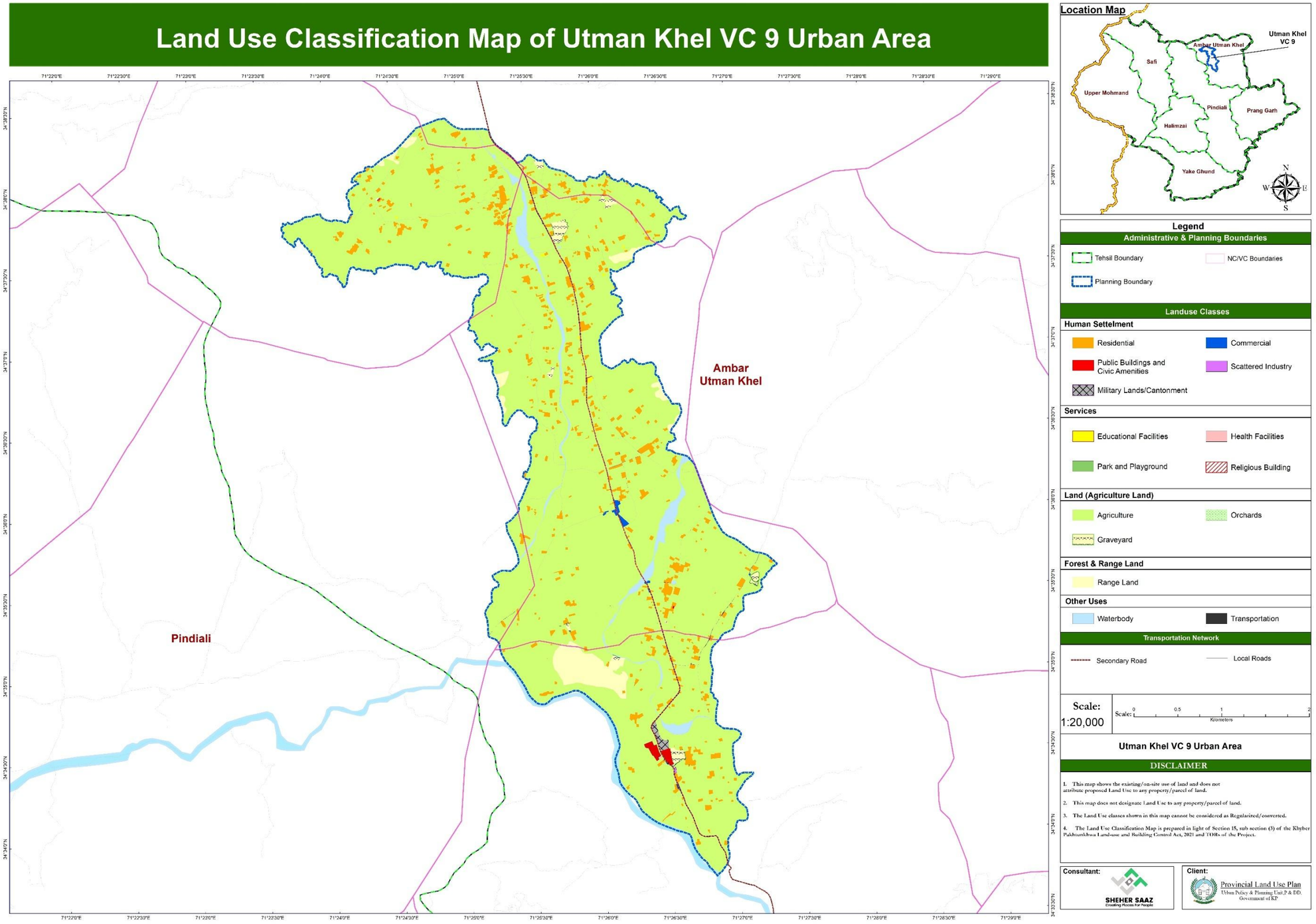
Other land uses are minimal: water bodies cover 93.40 acres (2.20%), transportation infrastructure 48.30 acres (1.14%), and graveyards 27.84 acres (0.65%). Urban and institutional uses, including public buildings (0.21%), education (0.07%), health (0.01%), commercial (0.15%), and religious facilities (0.02%), occupy a very small share, while scattered industry and orchards together constitute only 0.02%.

Overall, the land use pattern of Utman Khel VC-2 & 9 reflects a predominantly agricultural landscape with low-density settlements, limited urban development, and minimal social infrastructure, highlighting potential areas for future planned growth and service provision.

Table 18: Existing Land use distribution of Utman Khel Vc-2&9

Existing Land use	Area (Acre)	Percentage %
Residential	279.80	6.58%
Commercial	6.32	0.15%
Scattered Industry	0.42	0.01%
Public Buildings and Civic Amenities	8.83	0.21%
Religious Building	0.87	0.02%
Education Facilities	2.83	0.07%
Health Facilities	0.32	0.01%
Graveyard	27.84	0.65%
Range Land	105.25	2.48%
Agriculture	3670.42	86.34%
Orchards	0.28	0.01%
Military Lands/Cantonment	6.41	0.15%
Transportation	48.30	1.14%
Waterbody	93.40	2.20%
Total	4251.30	100.00%

Map 20: Existing Land use Classification of Utman Khel Vc-2&9



3.4.4 Qandahari Vc-3&2

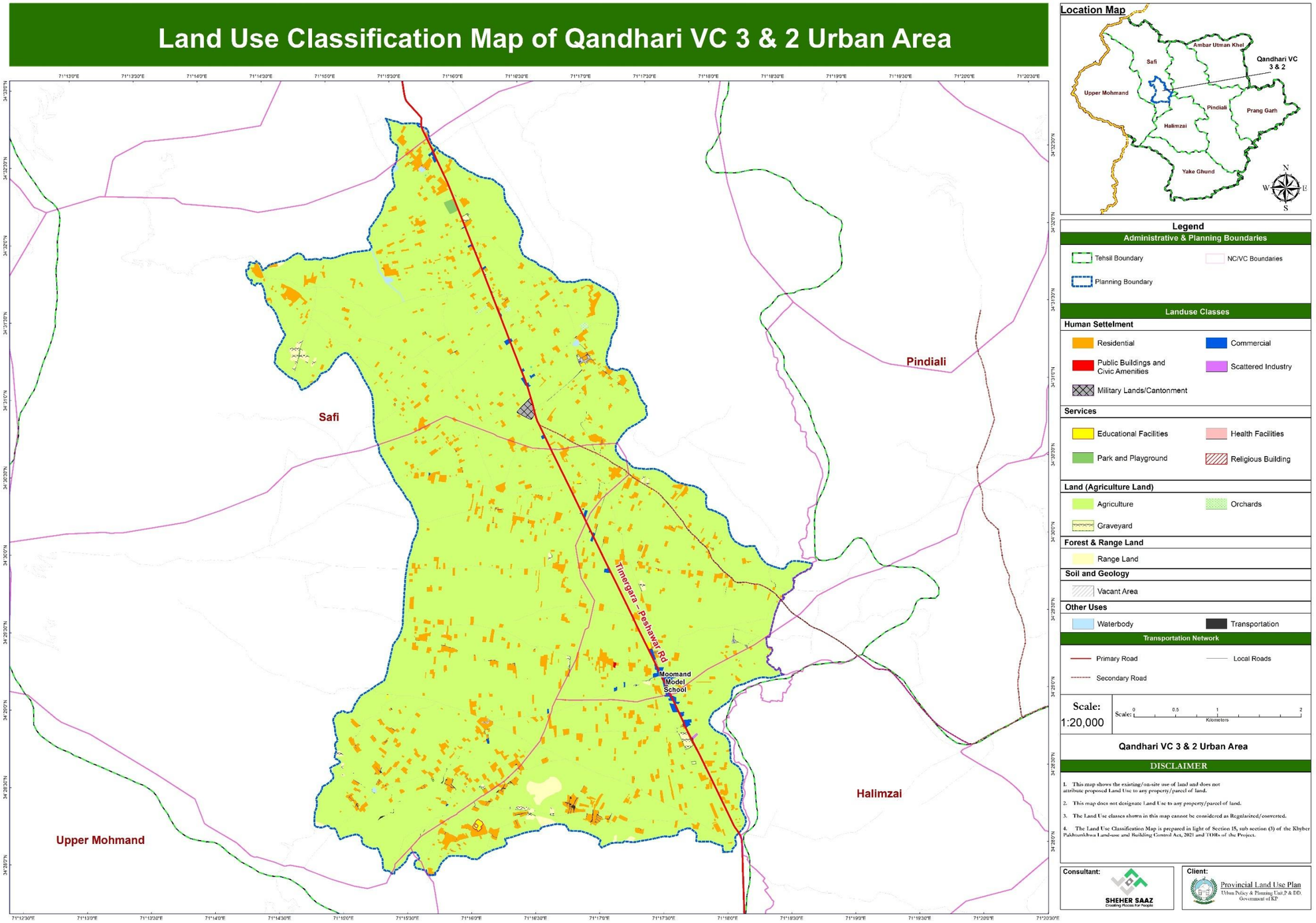
Qandahari (VC-3 & 2) covers a total area of 7,599.95 acres, with land use strongly dominated by agriculture, occupying 6,670.42 acres (87.77%), reflecting its predominantly rural and agrarian character. Residential areas account for 645.94 acres (8.50%), indicating low-density settlements, while range land is minimal at 11.99 acres (0.16%).

Supporting land uses include transportation infrastructure over 152.27 acres (2.00%), graveyards (33.98 acres; 0.45%), and water bodies (7.32 acres; 0.10%). Urban and institutional uses such as commercial areas (0.36%), education facilities (0.08%), religious buildings (0.01%), and public buildings (0.01%) occupy a very small share. Scattered industry, military lands, orchards, barren land, and vacant areas together contribute less than 1%, highlighting limited economic and urban activities.

Table 19: Existing Land use distribution of Qandahari Vc-3&2

Existing Land use	Area (Acre)	Percentage %
Residential	645.94	8.50%
Commercial	27.39	0.36%
Scattered Industry	0.77	0.01%
Public Buildings and Civic Amenities	0.48	0.01%
Religious Building	0.70	0.01%
Education Facilities	6.09	0.08%
Park and Playground	4.73	0.06%
Graveyard	33.98	0.45%
Range Land	11.99	0.16%
Agriculture	6670.42	87.77%
Orchards	4.36	0.06%
Barren Land	20.87	0.27%
Transportation	152.27	2.00%
Military Lands/Cantonment	7.67	0.10%
Vacant Area	4.97	0.07%
Waterbody	7.32	0.10%
Total	7599.95	100.00%

Map 21: Existing Land use Classification of Qandahari Vc-3&2



3.5 Potential Settlements/Areas

3.5.1 Baizai -4

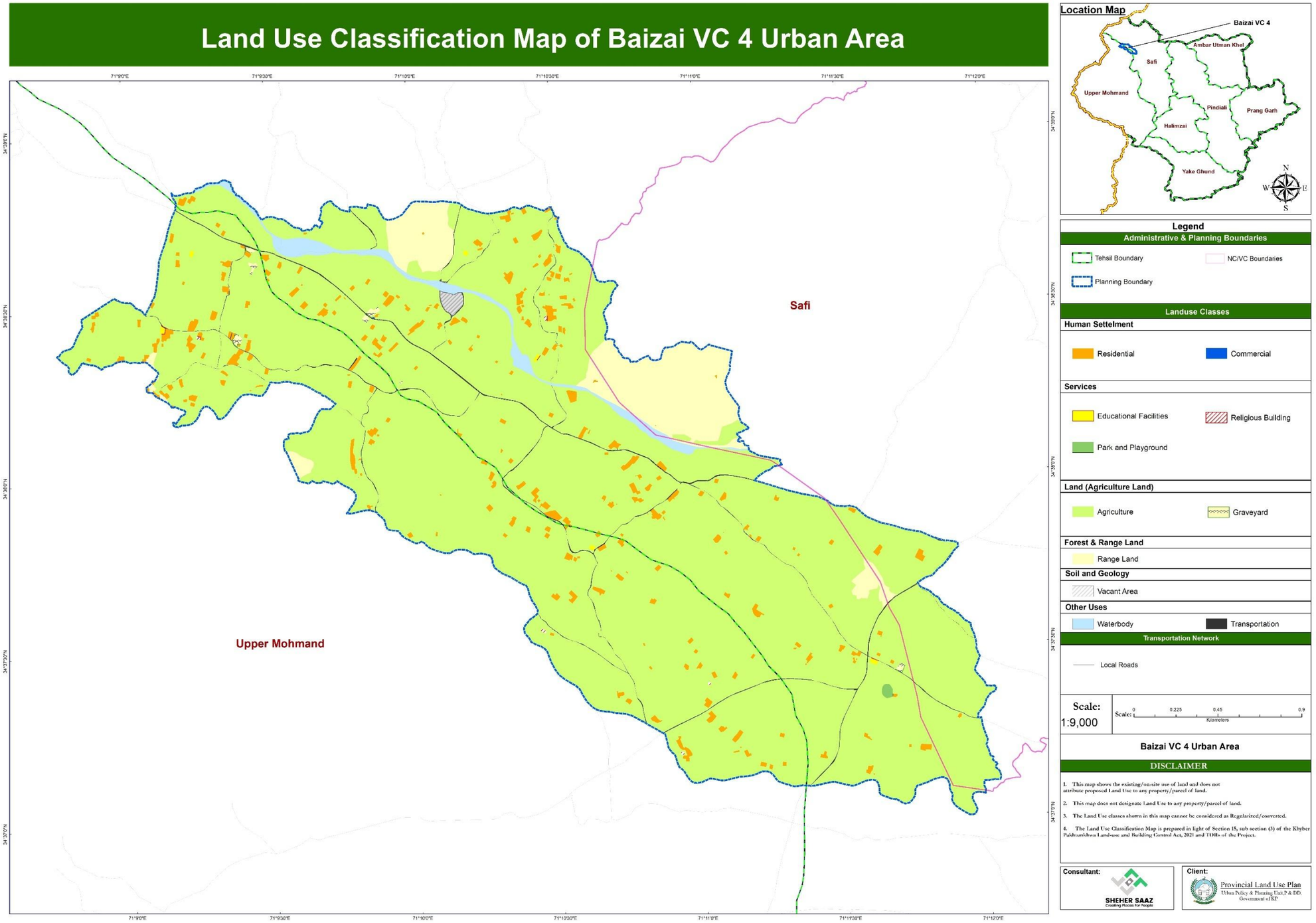
Baizai-4 covers a total area of 1,827.07 acres, with land use overwhelmingly dominated by agriculture, which occupies 1,589.45 acres (86.99%), reflecting the area's strong rural and agrarian character. Residential land is limited to 61.31 acres (3.36%), indicating small, scattered settlements, while range land accounts for 114.13 acres (6.25%), providing some open and grazing areas.

Supporting infrastructure and community land uses are minimal: transportation occupies 25.19 acres (1.38%), water bodies 28.69 acres (1.57%), graveyards 2.58 acres (0.14%), and parks/playgrounds 0.99 acres (0.05%). Institutional uses including education (0.07%) and religious buildings (0.03%) and commercial land (0.00%) occupy a very small share.

Table 20: Existing Land use distribution of Baizai -4

Existing Land use	Area (Acre)	Percentage %
Residential	61.31	3.36%
Commercial	0.04	0.00%
Education Facilities	1.30	0.07%
Park and Playground	0.99	0.05%
Graveyard	2.58	0.14%
Range Land	114.13	6.25%
Agriculture	1589.45	86.99%
Religious Building	0.51	0.03%
Transportation	25.19	1.38%
Vacant Area	2.88	0.16%
Waterbody	28.69	1.57%
Total	1827.07	100.00%

Map 22: Land use Classification of Baizai -4 Potential Settlement



3.5.2 Lakarai

Lakarai spans a total area of 3,764.39 acres, with agriculture as the dominant land use, covering 2,959.63 acres (78.62%), reflecting the area's predominantly rural and agrarian character. Residential areas occupy 220.82 acres (5.87%), while range land accounts for 47.01 acres (1.25%), indicating small, dispersed settlements and limited open grazing areas.

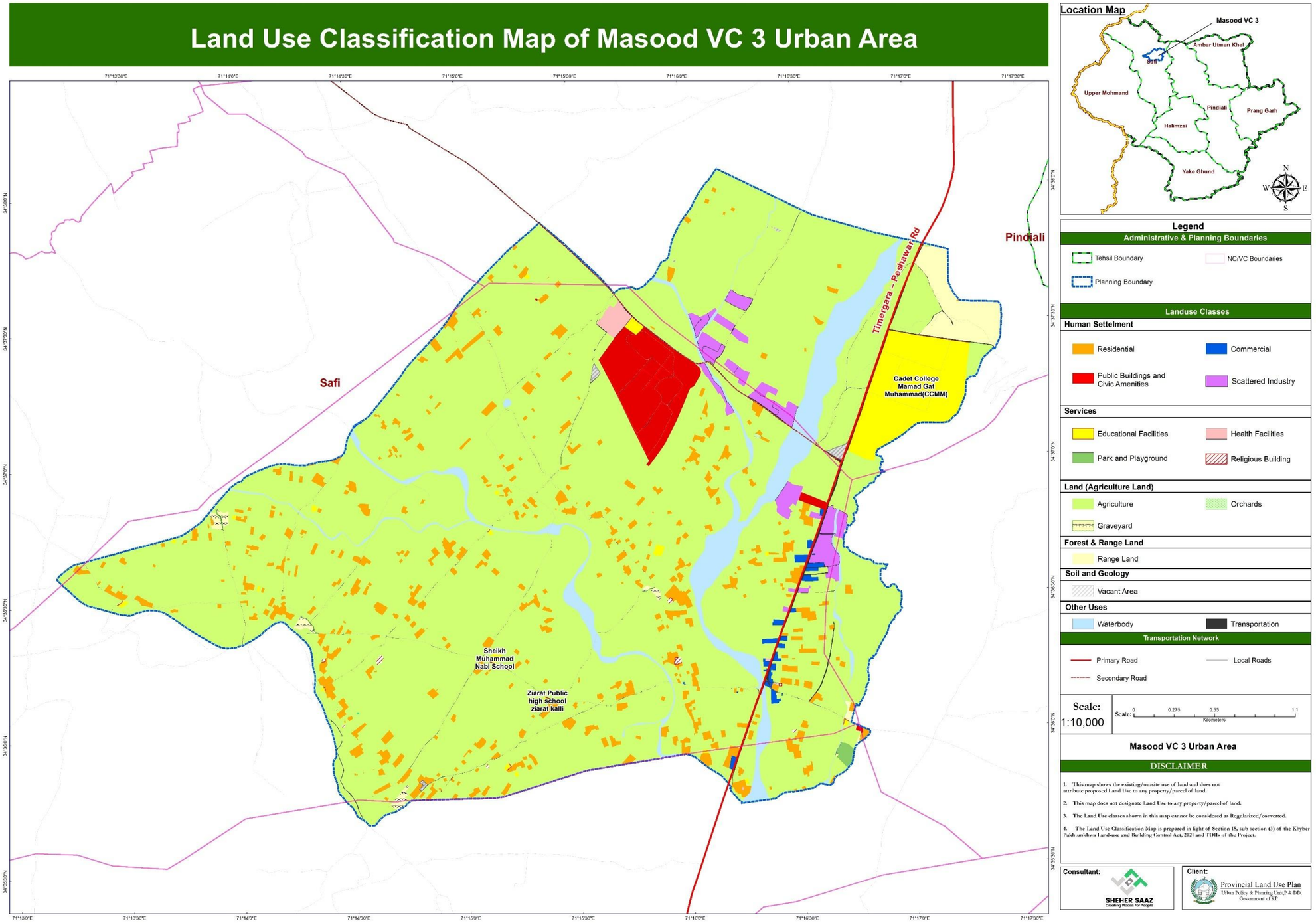
Economic and urban activities are modest: scattered industry covers 59.02 acres (1.57%), commercial land 12.33 acres (0.33%), and transportation infrastructure 47.88 acres (1.27%). Social and institutional uses include education facilities (117.32 acres; 3.12%), public buildings (84.70 acres; 2.25%), health facilities (8.34 acres; 0.22%), and religious buildings (2.01 acres; 0.05%), reflecting moderate community infrastructure.

Water bodies cover a significant 187.70 acres (4.99%), while parks/playgrounds (0.09%), graveyards (0.25%), and orchards (0.01%) occupy minimal areas. Overall, Lakarai exhibits a largely agricultural landscape with low-density settlements, limited urban infrastructure, and modest community facilities, with potential for planned development.

Table 21: Existing Land use distribution of Lakarai

Existing Land use	Area (Acre)	Percentage %
Residential	220.82	5.87%
Commercial	12.33	0.33%
Scattered Industry	59.02	1.57%
Public Buildings and Civic Amenities	84.70	2.25%
Religious Building	2.01	0.05%
Education Facilities	117.32	3.12%
Health Facilities	8.34	0.22%
Park and Playground	3.51	0.09%
Graveyard	9.57	0.25%
Range Land	47.01	1.25%
Agriculture	2959.63	78.62%
Orchards	0.28	0.01%
Transportation	47.88	1.27%
Vacant Area	4.27	0.11%
Waterbody	187.70	4.99%
Total	3764.39	100.00%

Map 23: Land use Classification Lakarai



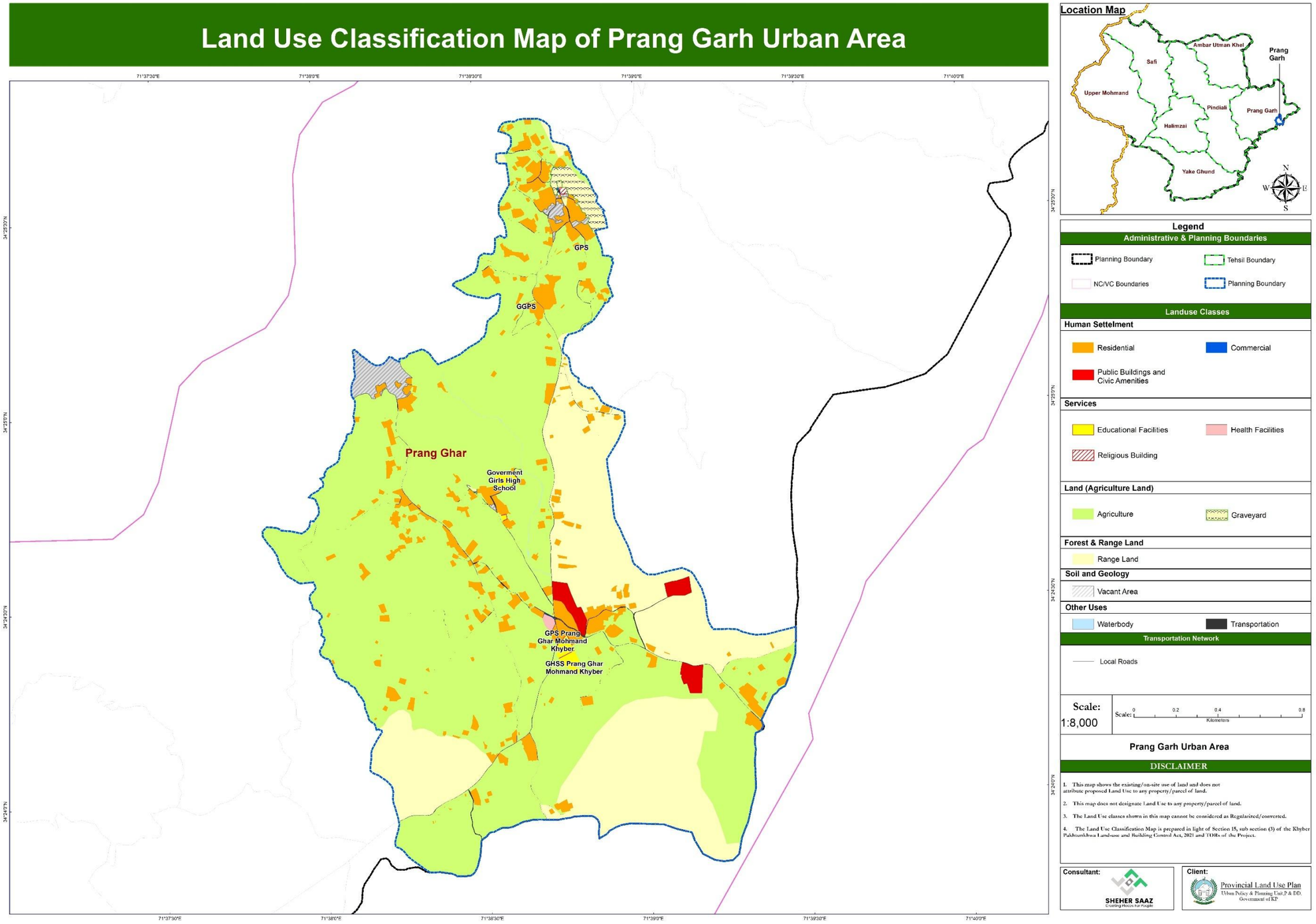
3.5.3 Prang Ghar

The land-use distribution shows that the total area of 6,392 acres is dominated by Range Land, which covers the largest share at 36.24% (2,316 acres), followed by a significant portion of Vacant Area, accounting for 25.91% (1,656 acres). Residential use forms the next major category, occupying 23.29% (1,488 acres), indicating a sizeable settled population. In contrast, commercial activities cover only 0.95% (61 acres) and scattered industry is almost negligible at 0.02% (1.29 acres), showing very limited economic or industrial land use. Public amenities such as education facilities (0.81%), health facilities (0.27%), and public buildings (0.20%) occupy relatively small areas, suggesting a shortage of dedicated institutional infrastructure. Religious buildings (0.12%), parks/playgrounds (0.31%), and agriculture (0.06%) also represent very minor proportions. Military land makes up 4.14% (265 acres), while transportation infrastructure such as roads occupies 5.90% (377 acres). Waterbodies account for 0.57% (37 acres), and the graveyard area stands at 1.21% (78 acres).

Table 22: Existing Land use distribution of Prang Ghar

Existing Land use	Area (Acre)	Percentage %
Residential	932.21	12.27%
Commercial	86.18	1.13%
Scattered Industry	72.50	0.95%
Public Buildings and Civic Amenities	62.42	0.82%
Religious Building	14.81	0.19%
Education Facilities	23.25	0.31%
Health Facilities	13.46	0.18%
Park and Playground	19.37	0.25%
Graveyard	79.44	1.05%
Agriculture	4036.73	53.14%
Range Land	1437.36	18.92%
Transportation	294.60	3.88%
Vacant Area	185.80	2.45%
Military Lands/Cantonment	178.36	2.35%
Waterbody	159.53	2.10%
Total	7596.01	100.00%

Map 24: Existing Land use Classification Prang Ghar



4 CHAPTER IV: URBANIZATION AND HIERARCHY OF HUMAN SETTLEMENTS

4.1 Urbanization

Urbanization refers to the systematic transformation of rural areas into urbanized regions, driven by economic development and industrialization. Demographically, it refers to the shift of populations from rural to urban settings over time. This process predominantly leads to the formation and expansion of towns and cities as more people start living and working in central urban areas. Over the past fifty years, many developing countries have experienced rapid urbanization, resulting in a high concentration of urban populations in large cities. Urbanization is not just a modern occurrence but a significant and historical shift in human social structures on a global scale, where rural cultures are rapidly being replaced by urban ones.

Urbanization has both positive and negative impacts. On the positive side, it drives economic development and improves education. However, it also strains existing social services and infrastructure. For example, a sudden population increase can lead to housing shortages, resulting in the development of slums. To address urbanization, long-term planning for cities and towns is crucial. This planning should include considerations for housing, infrastructure, employment, and social services to manage urban growth effectively. Such planning is essential for creating attractive, affordable, sustainable, and well-serviced communities with access to job opportunities.

4.1.1 Urbanization of District Mohmand

District Mohmand has gone through a dramatic demographic shift over the last four decades. In 1981, its population was just under 380,000, but by 1990 it had already crossed the half-million mark (513,000). The upward trend continued into the 21st century, with the population reaching just over 1 million by 2017, and further increasing to 1.15 million in 2023. This doubling in less than thirty years reflects the combined effect of a high natural growth rate and steady in-migration from surrounding rural areas.

Despite this rapid rise, the district is still overwhelmingly rural. As of 2023, over 92% of residents live in rural areas, while the urban share is just 8% (94,707 people). However, the pace of change within the two recognized towns, Jamrud and Landi Kotal is striking. Jamrud's population has more than doubled since 1998, and today it has around 56,600 residents. If current trends continue, it is projected to cross the one-million threshold by 2045, effectively transforming into a major secondary city. Landi Kotal has grown more moderately, from about 22,000 people in 1998 to nearly 38,000 in 2023, but projections still suggest that it could exceed half a million residents within two decades.

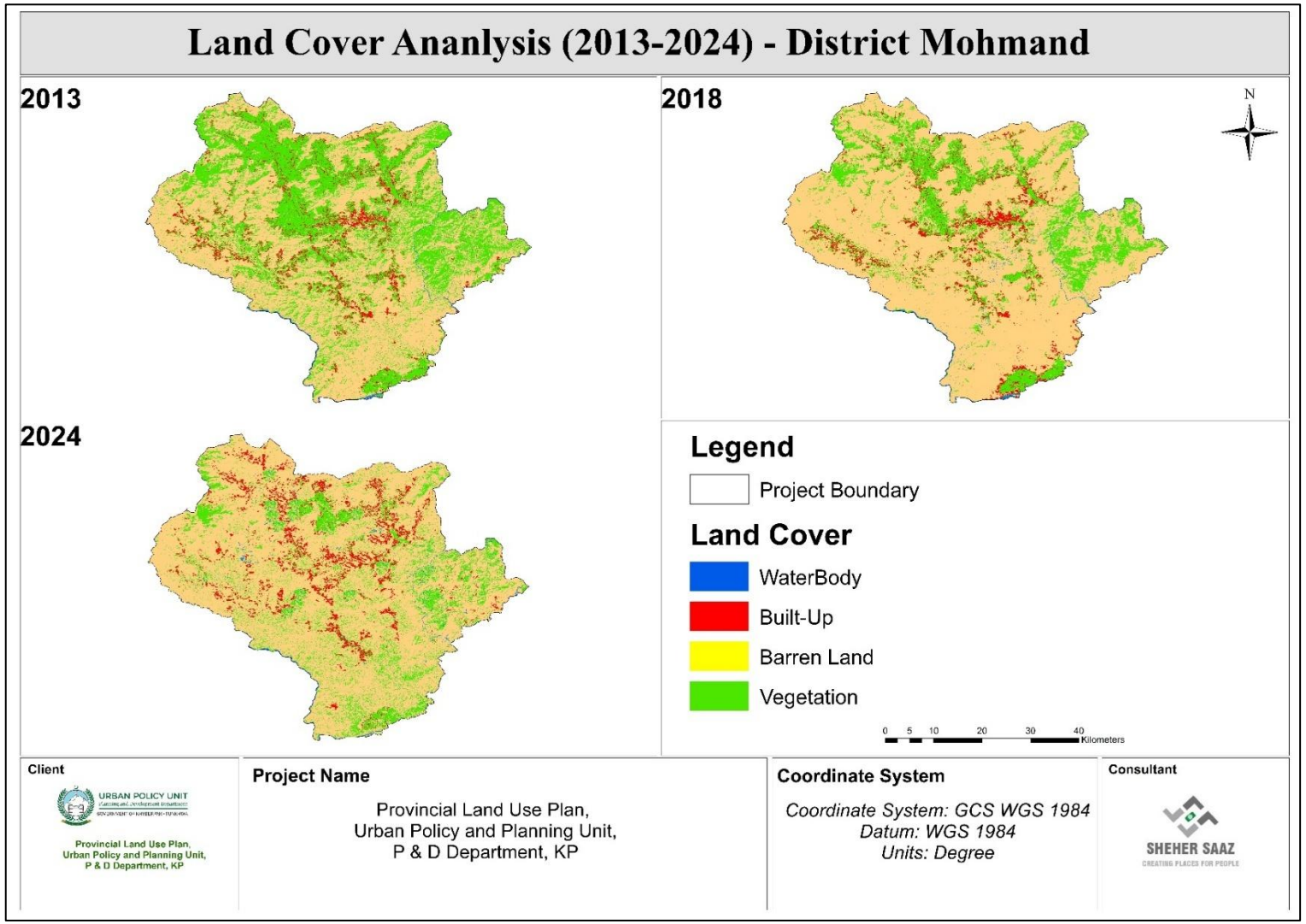
At the sub-district level, Bara Tehsil is by far the largest, with almost 550,000 residents, nearly half of the district's total population. Landi Kotal and Jamrud follow, with 312,000 and 243,000 people respectively, while Mulla Gori remains sparsely populated at around 43,000. The settlement pattern shows how people continue to cluster along transport corridors and fertile valleys, particularly around routes connecting to Peshawar.

4.1.2 Growth Direction

Over the last two decades, District Mohmand has experienced a significant transformation in its land cover and settlement pattern. The built-up area has expanded rapidly, increasing from around 84 sq. km in 2003 to nearly 437 sq. km in 2023. This expansion is not uniform but is shaped by the district's geography, its transport corridors, and the strong urban influence of Peshawar. The most visible direction of growth is eastward and northeastward toward Peshawar, while another strong axis of expansion follows the Peshawar–Torkham Highway (N-5) in a linear, corridor-based form. In contrast, the rugged northern and western areas of the district show limited change due to topographical constraints.

This growth has come with a notable shift in land use. Vegetation and agricultural land have declined by almost one-third, while barren land has more than doubled. Much of the new urban area has been developed on former cultivated or vegetated land, showing a gradual transition from vegetation to barren land and then to built-up. The plains in the east and central valleys of the district are under the greatest development pressure, whereas the higher hill ranges remain relatively stable.

Map 25: Growth Trend Map - District Mohmand



4.1.3 Drivers of Urbanization

Urbanization in Mohmand District is driven by a combination of geopolitical, economic, and social factors. The district's strategic location, near Peshawar and along the Afghanistan-Pakistan border, plays a crucial role in its urban development. This proximity to a major city and an international border has led to significant military presence and infrastructure development, including roads, bridges, and other critical facilities, which improve connectivity within the district and with neighboring areas. As a result, people are drawn to urban centers for better access to these amenities.

Economic opportunities are another major driver of urbanization in Mohmand District. The region's evolving economy, characterized by trade due to its border location, small-scale industries, and agricultural advancements, attracts people to urban areas in search of better job prospects. Additionally, the construction of large-scale projects like the Mohmand Dam has created jobs and further stimulated economic activity, encouraging rural populations to migrate towards urban centers.

Population growth and migration also contribute significantly to urbanization in Mohmand. Natural population increases, coupled with internal migration from rural areas, have led to the expansion of urban centers. This movement is often motivated by the desire for better living conditions, as urban areas typically offer more comprehensive educational and healthcare services. Moreover, the return of populations displaced by past conflicts has added to the urban population, as these individuals seek safety and access to essential services in more secure environments.

The administrative reforms following the merger of the Federally Administered Tribal Areas (FATA) into Khyber Pakhtunkhwa have further accelerated urbanization in Mohmand District. The establishment of district headquarters and other administrative hubs has centralized governance and services, making urban centers more attractive for those seeking closer proximity to these facilities. Improved security and stability in the region have also made urban living more appealing, as people are drawn to areas that offer a higher sense of safety and stability.

4.1.4 Settlements to be Urbanized by 2045

Several settlements in District Mohmand are projected to reach urban scale by 2045 due to rapid population growth. Based on demographic and functional analysis, rural settlements will have populations, qualifying them for urban status. These include:

- **Ambar Utman Khel Tehsil**: Utman Khel 9, Utman Khel 2
- **Halim Zai Tehsil**: Ghalanai
- **Pindiali Tehsil:** Pindiali
- **Prang Ghar Tehsil:** Prang Ghar
- **Safi Tehsil:** Lakarai, Qandahari Vc-3&2
- **Ekk/Yake Tehsil:** Yake Ghund
- **Upper Mohmand Tehsil:** Baizai 4, Khwezai VC 1

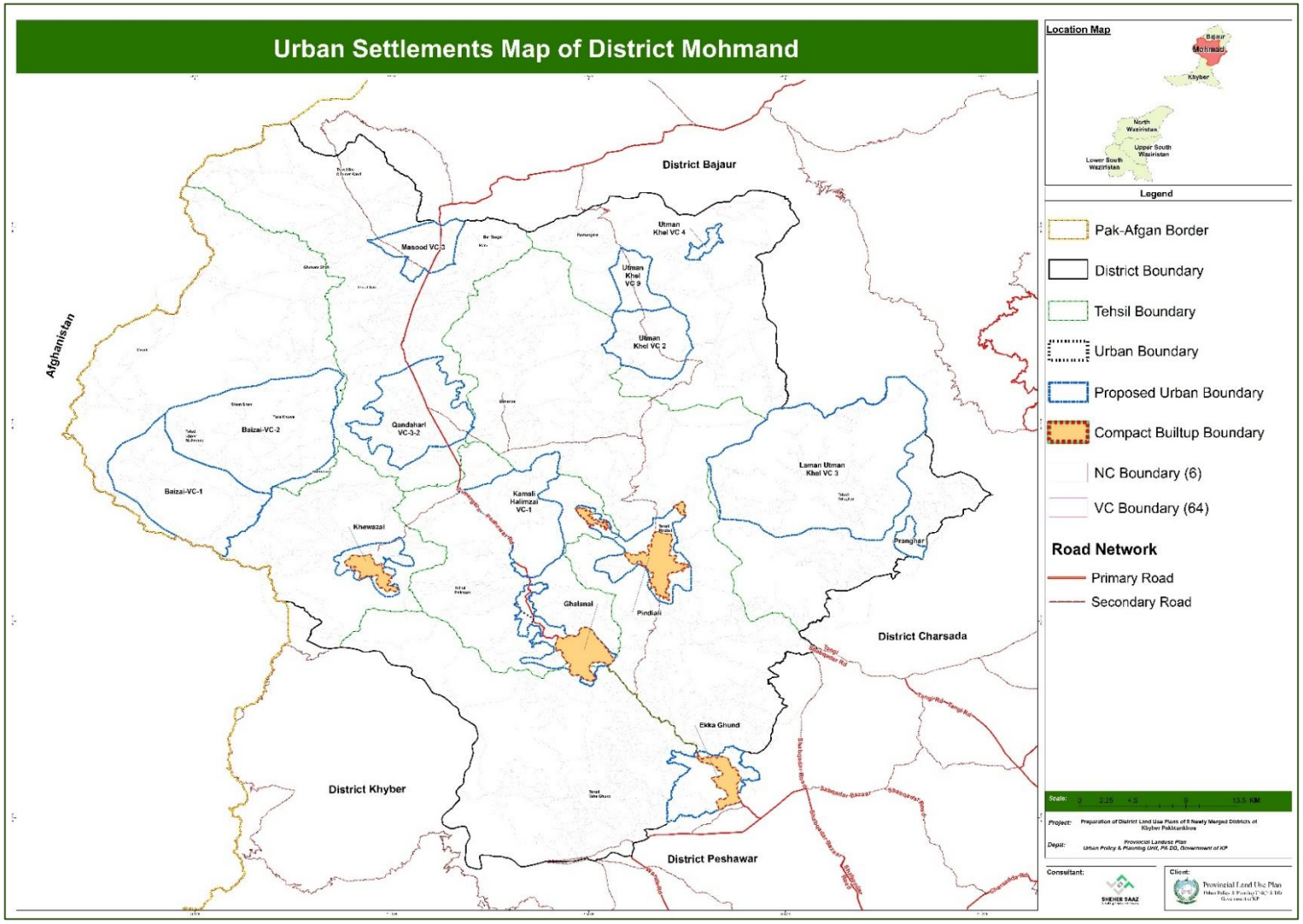
These areas show growing urban functions and should be prioritized for basic services, infrastructure, and inclusion in urban development plans. The table and the map below show the village councils which need to be urbanized by 2045.

Table 23: Potential Urban Settlements to be urbanized by 2045

Sr. No.	Tehsil	Existing Hierarchy	Settlement Name	Settlement by Type	Population
					2045
1	Ambar Utman Khel Tehsil	Rural	Utman Khel Vc-2&9	Small City	63675
2	Halim Zai Tehsil	Urban	Ghalanai	Small City	73704
3	Pindiali Tehsil	Rural	Pindiali	Small City	80180
4	Prang Ghar Tehsil	Rural	Prang Ghar	Small City	17639
5	Safi Tehsil	Rural	Lakarai	Small City	10575
		Rural	Qandahari Vc-3&2	Small City	31714
6	Yake Tehsil	Rural	Yake Ghund	Small City	80614
7	Upper Mohmand Tehsil	Rural	Baizai -4	Small City	11031
		Rural	Khwezai VC 1	Small City	9767

Source: Devised by Consultant

Map 26: Compact and Proposed Urban Boundaries



4.2 Hierarchy of Settlements

4.2.1 Objectives of Hierarchy of Settlements

The overall objective of establishing hierarchy of settlements is to describe and understand the existing structure of the network of settlements (urban centers and small settlements) in Mohmand as a key consideration in the formulation of development strategies and projects. Structure is determined by the functions and roles of the settlements.

Major objectives of the Settlement Hierarchy are as below:

- Accommodate and promote the development of linkages and infrastructure servicing of these settlements.
- Accommodate and promote proper planning and sustainable development in their environs.
- Promote the role of these Settlements as economic, social and cultural centers for the surrounding areas.
- Promote growth in smaller areas to allow for balanced and coordinated development throughout Mohmand District.
- Promote linkages between larger and smaller towns in order to distribute the resulting influence throughout the region.
- Promote the strengthening of Settlements/Towns as employment and service centers and as attractive residential centers.

4.2.2 Hierarchy of Human Settlements and Urban Planning

Although not declared but there are only three identified urban settlements in Mohmand District, there is a need to identify criteria by which rural settlements can be categorized by hierarchy. Since, there is no universally agreed-upon standard for these thresholds to establish a relevant settlement hierarchy, the consultant has developed criteria based on indicators of human settlements including population, density, administrative status, and infrastructure development as these indicators are essential for urban planning and resource allocation:

- **Population & its Density**
- **Administrative Status of Settlement**
- **Education Facilities**
- **Health Facility**
- **Access Roads**

These indicators have been assigned weight based on the outcome of the analysis of spatial and non-spatial data, best practices, professional judgment, and the importance of the criteria identified. The criteria for the hierarchy of human settlements are shown below:

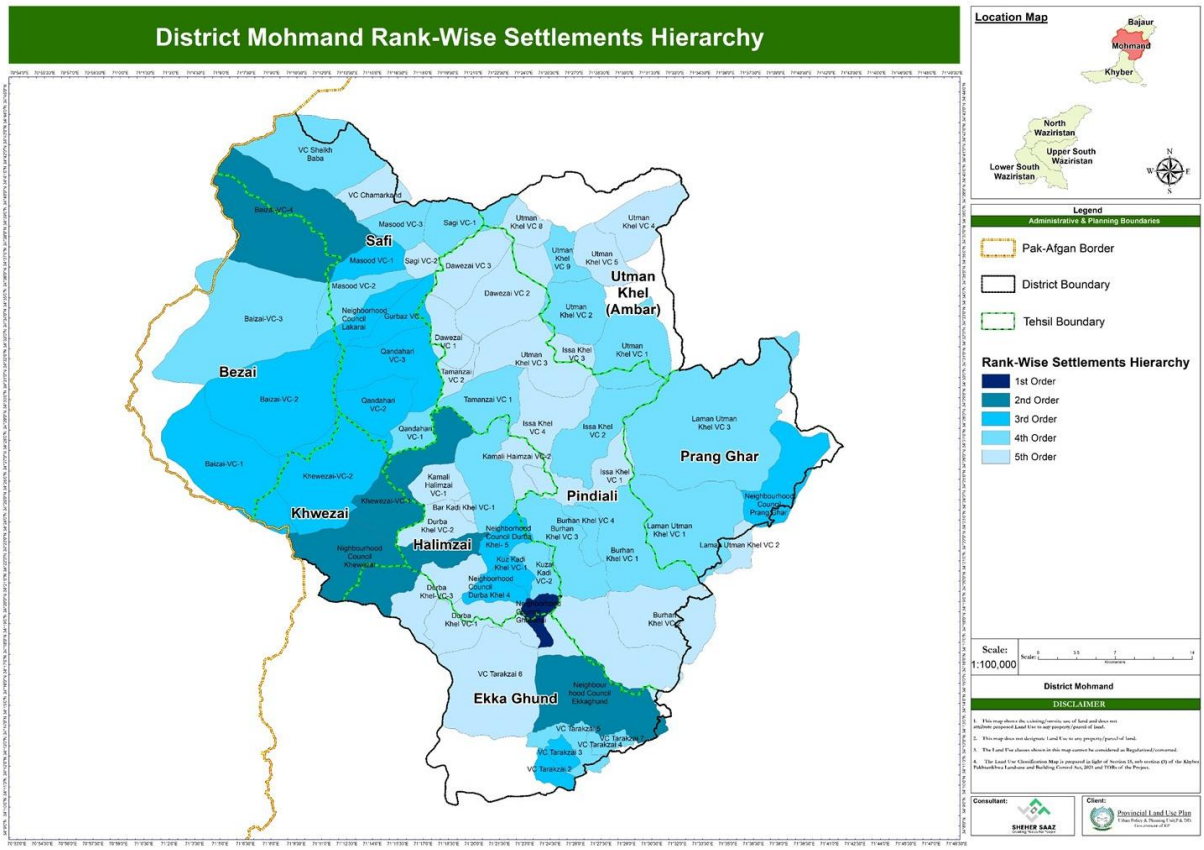
Table 24: Key Indicators of Human Settlements in Mohmand District

Indicator	
Population	• Every 10000 population = 1.0
Density	• 0-5000 = Low Density = 0.5 • 5001-10001 = Medium Density = 1.0 • 10002-15002= High Density = 1.5 • >15003 = Very High Density = 2.0
Administrative Status of Settlement	• District Headquarter = 2.0 • Tehsil Headquarter = 1.5 • Village Council = 0.5 • Cantonment = 0.0
Education Facilities	• No Education Facility = 0.0 • Every 1 Primary School = 0.15 • Every 1 Middle School = 0.25 • Every 1 High School = 0.5 • Every 1 Higher Secondary School/Inter College = 1.0 • Every 1 Degree College = 1.5 • Every 1 University = 2.0
Health Facility	• No Health Facility = 0.0 • Every 1 Dispensary = 0.25 • Every 1 Basic Health Unit = 0.5 • Every 1 Rural Health Centre = 1.0 • Every 1 Other Health Centre = 1.5 • Every 1 Hospital = 2.0
Access Roads	• Metaled Road = 2.0 • Unmetalled road = 1.0 • Inaccessible = 0.0

Source: Devised by Consultant, 2024

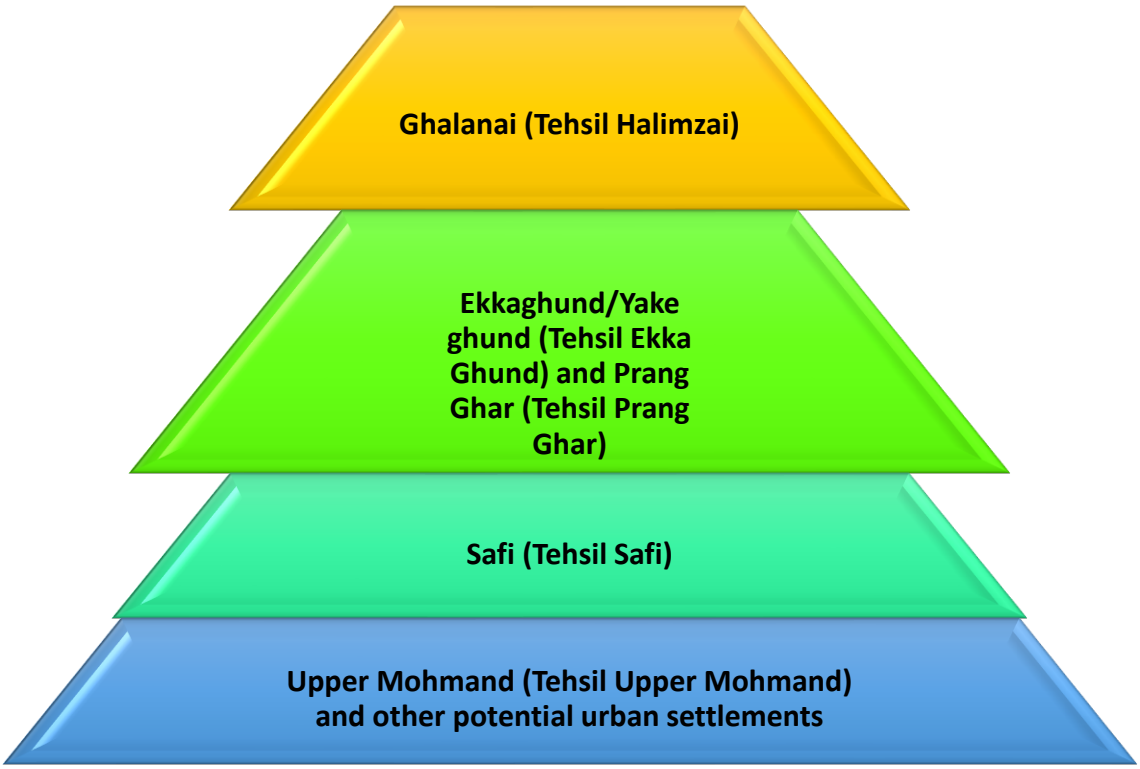
According to the availability of services and other factors mentioned above, the Mohmand district's settlement hierarchy is split into five categories: first order, second order, third order, fourth order, and fifth order.

Map 27: Rank-Wise Settlements Hierarchy

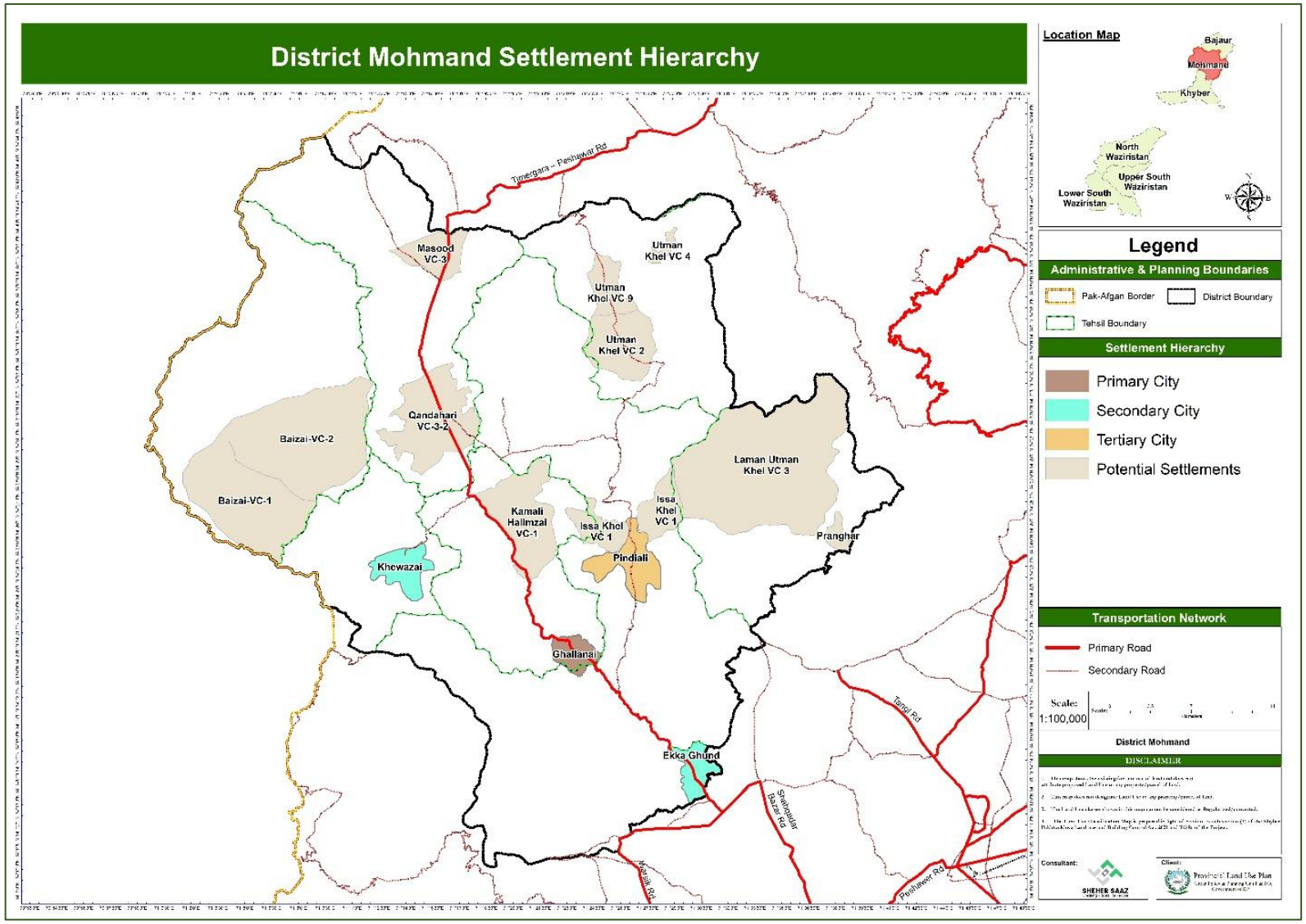


In District Mohmand, Ghalanai in Tehsil Halimzai functions as the primary central place, ranked highest in the district's settlement hierarchy. As the administrative headquarters, it offers high-order services such as district-level healthcare, education, and trade facilities, attracting people from across the district due to its central location and administrative significance. At the secondary level, Yakeghund/Yakeghund (Tehsil Yake Ghund/Yakeghund) and Prang Ghar (Tehsil Prang Ghar) act as regional hubs, providing intermediate services including healthcare, education, and trade for surrounding settlements. While smaller in scale compared to Ghalanai, these centers play a vital role in connecting rural areas with the district's primary urban core. The tertiary central places, Safi (Tehsil Safi) and Upper Mohmand (Tehsil Upper Mohmand), provide basic services such as local markets, primary schools, and healthcare facilities, primarily catering to the immediate rural communities in their vicinity. Beyond these centers, the rural villages offer only minimal services, relying heavily on the higher-order centers for administrative and socio-economic needs. This hierarchical settlement structure, aligned with Central Place Theory, highlights Ghalanai's dominance as the main service center, supported by secondary and tertiary nodes that ensure accessibility and service distribution throughout Mohmand District.

Figure 3: Hierarchical Structure of Settlements in Mohmand District



Map 28: Hierarchical Structure of Settlements in Mohmand District



5 CHAPTER V: LAND SUITABILITY AND MULTI-CRITERIA ANALYSIS

5.1 Multi-Criteria Decision Analysis (MCDA)

Multi-criteria decision-making is one approach used to facilitate the consideration of multiple criteria by decision-makers. MCDA is used to logically evaluate and compare multiple, often conflicting, criteria in order to make the best possible decision. Especially useful when you have a wide range of stakeholders with conflicting interests, values and goals.

Though the multi-criteria analysis can be carried out in multiple ways, the consultant has pooled two criterion types into one i.e., land suitability classes and conditional suitability.

The general equation for multi-criteria analysis is as under:

$$Multi\ Criteria\ Analysis = w\ x\ C\ x\ r$$

Where;
w = specified weightage to the class.
C = Criteria or Factors involved in criteria. &
r = restrictions or constraints involved in the criteria.

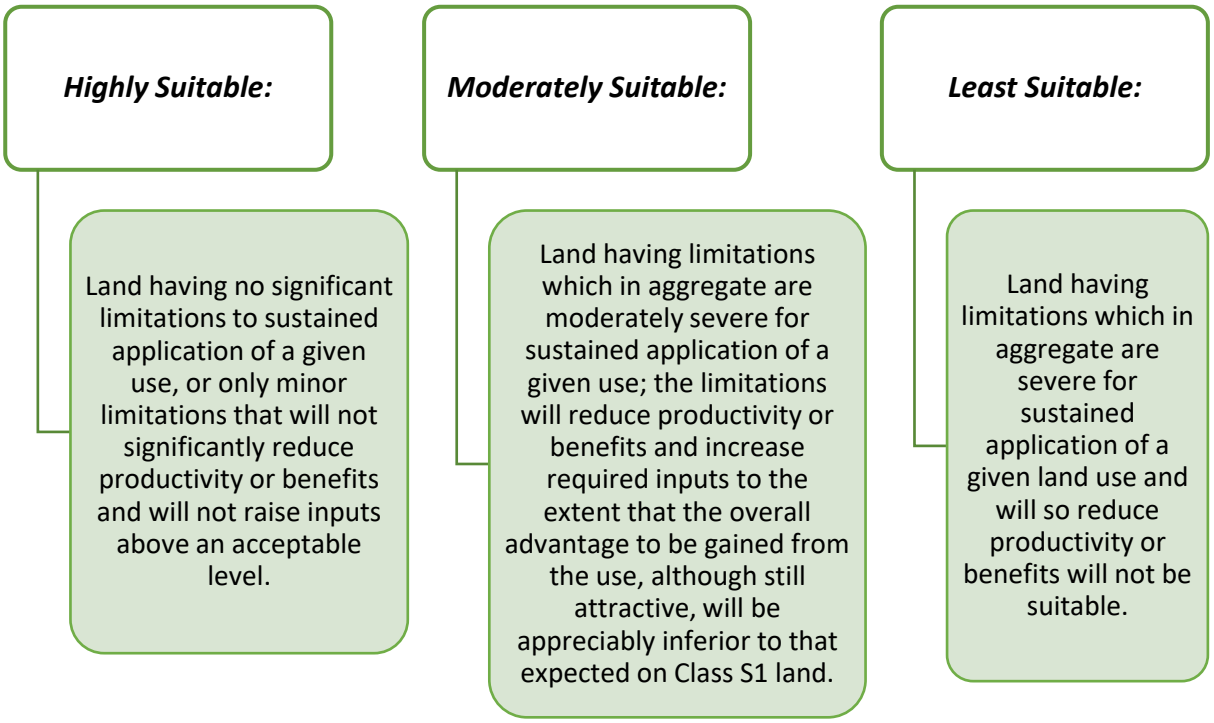
Multi-criteria analysis can be performed using a variety of techniques, It can be performed using the raster calculator method or it can be used using the weighted overlay method. In either case, the basic essence remains the same. The core of multi-criteria analysis revolves around the equation stated above.

Land's suitability is the aptness of a given type of land for a defined use i.e., residential, or commercial. Suitability can consider land in its existing condition or after improvements. The process of land suitability classification is the appraisal and grouping of specific areas of land in terms of their suitability for defined uses. Multi-criteria analysis has been used to determine suitable land uses for existing land parcels.

The consultant has pooled two criterion types into one i.e., land suitability classes and conditional suitability.

Land suitability classes reflect degrees of suitability. The classes are numbered consecutively in sequence of decreasing degrees of suitability within the Order. The opted criterion provides following three suitability classes:

Figure 4: Classes of the LSA



Source: Developed by Consultant

5.2 Land Suitability Analysis (LSA) for Land uses

The criteria for the Land Suitability Assessment (LSA) of various land uses, residential, agricultural, commercial, and industrial, are developed based on extensive consultations with the client. These discussions help identify key factors such as land characteristics, environmental sustainability, infrastructure availability, and community needs, ensuring that each land use is appropriately allocated. The details of all land-uses are given below:

5.2.1 LSA Criteria for Residential

The residential criteria are made by using factors and constraints of planning development. The important factor is the proximal of land to primary and secondary roads, planned residential, water bodies and land cover. The table below shows the selected criteria for residential.

Table 25: Factors and Criteria of Residential

S. No	Parameters	Classes (Meters) (Degree)	Weights 1 = Not Suitable 2 = Moderate 3 = Most Suitable	Influence
1	Primary Roads	11 - 50	1	15
		51 - 1400	2	
		1401 - 2800	3	
		Above 2801	2	

S. No	Parameters	Classes (Meters) (Degree)	Weights 1 = Not Suitable 2 = Moderate 3 = Most Suitable	Influence
2	Secondary Roads	11 - 50	1	20
		51 - 1500	3	
		1501 - 2900	3	
		Above 2901	2	
3	Planned Residential	0 - 400	3	15
		401 - 800	3	
		801 - 1600	2	
		Above 1601	1	
4	Waterbodies	0 - 50	1	20
		51 - 500	2	
		501 - 1200	3	
		Above 1201	3	
5	Land Cover	Built-Up	1	10
		Vacant	3	
		Agriculture	2	
6	Slope	0-9 Degree	3	15
		10-15	2	
		Above 15 degree	1	

Source: Developed by Consultants

5.2.2 LSA Criteria for Commercial

The commercial criteria are made by using factors and constraints of planning development. The important factor is the proximal of land to Primary and Secondary Roads, Existing Commercial Bazaar and Land Cover.

Table 26: Factors and Criteria for Commercial

Criteria For Commercial				
S. No	**Parameters**	**Classes (Meters) (Degree)**	**Weights** **1 = Least Suitable** **2 = Moderate** **3 = Most Suitable**	**Influence**
1	**Primary Roads**	11 - 70	3	20
		71 - 800	2	
		801 - 1600	1	
		Above 1600	1	
2	**Secondary Roads**	20 - 80	3	30
		81 - 900	2	
		901 - 1800	1	

		Above 1800	1	
3	**Existing Commercial Bazar**	0 - 600	3	20
		601 - 1200	2	
		1201 - 1800	2	
		Above 1800	1	
4	**Land Cover**	Built-Up	1	10
		Vacant	3	
		Agriculture	2	
5	**Slope**	0-9 Degree	3	15
		10-15	2	
		Above 15 degree	1	

Source: Developed by Consultants

5.2.3 LSA Criteria for Industry

The Industrial criteria have been made by using factors of planning development. The important factor is the proximal of land to road, community facilities and parks and playgrounds. For the Land cover, the built-up area is least suitable, vegetation is moderately suitable and vacant is highly suitable.

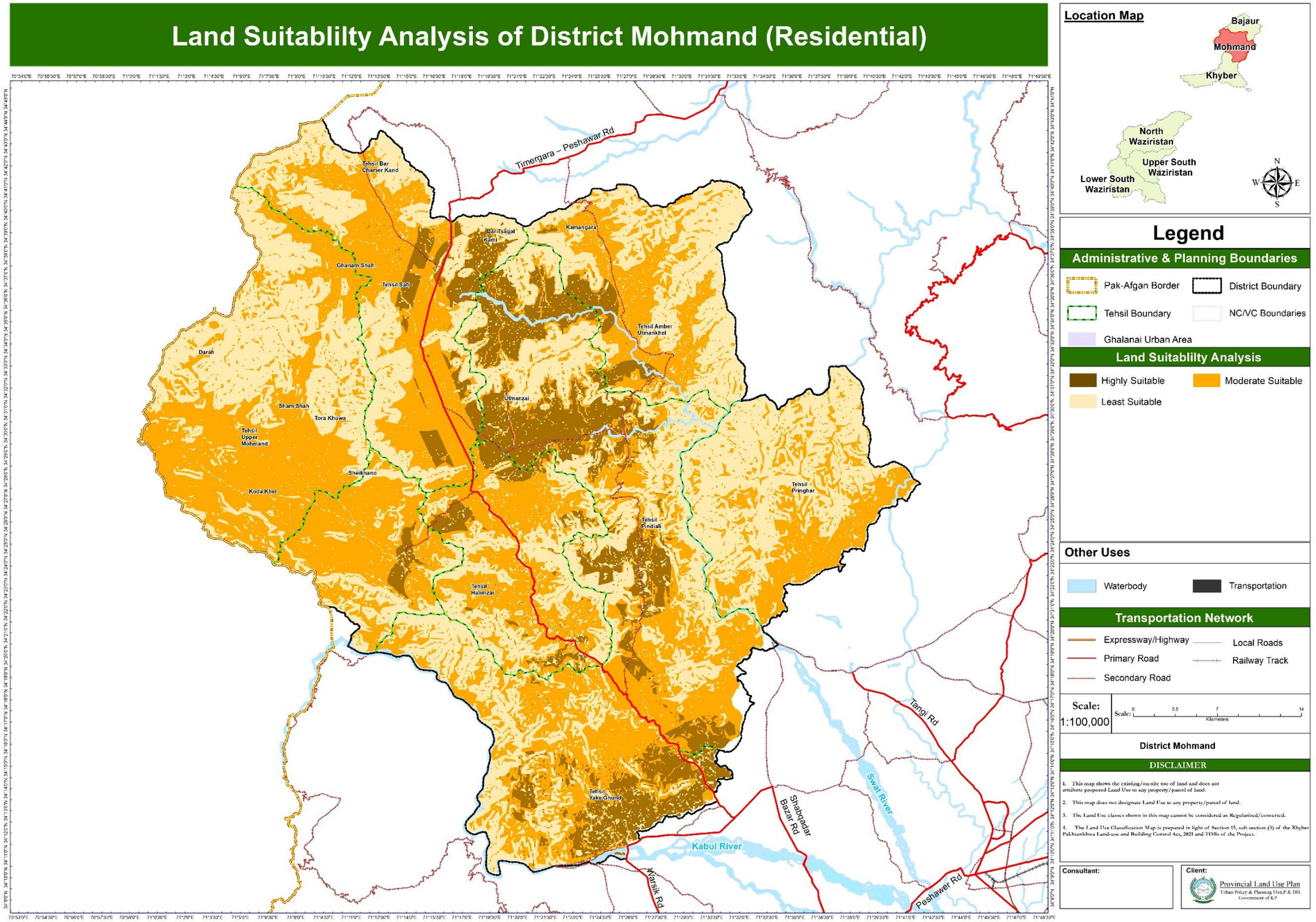
Table 27: LSA Criteria for Industry

Criteria For Industry				
S. No	**Parameters**	**Classes (Meters) (Degree)**	**Weights** **1 = Least Suitable** **2 = Moderate** **3 = Most Suitable**	**Influence**
1	Primary Roads	11 - 700	3	10
		701 - 1400	2	
		1401 - 2100	1	
		Above 2100	1	
2	Secondary Roads	6 - 650	3	20
		551 - 1200	2	
		1201 - 1650	2	
		Above 1650	1	
3	Waterbodies	0 - 50	1	25
		51 - 500	2	
		501 - 1200	3	
		Above 1200	3	
4	Existing Industrial Block	0 - 500	1	20

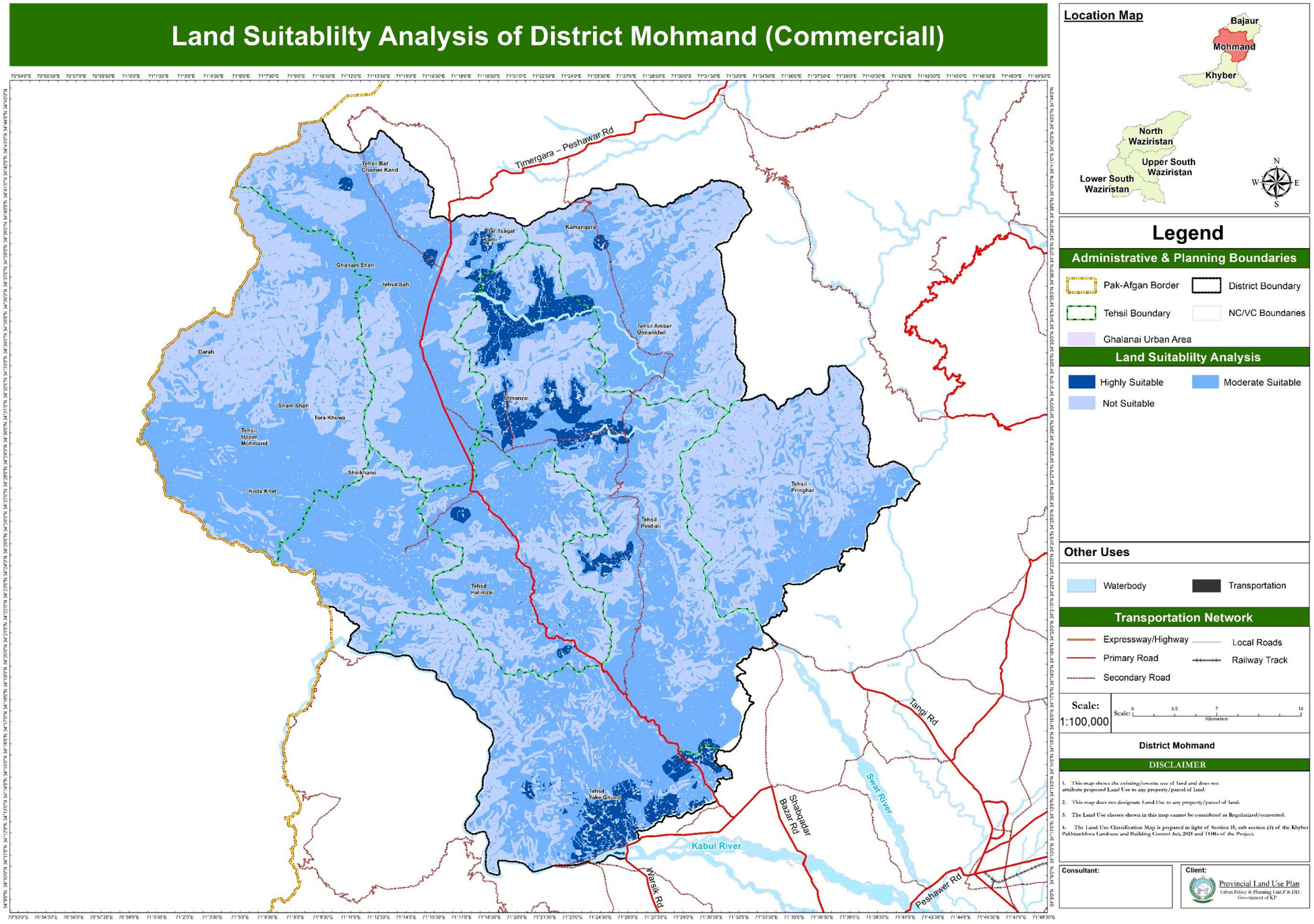
		501 - 1000	2	
		1001 - 1500	3	
		Above 1500	3	
5	Land Cover	Built-Up	1	10
		Vacant	3	
		Agriculture	2	

Source: Developed by Consultants

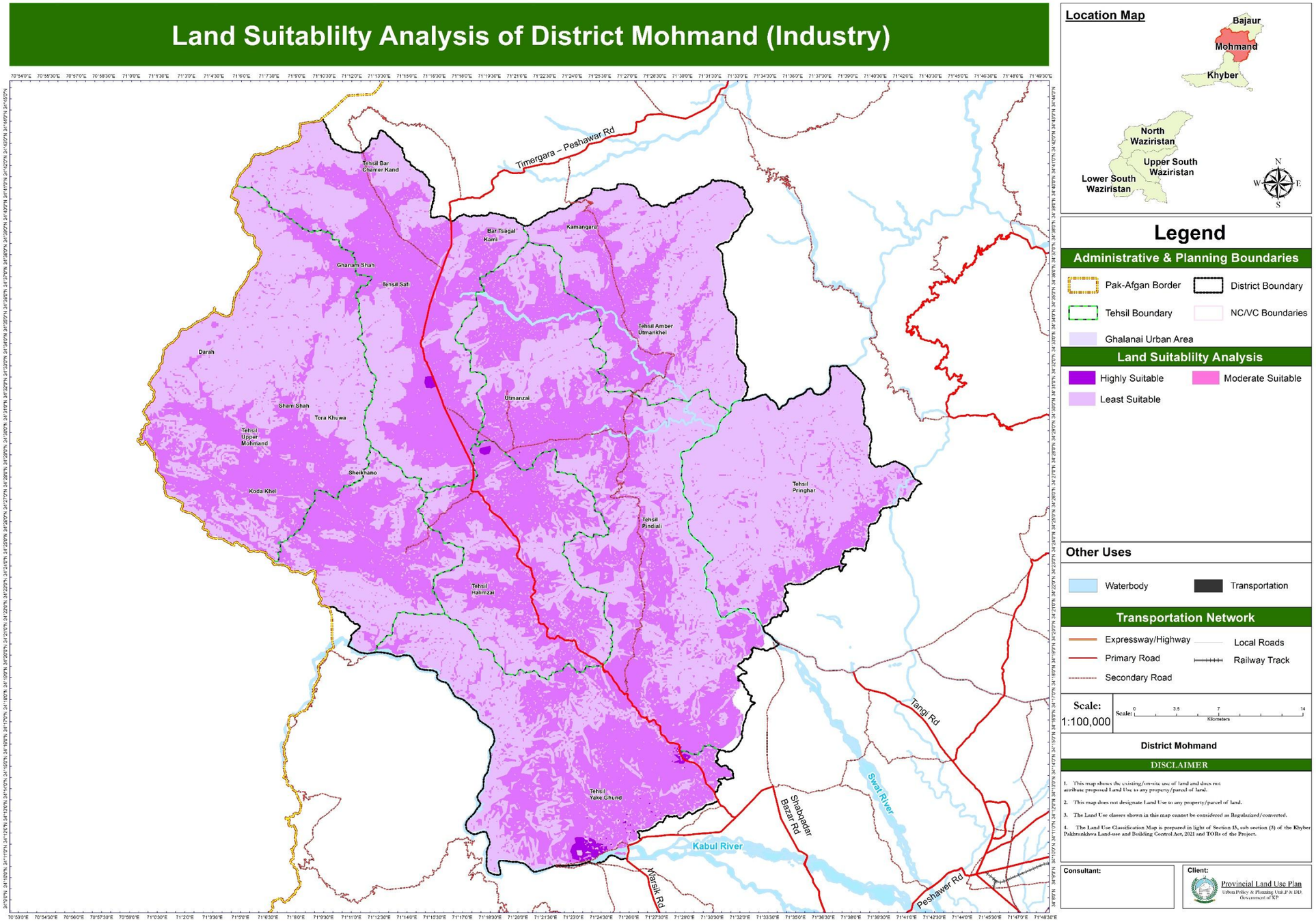
Map 29: Land Suitability Analysis of Residential Land Use



Map 30: Land Suitability Analysis Commercial



Map 31: Land Suitability Analysis for Industry



Source: Developed by Consultants

6 CHAPTER VI: SECTORAL STUDIES

6.1 RESIDENTIAL ZONES

6.1.1 Existing Housing Stock

As per the census report of 2017, the total population of 474,345 people in Mohmand District was accommodated in 49,875 housing units as against the population of 334,453 people enumerated in 37,163 housing units in year 1998. However, according to 7th census (2023), this population has increased to 553,933 people, which are housed in 63,973 units.

From 1998 to 2017, the total number of housing units in Mohmand district represents a growth of approximately 32.88%. However, this increase has further shown potential in intercensal period from 2017 to 2023. Within this period, the housing stock increased to 29.5%. This substantial rise indicates significant development efforts and population growth in the region over the two decades. In parallel to district, the analysis overtime of the Mohmand tehsils has been carried out using intercensal period of 1998-2023. The following table depicts housing units by tehsil:

Table 28: Tehsil Wise Details of Housing Units - Mohmand District

Administrative Unit	Housing Units		
	1998	**2017**	**2023**
Ambar Utman Khel Tehsil	3,994	6,853	10,021
Halim Zai Tehsil	5,620	8,738	10,149
Pindiali Tehsil	5,895	9,022	13,364
Prang Ghar Tehsil	2,461	4,386	4,285
Safi Tehsil	6,524	8,538	10,522
Upper Mohmand Tehsil	8,963	5,663	7,292
Yake Ghund Tehsil	3,706	6,184	8,340

Source: Census Report of 1998 & 2017, Pakistan Bureau of Statistics

6.1.2 Household Size

In Ambar Utman Khel Tehsil, the number of housing units increased from 3,994 in 1998 to 6,853 in 2017, marking a growth of 71.6%. By 2023, the housing units further increased to 10,021, indicating a 46.3% rise from 2017. Similarly, Halim Zai Tehsil also experienced growth in housing units, rising from 5,620 in 1998 to 8,738 in 2017, which is a 55.4% increase. By 2023, the number of housing units further grew to 10,149, showing a 16.1% increase from 2017. In parallel, Pindiali Tehsil saw significant growth, with housing units increasing from 5,895 in 1998 to 9,022 in 2017, representing a 53% rise. This growth continued at a faster pace, with housing units reaching 13,364 by 2023, a 48% increase from 2017. This increase in housing units suggests ongoing development and population growth in the tehsils, possibly driven by improved infrastructure and economic opportunities.

Safi Tehsil experienced moderate growth, with housing units increasing from 6,524 in 1998 to 8,538 in 2017, a 30.9% rise. The number of housing units further increased to 10,522 by 2023, showing a 23.2% rise from 2017. The steady growth in Safi Tehsil points to consistent development and an increasing demand for housing. In addition, Yake Ghund Tehsil shows robust growth, with housing units increasing from 3,706 in 1998 to 6,184 in 2017, a 66.8% rise. By 2023, the housing units further increased to 8,340, marking a 34.9% rise from 2017. The consistent rise in housing units reflects ongoing development and population growth in the tehsil.

In Upper Mohmand Tehsil, there was a decrease in housing units from 8,963 in 1998 to 5,663 in 2017, marking a significant reduction of 36.8%. However, by 2023, the number of housing units recovered to 7,292, indicating a 28.8% increase from 2017. This fluctuation might be due to factors such as conflict, displacement, or other disruptions, followed by stabilization or resettlement efforts. In Prang Ghar Tehsil, housing units grew from 2,461 in 1998 to 4,386 in 2017, showing a notable increase of 78.2%. However, by 2023, there was a slight decline in housing units to 4,285, marking a 2.3% decrease. This decline could indicate challenges such as migration out of the area, redevelopment, or other socio-economic factors affecting the housing sector.

Although the 2023 census provides separate household size data for rural and urban areas at the national and provincial levels, such disaggregated figures are not available for Mohmand District, where only overall tehsil-level averages are reported. Given this limitation, the projections in this report are based on available tehsil data, which predominantly represent rural settlements. The average household size of 8.6 reported in 2023 reflects a declining trend from earlier decades and aligns with broader regional shifts toward smaller family units. In the absence of official urban-specific household size data for Mohmand, no artificial differentiation has been made between urban and rural estimates. Instead, the tehsil-level averages have been conservatively applied across the district, ensuring consistency with official data and acknowledging Mohmand's primarily rural demographic structure.

The data on average household sizes in Mohmand District and its various tehsils from the 1998, 2017, and 2023 censuses reveal a varying trend towards smaller family units. Ambar Utman Khel Tehsil followed a similar trend as that of overall district, with an increase from 7.8 in 1998 to 8.96 in 2017. This 14.9% growth rate indicates development and population increase. However, by 2023, the rate dropped to 7.9. Similarly, Pindiali Tehsil shows an increase in the growth rate from 8.7 in 1998 to 9.69 in 2017, representing a 11.4% rise. However, by 2023, the rate decreased to 8.4, marking a significant decline. This reduction might reflect socio-economic changes, such as reduced birth rates or increased out-migration, and economic, security and other factors affecting the overall population growth in the tehsil.

In Halim Zai Tehsil, the growth rate increased slightly from 8.5 in 1998 to 8.81 in 2017. By 2023, the rate stabilized at 8.7, indicating a steady population with minor fluctuations. In Safi Tehsil, the growth rate remained relatively stable, increasing marginally from 11.0 in 1998 to 11.04 in 2017. By 2023, there was a slight decrease to 10.4, which might indicate a plateauing of population growth. Similarly, Prang Ghar Tehsil experienced growth from 7.5 in 1998 to 8.21

in 2017. By 2023, the rate increased slightly to 8.4, indicating a consistent but modest population growth. The steady increase could be due to gradual development, improved living conditions, or slight changes in migration patterns.

Upper Mohmand Tehsil shows a consistent pattern, with the growth rate decreasing slightly from 8.9 in 1998 to 8.87 in 2017, and then stabilizing at 8.7 in 2023. This trend reflects a stable population with minimal fluctuations, possibly due to balanced migration and birth rates, indicating a mature population structure. Yake Ghund Tehsil shows stability from 9.1 in 1998 and 2017. However, by 2023, the rate dropped to 7.6, suggesting a significant decline in growth. This drop could be indicative of out-migration, economic difficulties, or other demographic changes impacting the tehsil. The fluctuating trend in average household size in several areas could indicate varying level of changes occurring in each tehsil such as smaller family units, possibly influenced by factors such as better access to education, family planning, and the starting impacts of security situation

Table 29: Comparison of Average Household Size - Mohmand District

Administrative Unit	Census 1998	Census 2017	Census 2023
Mohmand District	9.0	9.37	8.6
Ambar Utman Khel Tehsil	7.8	8.96	7.9
Halim Zai Tehsil	8.5	8.81	8.7
Pindiali Tehsil	8.7	9.69	8.4
Prang Ghar Tehsil	7.5	8.21	8.4
Safi Tehsil	11.0	11.04	10.4
Upper Mohmand Tehsil	8.9	8.87	8.7
Yake Ghund Tehsil	9.1	9.10	7.6

Source: Census Report of 1998, 2017, and 2023, Pakistan Bureau of Statistics

6.1.3 Existing Housing Scheme Public and Private

Mohmand District in Khyber Pakhtunkhwa (KP) has few significant housing projects because its location is remote, it is recovering from conflict and the infrastructure is still poor. Progress in public-sector activities is mainly fueled by federal and provincial work, but it is generally slow. Although the NAHP of the federal government plans long-term housing schemes in tribal areas like Mohmand, none of its projects have started operating yet. In the same vein, the KP government's Awami Saakht Programme which seeks to offer affordable housing in neglected areas across merged districts, talks about pilot schemes, but implementation is still being delayed. Infrastructure efforts, especially for roads and schools, have received the highest priority from the FATA Development Authority which focuses its housing plan on accommodating a small number of families that suffered in the conflict. The Prime Minister's Tribal Districts Development Package distributes money for housing, though most of the funds are needed for urgent things like electricity and healthcare.

Because of security trouble, problems with land ownership and a shortage of basic infrastructure, private housing is almost nonexistent in Mohmand. While small, private builders develop housing in Ghalanai, the big companies are wary of this city. Even though the

assistance by UN-Habitat and UNDP is small compared to need, donor funding helps the organizations focus on rebuilding and fixing shelter for those displaced by conflicts. The World Bank trains rural development professionals which in turn builds strong systems for housing.

6.1.4 Housing Shortage/Backlog

The main aspects that need to be considered for assessing housing backlog include population, household size and the current housing stock. The overall required number of houses in Mohmand district was calculated by dividing the current population with the household size of each census. The difference between the number of houses required and the existing housing stock gives the current housing backlog which turns out to be 1,240 units in the year 2017.

The projected population for the year 2023 shows an increase of 553,933 people in five years. This constant increase results in increasing demand of housing units. The total requirement as per current population and household size of Mohmand District turns out to be 438 units till 2023 as mentioned below;

Table 30: Housing Backlog Mohmand District

Year	Population	Household size	Required housing units	Existing housing units	Backlogs
2017	474,345	9.37	50,624	49,384	1,240
2023	553,933	8.60	64,411	63,973	438

Source: Census Report of 2017, 2023, Pakistan Bureau of Statistics

The housing situation across Ghalanai and other settlements has been assessed based on projected population for 2025, household size from census data, and existing housing units.

Ghalanai, with a projected population of 46,012 in 2025 and an average household size of 8.7, currently has 3,067 housing units. The required number of units to adequately house the population is estimated at 5,289, leaving a backlog of 2,221 units and an unserved population of 19,325. The area occupied by existing settlements is approximately 211.71 acres.

Yake Ghund, with a projected population of 50,541 and an average household size of 7.6, has 3,369 existing housing units. The required housing units are 6,650, resulting in a backlog of 3,281 units and an unserved population of 24,933. The settlement spans approximately 681.76 acres.

Pindiali has a projected 2025 population of 40,364 and an average household size of 8.4. Existing housing units' number 2,691, while 4,805 units are required, creating a backlog of 2,114 units and leaving 17,760 people without adequate housing. The settlement occupies 356.56 acres. Utman Khel VC-2&9, with a population of 28,547 and an average household size of 7.9, has 1,903 existing units. The housing requirement is 3,614 units, giving a backlog of 1,710 units and an unserved population of 13,512 across an area of 256.56 acres.

Qandahari VC-3&2, with a projected population of 22,347 and household size of 10.4, has 1,490 existing housing units. The required units are 2,149, leaving a backlog of 659 units and an unserved population of 6,853. The settlement covers 102.96 acres. Prang Ghar has a

projected population of 11,092 and a household size of 8.4. Existing units number 555, while 1,320 units are required, resulting in a backlog of 766 units and 6,433 people without adequate housing. The settlement area is 76.58 acres.

Lakarai, with a population of 7,452 and an average household size of 10.4, has 373 housing units. The required number of units is 716, giving a backlog of 344 units and an unserved population of 3,577. The area occupied is 41.92 acres. Baizai-4, with a population of 3,874 and household size of 8.7, has 194 existing housing units. The required number of units is 445, leaving a backlog of 252 units and 2,189 people unserved. The settlement occupies 37.74 acres.

Overall, all settlements show significant housing deficits relative to their projected populations, with the largest backlog observed in Yake Ghund, followed by Ghalanai and Pindiali. Addressing these deficits will require planned expansion of housing infrastructure, efficient land use, and consideration of sustainable, high-density solutions to accommodate future population growth while optimizing the use of available settlement areas.

Table 31: Housing Backlog Urban Centre and Settlements

Settlements	Year	Population 2025	Household Size (Census)	Existing Housing Units	Required Housing Units	Backlogs	Un Served Population	Area/Acres
Ghalanai	2025	46012	8.7	3,067	5,289	2,221	19325	211.71
Yake Ghund		50541	7.6	3,369	6,650	3,281	24933	681.76
Pindiali		40364	8.4	2,691	4,805	2,114	17760	356.56
Utman Khel Vc-2&9		28547	7.9	1,903	3,614	1,710	13512	256.56
Qandahari Vc-3&2		22347	10.4	1,490	2,149	659	6853	102.96
Prang Ghar		11092	8.4	555	1,320	766	6433	76.58
Lakarai		7452	10.4	373	716	344	3577	41.92
Baizai -4		3874	8.7	194	445	252	2189	37.74

Source: Calculated by Consultants

6.1.5 Additional Housing Demand (2025-2045)

6.1.5.1 Urban Centre

6.1.5.1.1 Ghalanai

An assessment of additional housing demand has been carried out for Ghalanai, the primary urban center within the planning area, based on projected population growth for the years 2025 and 2045. The analysis applies a consistent average household size of 8.7 persons per household, assumed to remain constant throughout the planning horizon, to estimate current and future housing requirements.

Ghalanai's population is projected to increase from 46,012 persons in 2025 to 73,704 persons by 2045, reflecting sustained urbanization and its role as a major administrative and service hub. Based on the prevailing household size, the existing housing requirement is estimated at approximately 5,289 housing units in 2025, which is projected to increase to 8,472 housing units by 2045. This results in an additional demand of around 3,183 housing units over the planning period.

Table 32: Additional Housing Demand in Urban centers (Current 2025 and Future 2045)

Ghalanai		
Projected Population	***2025***	***2045***
	46,012	73,704
Household Size from 2025 till 2045	8.70	
Future Requirements Housing Units for 2042	5,289	8,472

Source: Calculated by Consultants

6.1.5.2 Potential Urban Centre

A detailed assessment of housing demand has been undertaken for Yake Ghund, Pindiali, Utman Khel VC-2 & VC-9, and Qandahari VC-3 & VC-2, which represent some of the largest and fastest-growing settlements within the planning area. The analysis is based on projected population figures for 2025 and 2045 and applies area-specific average household sizes, assumed to remain constant throughout the planning horizon, to estimate existing and future housing requirements.

Yake Ghund is projected to witness substantial demographic growth, with its population increasing from 50,541 persons in 2025 to 80,614 persons by 2045. Based on an average household size of 7.6 persons, the settlement's housing requirement is estimated at approximately 6,650 housing units in 2025, rising significantly to 10,607 units by 2045. This represents an additional demand of nearly 3,957 housing units, indicating intense future pressure on land availability, infrastructure, and municipal services. Yake Ghund therefore qualifies as a primary residential growth centre, requiring planned densification and large-scale residential land allocation.

Pindiali shows a sharp increase in population, nearly doubling from 40,364 persons in 2025 to 80,180 persons in 2045. With an average household size of 8.4 persons, the settlement requires around 4,805 housing units in 2025, which will increase to 9,545 housing units by 2045. The resulting additional demand of approximately 4,740 housing units is among the highest across the assessed settlements, underscoring the urgency for structured residential expansion, serviced housing schemes, and the prevention of informal sprawl.

The combined area of Utman Khel VC-2 and VC-9 is projected to grow rapidly, with population increasing from 28,547 persons in 2025 to 63,675 persons by 2045. Assuming an average household size of 7.9 persons, housing demand is estimated at 3,614 units in 2025, rising

sharply to 8,060 units by 2045. This equates to an additional requirement of approximately 4,446 housing units, reflecting very high growth momentum and positioning the area as a strategic zone for future residential development and infrastructure investment.

Qandahari VC-3 and VC-2 exhibit comparatively moderate growth, with population projected to increase from 22,347 persons in 2025 to 31,714 persons in 2045. Due to a relatively high average household size of 10.4 persons, the housing requirement is lower in unit terms, increasing from 2,149 units in 2025 to 3,049 units by 2045. The additional demand of about 900 housing units indicates gradual residential expansion, with emphasis needed on upgrading existing housing stock rather than large-scale outward expansion.

Table 33: Additional Housing Demand in Potential urban centers (Current 2025 and Future 2045)

Yake Ghund		
Projected Population	2025	2045
	50,541	80,614
Household Size from 2025 till 2045	7.60	
Future Requirements Housing Units for 2042	6,650	10,607
Pindiali		
Projected Population	2025	2045
	40,364	80,180
Household Size from 2025 till 2045	8.40	
Future Requirements Housing Units for 2042	4,805	9,545
Utman Khel Vc-2&9		
Projected Population	2025	2045
	28,547	63,675
Household Size from 2025 till 2045	7.90	
Future Requirements Housing Units for 2042	3,614	8,060
Qandahari Vc-3&2		
Projected Population	2025	2045
	22,347	31,714
Household Size from 2025 till 2045	10.40	
Future Requirements Housing Units for 2042	2,149	3,049

Source: Calculated by Consultants

6.1.5.3 Potential Urban Settlements / Areas

An assessment of additional housing demand has been carried out for selected potential settlements, namely Baizai-4, Lakarai, Prang Ghar based on projected population growth for the years 2025 (current) and 2045 (future). The analysis applies settlement-specific average household sizes, assumed to remain constant over the planning horizon, to estimate the number of required housing units and to identify future residential pressure in these areas.

Baizai-4 is projected to experience a population increase from 7,158 persons in 2025 to 11,031 persons by 2045, reflecting steady demographic growth. With an average household size of 8.7 persons per household, the settlement requires approximately 823 housing units in 2025, which will increase to 1,268 housing units by 2045. This growth indicates a net additional

demand of around 445 housing units over the planning period, highlighting the need for phased residential land allocation and supporting infrastructure.

In Lakarai, the population is projected to grow from 7,452 in 2025 to 10,575 in 2045. Owing to a relatively higher average household size of 10.4 persons per household, the number of required housing units is comparatively lower when assessed against population figures. The settlement requires about 716 housing units in 2025, increasing to 1,017 units by 2045, resulting in an additional demand of approximately 301 housing units. This reflects the influence of larger household sizes on moderating housing unit demand, though pressure on existing housing stock will still intensify.

Prang Ghar emerges as the most significant growth node among the assessed settlements. The population is projected to increase from 11,092 persons in 2025 to 17,639 persons by 2045. With an average household size of 8.4, the housing requirement is estimated at 1,320 units in 2025, rising sharply to 2,100 units by 2045. This translates into an additional demand of approximately 780 housing units, underscoring the need to prioritize Prang Ghar for planned residential expansion, serviced plots, and integrated neighborhood development.

Khwezai VC-1 is projected to grow from 6,337 persons in 2025 to 9,767 persons in 2045. Based on an average household size of 8.7, the settlement requires 728 housing units in 2025, increasing to 1,123 units by 2045. The resulting additional demand of about 395 housing units indicates moderate to high residential growth, necessitating proactive planning to avoid unplanned sprawl and to ensure adequate access to basic services.

Table 34: Additional Housing Demand in Potential Settlements/areas (Current 2025 and Future 2045)

Baizai -4		
Projected Population	2025	2045
	7,158	11,031
Household Size from 2025 till 2045	8.70	
Future Requirements Housing Units for 2042	823	1,268
Lakarai		
Projected Population	2025	2045
	7,452	10,575
Household Size from 2025 till 2045	10.40	
Future Requirements Housing Units for 2042	716	1,017
Prang Ghar		
Projected Population	2025	2045
	11,092	17,639
Household Size from 2025 till 2045	8.40	
Future Requirements Housing Units for 2042	1,320	2,100

Source: Calculated by Consultants

6.1.6 Future Area Requirement

This section presents a comprehensive analysis of existing and projected housing needs across urban centers, potential urban centers, and potential settlements, assessing gaps, required land, and phased development strategies from 2025 to 2045. The assessment evaluates projected populations, required housing units, and backlogs, while factoring in proposed plot sizes, residential zones, and allied land uses to determine the total area necessary for sustainable settlement expansion.

For urban centers, housing demand is analyzed across multiple residential zones, including Infill (0–10 Marla), Short Term (10–20 Marla), Medium Term (20–40 Marla), and Long Term (>40 Marla) zones. Each zone is designed to accommodate a proportion of the population, with land allocation and plot sizes reflecting settlement patterns, population density, and housing needs. The proposed plot sizes are based on detailed assessments of existing areas and are designed to meet both current and future housing demands.

In potential urban centers, including Mamund, Lara Dandokaii, and Gardai Utman Khel, housing needs are similarly distributed across Short, Medium, and Long Term Residential Zones, reflecting population proportions and proposed plot sizes. The phased approach ensures that residential expansion aligns with projected population growth, settlement patterns, and infrastructure capacity, while providing flexibility to adjust plot sizes to accommodate different income groups and resources.

For potential settlements, such as Salarzai, Nawagai, and Barang, housing demand is smaller but still significant. Planned residential zones are categorized as Short, Medium, and Long Term, based on population distribution and average plot sizes. The phased approach ensures that land allocation aligns with population growth, settlement patterns, and infrastructure capacity, while maintaining flexibility for alternative plot sizes when required.

Overall, this analysis highlights a structured, phased housing strategy across urban and peri-urban areas, ensuring adequate land provision, sustainable settlement expansion, and flexibility to respond to future demographic changes, infrastructure capacity, and community needs.

Table 35: Existing and Proposed Future area requirement of housing

Settlements	Existing Housing Units	Required Housing Units	Backlogs	*Proposed Plot Size*	*Proposed Zones*	Percentage	Population	Req. Housing Units	Area Required (Marla)	Area into Acres	Area Required for Allied Uses	Total Area Required Phase-Wise	Existing GAP (Acres)	Total Area Required (Acres) (2025-2045)	Total Area Proposed Acres (2026-2045)
Urban Centre															
Ghalanai	3,067	5,289	2,221	Upto 10 Marla	Residential Zone (Master Plan)	55%	15,231	1751	17506	109.42	54.71	164.12	116.44	644.40	51.00
				20 Marla & above	Long Term	45%	12,461	1432	28647	179.04	89.52	268.57	95.27		1174.00
				Total		**100%**	**27,692**	**3183**	**46153**	**288.46**	**144.23**	**432.69**	**211.71**		**1225.00**
Potential Urban Centre															
Yake Ghund															
Yake Ghund	3,369	6,650	3,281	10-20 Marla	Short Term Residential Zone	15%	4,511	594	8903	55.65	27.82	83.47	102.26	1915.22	330.86
				20-40 marla	Medium Term Residential Zone	30%	9,022	1187	35613	222.58	111.29	333.87	204.53		298.00
				40 Marla & Above	Long Term Residential Zone	55%	16,540	2176	87053	544.08	272.04	816.13	374.97		385.11
				Total		**100%**	**30,073**	**3957**	**131569**	**822.31**	**411.15**	**1233.46**	**681.76**		**1013.97**
Pindiali															
Pindiali	2,691	4,805	2,114	Upto 10 Marla	Infill Residential	10%	3,982	474	4740	29.63	14.81	44.44	35.66	1489.72	26.81
				10-20 marla	Short Term Residential Zone	40%	15,926	1896	28440	177.75	88.88	266.63	142.62		262.31
				20-40 marla	Medium Term Residential Zone	15%	5,972	711	21330	133.31	66.66	199.97	53.48		296.99
				40 Marla & Above	Long Term Residential Zone	35%	13,936	1659	66360	414.75	207.38	622.13	124.80		358.00
				Total		**100%**	**39,816**	**4740**	**120870**	**755.44**	**377.72**	**1133.16**	**356.56**		**944.11**
Utman Khel Vc-2&9															
Utman Khel Vc-2&9	1,903	3,614	1,710	10-20 Marla	Short Term Residential Zone	50%	17,564	2223	33349	208.43	104.22	312.65	128.28	1257.04	217.82
				20-40 marla	Medium Term Residential Zone	35%	12,295	1556	46689	291.81	145.90	437.71	89.80		310.53
				40 Marla & Above	Long Term Residential Zone	15%	5,269	667	26679	166.75	83.37	250.12	38.48		383.55
				Total		**100%**	**35,128**	**4447**	**106718**	**666.99**	**333.49**	**1000.48**	**256.56**		**911.90**
Qandahari Vc-3&2															
Qandahari Vc-3&2	1,490	2,149	659	10-20 Marla	Short Term Residential Zone	50%	4,684	450	6756	42.22	21.11	63.34	51.48	314.08	
				20-40 marla	Medium Term Residential Zone	25%	2,342	225	6756	42.22	21.11	63.34	25.74		218.66

				40 Marla & Above	Long Term Residential Zone	25%	2,342	225	9008	56.30	28.15	84.45	25.74		405.68
				Total		**100%**	**9,368**	**901**	**22519**	**140.75**	**70.37**	**211.12**	**102.96**		**438.10**
Potential Settlement															
Prang Ghar															
Prang Ghar	555	1,320	766	Upto 10 Marla	Short Term Residential Zone	25%	1,637	195	1949	12.18	6.09	18.27	19.15	193.49	53.29
				10-20 marla	Medium Term Residential Zone	30%	1,964	234	3507	21.92	10.96	32.88	22.97		37.05
				20 Marla & above	Long Term Residential Zone	45%	2,946	351	7015	43.84	21.92	65.76	34.46		100.26
				Total		**100%**	**6,547**	**779**	**12470**	**77.94**	**38.97**	**116.91**	**76.58**		**190.60**
Lakarai															
Lakarai	373	716	344	Upto 20 Marla	Medium Term Residential Zone	55%	1,718	165	2478	15.49	7.74	23.23	23.06	96.83	207.38
				More than 20 Marla	Long Term Residential Zone	45%	1,406	135	3379	21.12	10.56	31.68	18.86		312.66
				Total		**100%**	**3,124**	**300**	**5858**	**36.61**	**18.30**	**54.91**	**41.92**		**520.04**
Baizai -4															
Baizai -4	194	445	252	Upto 20 Marla	Medium Term Residential Zone	40%	1,550	178	2672	16.70	8.35	25.05	15.10	137.93	83.12
				More than 20 Marla	Long Term Residential Zone	60%	2,324	267	8015	50.09	25.05	75.14	22.64		325.33
				Total		**100%**	**3,874**	**445**	**10687**	**66.79**	**33.40**	**100.19**	**37.74**		**408.45**

- ***Ghalanai***

Ghalanai, as the primary urban center, currently has 3,067 existing housing units and faces a backlog of 2,221 units, with a total required housing demand of 5,289 units. The projected population for 2025–2045 is 27,692, necessitating approximately 3,183 new housing units.

The residential zones are planned based on plot sizes derived from detailed assessments of existing settlement patterns and population densities. Short-term residential zones consist of plots up to 10 Marla, covering 55% of the development area, while long-term residential zones are for 20 Marla and above, accounting for 45%. The proposed land allocation includes both residential plots and allied uses, such as roads, parks, and civic amenities.

For the short-term 10 Marla plots, the area required is 109.42 acres, with an additional 54.71 acres for allied uses, totaling 164.12 acres. Long-term plots (20 Marla and above) require 179.04 acres, with 89.52 acres for allied uses, totaling 268.57 acres. Combining all phases, Ghalanai requires 432.69 acres of land for residential development, with 211.71 acres representing the existing gap. The total area required from 2025–2045 is projected at 1,225 acres.

- ***Yake Ghund***

Yake Ghund, a potential urban center, currently has 3,369 existing housing units with a backlog of 3,281 units, bringing the total required housing units to 6,650. The projected population for 2025–2045 is 30,073, necessitating approximately 3,957 new housing units to meet future demand.

The residential zones are planned using 10–20 Marla, 20–40 Marla, and 40 Marla & above plots, based on detailed density and settlement assessments of the area. Short-term residential zones (10–20 Marla) cover 15% of the development, medium-term zones (20–40 Marla) cover 30%, and long-term zones (40 Marla & above) occupy 55%, ensuring a phased and realistic approach to land allocation.

The short-term plots require 55.65 acres with 27.82 acres for allied uses, totaling 83.47 acres, while medium-term plots need 222.58 acres with 111.29 acres for allied uses, totaling 333.87 acres. Long-term plots demand 544.08 acres, with 272.04 acres for allied uses, totaling 816.13 acres. The total area required across all phases is 1,233.46 acres, including an existing gap of 681.76 acres, with the overall projected land requirement from 2026–2045 being 1,013.97 acres.

- ***Pindiali***

Pindiali currently has 2,691 existing housing units with a backlog of 2,114 units, resulting in a total required housing demand of 4,805 units. The projected population for 2025–2045 is 39,816, requiring approximately 4,740 new housing units to accommodate growth.

Residential planning is organized across infill, short-term, medium-term, and long-term zones with plot sizes ranging from up to 10 Marla to 40 Marla & above, determined through density-based assessments of the existing settlements and land use patterns. Short-term zones cover

10–20 Marla plots (40%), medium-term zones cover 15%, and long-term zones for larger plots account for 35%, providing a phased approach aligned with population projections.

The infill 10 Marla plots require 29.63 acres, with 14.81 acres for allied uses, totaling 44.44 acres. Short-term plots require 177.75 acres plus 88.88 acres for allied uses, totaling 266.63 acres. Medium-term plots demand 133.31 acres plus 66.66 acres for allied uses, totaling 199.97 acres, and long-term plots require 414.75 acres plus 207.38 acres for allied uses, totaling 622.13 acres. The overall land requirement across all phases sums to 1,133.16 acres, with an existing gap of 356.56 acres and a total projected requirement from 2025–2045 of 944.11 acres.

- ***Utman Khel VC-2 & 9***

Utman Khel VC-2 & 9 currently has 1,903 existing housing units with a backlog of 1,710 units, resulting in a total required housing demand of 3,614 units. The projected population for 2025–2045 is 35,128, requiring approximately 4,447 new housing units. Residential development is planned across short-term (10–20 Marla), medium-term (20–40 Marla), and long-term (40 Marla & above) zones, based on detailed density and settlement assessments. The phased allocation is 50% short-term, 35% medium-term, and 15% long-term, ensuring realistic planning aligned with population growth and land availability.

- Short-term plots require 208.43 acres, with 104.22 acres for allied uses, totaling 312.65 acres.
- Medium-term plots require 291.81 acres, with 145.90 acres for allied uses, totaling 437.71 acres.
- Long-term plots require 166.75 acres, with 83.37 acres for allied uses, totaling 250.12 acres.

The total land required across all phases is 1,000.48 acres, with an existing gap of 256.56 acres, and the projected total requirement for 2025–2045 is 911.90 acres. The proposed plot sizes are derived from existing settlement patterns and density analysis, ensuring that the development is both realistic and sustainable. They are flexible and can be adjusted according to income groups, available resources, land availability, and future population projections

- ***Qandahari VC-3 & 2***

Qandahari VC-3 & 2 currently has 1,490 existing housing units with a backlog of 659 units, resulting in a total required housing demand of 2,149 units. The projected population for 2025–2045 is 9,368, necessitating approximately 901 new housing units.

Residential planning is organized across short-term (10–20 Marla), medium-term (20–40 Marla), and long-term (40 Marla & above) zones, with allocation of 50% short-term, 25% medium-term, and 25% long-term, based on existing density assessments and settlement patterns.

- Short-term plots require 42.22 acres, with 21.11 acres for allied uses, totaling 63.34 acres.
- Medium-term plots require 42.22 acres, with 21.11 acres for allied uses, totaling 63.34 acres.
- Long-term plots require 56.30 acres, with 28.15 acres for allied uses, totaling 84.45 acres.

The total land required across all phases is 211.12 acres, with an existing gap of 102.96 acres, and the total projected requirement from 2025–2045 is 438.10 acres. These plot sizes are proposed based on realistic settlement assessments, considering density and population trends, and remain flexible to accommodate different income groups, available land, and *resources.*

- ***Prang Ghar***

Prang Ghar, a potential settlement, currently has 555 existing housing units with a backlog of 766 units, bringing the total required housing units to 1,320. The projected population for 2025–2045 is 6,547, necessitating approximately 779 new housing units. Residential planning is divided into short-term (up to 10 Marla), medium-term (10–20 Marla), and long-term (20 Marla & above) zones, based on existing density and settlement assessments. The phased allocation is 25% short-term, 30% medium-term, and 45% long-term, ensuring that land requirements are realistically aligned with growth and resource availability.

- Short-term plots require 12.18 acres, with 6.09 acres for allied uses, totaling 18.27 acres.
- Medium-term plots require 21.92 acres, with 10.96 acres for allied uses, totaling 32.88 acres.
- Long-term plots require 43.84 acres, with 21.92 acres for allied uses, totaling 65.76 acres.

The total area required across all phases is 116.91 acres, with an existing gap of 76.58 acres, and the total projected land requirement from 2026–2045 is 190.60 acres.

- Lakarai

Lakarai currently has 373 existing housing units with a backlog of 344 units, resulting in a total required housing units of 716. The projected population for 2025–2045 is 3,124, requiring approximately 300 new housing units.

Residential zones are planned as medium-term (up to 20 Marla) and long-term (more than 20 Marla) plots, based on existing density and land use assessments. Medium-term plots account for 55%, while long-term plots cover 45% of the development area.

- Medium-term plots require 15.49 acres, with 7.74 acres for allied uses, totaling 23.23 acres.

- Long-term plots require 21.12 acres, with 10.56 acres for allied uses, totaling 31.68 acres.

The total area required across all phases is 54.91 acres, with an existing gap of 41.92 acres, and the total projected land requirement from 2026–2045 is 520.04 acres.

- ***Baizai-4***

Baizai-4 currently has 194 existing housing units with a backlog of 252 units, resulting in a total required housing units of 445. The projected population for 2025–2045 is 3,874, requiring approximately 445 new housing units.

Residential planning is divided into medium-term (up to 20 Marla) and long-term (more than 20 Marla) zones, based on density and settlement assessments. Medium-term plots cover 40%, while long-term plots cover 60% of the total residential development.

- Medium-term plots require 16.70 acres, with 8.35 acres for allied uses, totaling 25.05 acres.
- Long-term plots require 50.09 acres, with 25.05 acres for allied uses, totaling 75.14 acres.

The total area required across all phases is 100.19 acres, with an existing gap of 37.74 acres, and the total projected land requirement from 2026–2045 is 408.45 acres. These plot sizes are proposed based on realistic assessments of settlement density and existing conditions, but are flexible, allowing for adjustments depending on income groups, available land, resources, and future population projections.

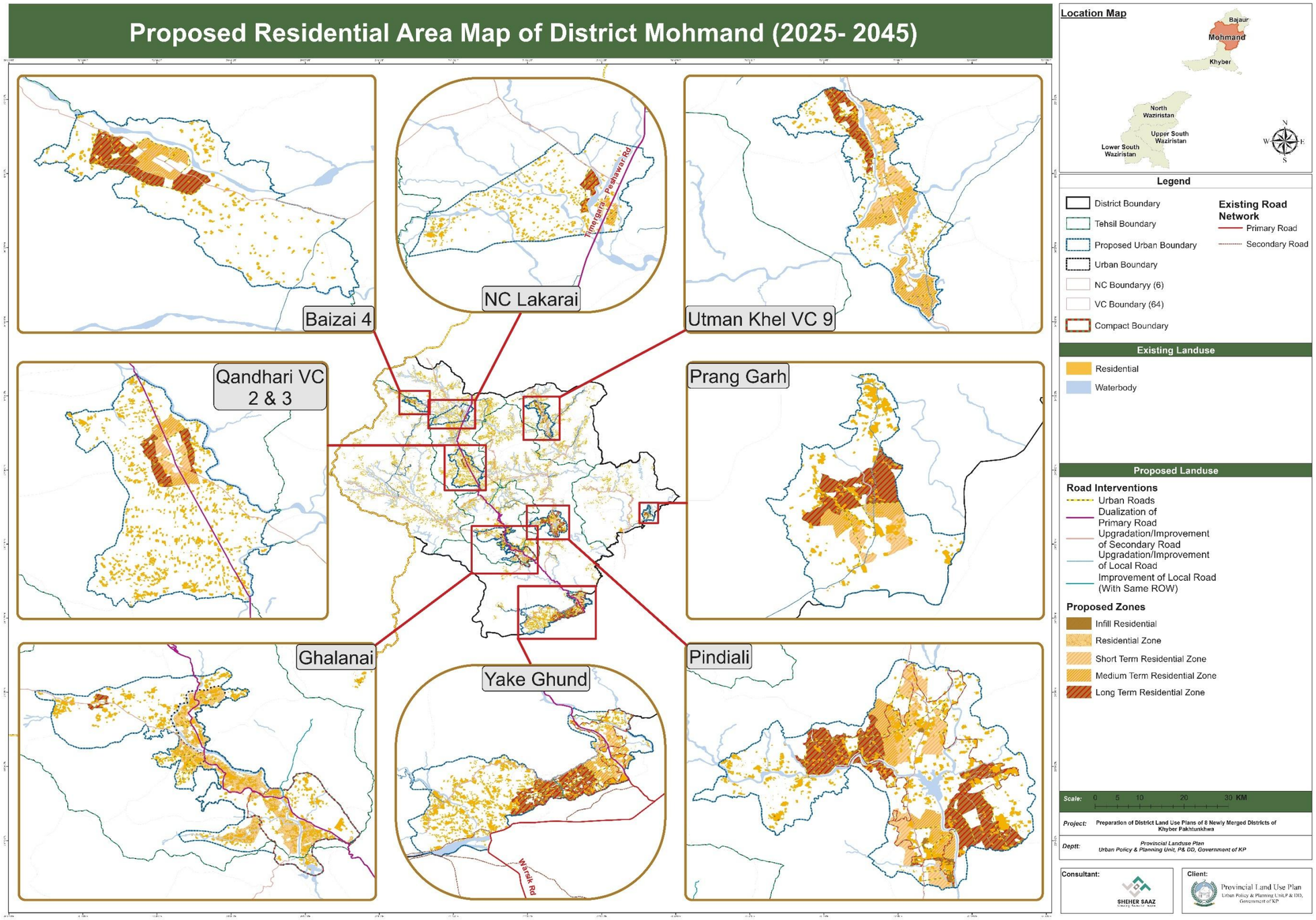
6.1.7 Proposed Locations and Area for New Housing Areas (Residential Zones)

The future housing demand of District Mohmand cannot be absorbed solely through infill development. In addition to the identified infill parcels, new residential zones have been delineated across the district to accommodate population growth up to 2045. These areas are strategically located within established urban centers and in potential Village Councils earmarked for urbanization under the settlement hierarchy framework. The proposed zoning approach follows a phased development strategy short, medium, and long term to align land release with actual demand and infrastructure expansion.

Existing Land Uses	***Existing Area/Acre***	***Proposed***	***Proposed Area/Acre***	***Total Proposed***
Ghalanai Urban Centre				
Residential	968.86	Proposed Residential Zone (Master Plan)	1174.47	1225.47
		Long Term Residential Zone	51.00	
Potential Urban Centre				
Yake Ghund				
Residential	1408.85	Infill Residential	21.56	2074.11
		Short Term Residential Zone	215.71	
		Medium Term Residential Zone	552.60	

		Long Term Residential Zone	1284.24	
Pindiali				
Residential	513.18	Infill Residential	30.11	1541.72
		Short Term Residential Zone	443.21	
		Medium Term Residential Zone	282.57	
		Long Term Residential Zone	785.83	
Utman Khel VC 9				
Residential	281.22	Short Term Residential Zone	496.91	1316.00
		Medium Term Residential Zone	521.44	
		Long Term Residential Zone	297.65	
Qandhari VC 3&2				
Residential	646.59	Short Term Residential Zone	219.67	625.36
		Medium Term Residential Zone	163.13	
		Long Term Residential Zone	242.56	
Potential Settlement				
Bazai-4				
Residential	61.31	Medium Term Residential Zone	73.27	236.04
		Long Term Residential Zone	162.77	
Lakarai				
Residential	220.82	Medium Term Residential Zone	79.77	190.27
		Long Term Residential Zone	110.50	
Prang Ghar				
Residential	88.65	Short Term Residential Zone	43.00	226.80
		Medium Term Residential Zone	59.48	
		Long Term Residential Zone	124.32	

Map 32: Proposed Residential Development - District Mohmand



6.2 TRADE ZONES, COMMERCIAL AREAS & MIXED LAND USE ZONES

6.2.1 Current Commercial Area Gap

Mohmand District, faces a significant commercial areas gap, particularly in its urban center of Ghalanai. This gap highlights the disparity between the existing commercial infrastructure, which is often adequate in quantity but deficient in quality, organization, and supporting facilities, and the growing demands driven by population expansion, economic activities such as marble processing, and challenges from post-merger integration with mainland Pakistan. Drawing from urban planning assessments, economic reports, and regional analyses, the key issues include unregulated growth, infrastructure shortfalls, economic pressures, security disruptions, and environmental vulnerabilities, all of which impede sustainable commercial development.[2]

The commercial development in Mohmand is largely unregulated and dispersed, with activities concentrated in hubs such as Ghalanai Bazar, which serves the southern urban area, and Mian Mandi Bazar, which caters to the north, encompassing approximately 37-38 acres, or 1% of the project area. Although this surpasses the current requirement of 16.2 acres for a 2022 population of 32,422 based on national standards, the layout follows haphazard ribbon development along major roads without diversified zoning for wholesale, storage, or mixed-use purposes. By 2040, with an anticipated population of 63,702 at a 2.8% annual growth rate, an additional 24 acres will be needed. Still, the existing fragmentation leads to inefficiencies, underutilization, and unauthorized conversion of agricultural or vacant land, lacking neighborhood-level facilities and increasing dependency on central markets.[3]

6.2.2 Proposed Locations for New Commercial Areas and Mixed Land Use Zones

Internationally, the allocation of commercial land is generally determined in terms of floor space per capita or as a percentage of total urban land use, rather than a fixed acreage per population. For example, in the United States, commercial land typically accounts for 5–10% of total urban land, with retail floor space ranging between 20–40 square feet per person (around 2–3.7 m² per capita). In the United Kingdom, benchmarks usually fall between 2–3 m² per person, guided by a "town center first" policy that prioritizes compact, service-oriented growth. Similarly, UN-Habitat and World Bank guidelines suggest that commercial and business uses together should occupy 5–7% of urban land, which translates to about 1.5–2.5 m² per capita. In South Asia, India's URDPFI Guidelines (2015) recommend around 0.8–1.2 acres per 1,000 people, or 0.15–0.25 m² of commercial space per person at different planning levels, which aligns closely with international averages but adjusts for higher densities.

In contrast, Pakistan follows the planning standard of 1 acre per 1,000 people (≈4 m² per capita) as defined in the National Reference Manual (NRM) of Planning Standards. This ratio is relatively higher than international averages, but it reflects the low- to medium-density settlement pattern in Pakistan, where commercial activity is plot-based, spread across bazaars, and rarely concentrated in multi-story retail complexes. The higher allocation ensures

[2] https://urbanpolicyunit.gkp.pk/wp-content/uploads/2020/03/Final-Structure-Plan-Ghalanai.pdf
[3] https://urbanpolicyunit.gkp.pk/wp-content/uploads/2023/07/Task-C-Draft-Master-Plan_Ghalanai.pdf

sufficient land for wholesale markets, truck terminals, and service-related commercial activities that are spatially more land-intensive than in compact, high-rise urban models. It also provides flexibility for future expansion of economic activity, recognizing that Pakistan's urban centers often evolve organically with scattered, mixed-use growth rather than tightly zoned systems.

On this Basis, the commercial total area from the Mohmand district was calculated:

Table 36: Total Commercial Area in Mohmand Area

Commercial Area Requirement (Till-2045) Using NRM Standard				
Name	***Total Population 2045***	***Existing Area/Acre***	***Area Required 2045/Acre***	***Standard***
Ghalanai	73704	87.79	73.70	1-Acre for 1000 Population
Yake Ghund	80614	82.18	80.61	
Pindiali	80180	1.91	80.18	
Utman Khel Vc-2&9	63675	6.31	63.67	
Qandahari Vc-3&2	31714	27.38	31.71	
Prang Ghar	17639	0.08	17.64	
Lakarai	10575	12.32	10.58	
Baizai -4	11031	0.04	11.03	

Source: Developed by Consultant, 2025

6.2.3 Analysis of LSA of Commercial Area

After calculating the required total area, it is important to see which land is suitable for the provision of a Commercial area. To perform LSA, it is important to develop a set of criteria that helps identify the area. (Refer to chapter 5, section 5.2.2.)

6.2.4 Proposed Commercial Area

The following table explains the proposed commercial activity in each settlement.

Table 37: Total Commercial Area in Mohmand Area

Name	Type of Commercial Activity	Proposed Area/Acre
Ghalanai	CBD	37.40
	Commercial Zone (Master Plan)	27.61
	Grain Market or Commercial Zone	8.20
Yake Ghund	CBD	14.90
	Commercial Zone	12.65
	Grain Market	3.32
Pindiali	CBD	11.83
	Linear Commercial	57.57
	Grain Market	7.14
Utman Khel Vc-2&9	CBD	18.97
	Commercial Zone	16.80
	Linear Commercial	24.87
	Grain Market	5.97
Qandahari Vc-3&2	Commercial Zone	19.02
	Grain Market	9.88
Prang Ghar	Commercial Zone	17.58
Lakarai	Commercial Zone	14.38
	Grain Market	3.47
Baizai -4	Linear Commercial	12.96

Source: Developed by Consultant, 2025

- ***Ghalanai Urban Centre:***

Ghalanai, Mohmand District's administrative headquarters and key urban hub, has been given 73.21 acres under the proposed Commercial Zone. The allotment is intended to support both current commercial activity and anticipated future demand for retail, office, and mixed commercial uses. The zoning focuses commercial growth on the district's primary urban node, emphasizing efficient land use, accessibility, and agglomeration benefits. It strengthens Ghalanai's position as the district's primary economic core and regional commercial hub, as evidenced by gravitational and centrality assessments, and ensures the district's economic base's long-term viability and vitality.

- ***Yeka Ghund Potential Urban Centre:***

Yeka Ghund has been designated a future urban hub, with growth expected by 2045, owing to its strategic location and direct connectivity to the Mohmand district. To address expected economic growth along the activity corridor, a 14.90-acre Central Business District (CBD) has been proposed to accommodate higher-order commercial and service functions. In addition, a 12.65-acre Business Zone has been established to meet the needs of the growing population for everyday business.

A 3.32-acre Grain Market has been proposed along the activity corridor to boost the local agrarian economy and strengthen agricultural value chains. The combined commercial allocation of roughly 30.87 acres promotes route-based commerce, strengthens regional

connections, and provides accessible services to Yeka Ghund and its surrounding communities, ensuring planned and long-term economic development.

- ***Utman Khel Potential Urban Centre:***

Utman Khel, a potential urban centre, has been designated with 18.97 acres for a Proposed Central Business District (CBD), 16.80 acres for Commercial Zones, 24.87 acres for Linear Commercial Development, and 5.97 acres for a Grain Market to support and sustain local agriculture.

The CBD is designed to concentrate higher-level commercial, business, and service functions within the urban core, whereas Commercial Zones provide space for daily retail and service needs. Linear commercial development along major transport corridors encourages corridor-based trade and strengthens regional connectivity. The grain market protects agricultural livelihoods, promotes agro-based commerce, and strengthens local economic ties. Collectively, these commercial allocations ensure balanced economic growth, reduce dependence on distant centres, improve accessibility, and promote sustainable urban development consistent with Utman Khel's emerging role in the district's urban hierarchy.

- ***Pindiali Potential Urban Centre:***

Pindiali, recognised as a prospective urban hub, has been assigned around 84.55 acres for commercial purposes. This includes 57.57 acres dedicated to Linear Commercial, an 11.83-acre Central Business District (CBD), and a 7.14-acre Grain Market. The large Linear Commercial zone promotes corridor-based, frontage-focused trade, enhancing commerce along key transportation routes, and benefiting nearby settlements such as Dawezai and Issa Khel. It also takes advantage of Pindiali's strategic position, approximately 43.5 km from Ghalanai.

The CBD aims to concentrate higher-level commercial, administrative, and service activities, acting as a hub for the city's economic life. The Grain Market promotes agricultural trade, supports local farming, and enhances the economic connections between rural and urban areas.

- ***Prang Ghar Potential Settlement:***

Prang Ghar, designated as a potential settlement, has been allocated 17.58 acres for a Proposed Commercial Zone. The settlement is located approximately 4 km from the MOTO SHAH Dam, a prominent tourist attraction expected to increase visitor flows to the area. The commercial zone is designed to meet the settlement's daily retail and service needs and to capitalize on tourism-driven demand, supporting facilities such as shops, food services, and hospitality.

- ***Qandhari Vc-2&3 Potential Urban Centre:***

Qandahari (VC-2 & VC-3), identified as a potential urban centre, has been allocated 19.02 acres for a Proposed Commercial Zone and 9.88 acres for a Grain Market along the Mohmand Agency Road, for a total commercial allocation of about 28.9 acres.

The proposed Commercial Zone will accommodate retail, service, and administrative operations to meet the settlement's growing population needs. The Grain Market is a stand-alone institution that promotes agricultural trade, preserves and strengthens local agriculture, and provides organised areas for agro-economic activities. These commercial zones will reduce reliance on Ghalanai, improve access to nearby communities, create local jobs, and encourage long-term economic growth while preserving Qandahari's agrarian base.

- ***Baizai -4 Potential Settlement:***

Baizai-4, identified as a potential settlement, has been assigned 12.96 acres for Linear Commercial development along major transportation routes. This space aims to promote corridor-based trade by offering accessible retail, service, and small commercial facilities to serve the daily needs of the local community.

By focusing commercial activities on key routes, the Linear Commercial zone utilises Baizai's connectivity to strengthen regional links and support the efficient flow of goods and services. This strategy boosts local economic activity, promotes development along major routes, and minimises residents' travel to larger urban centers. As a result, it fosters sustainable growth while preserving Baizai-4's emerging settlement character within the district's urban hierarchy.

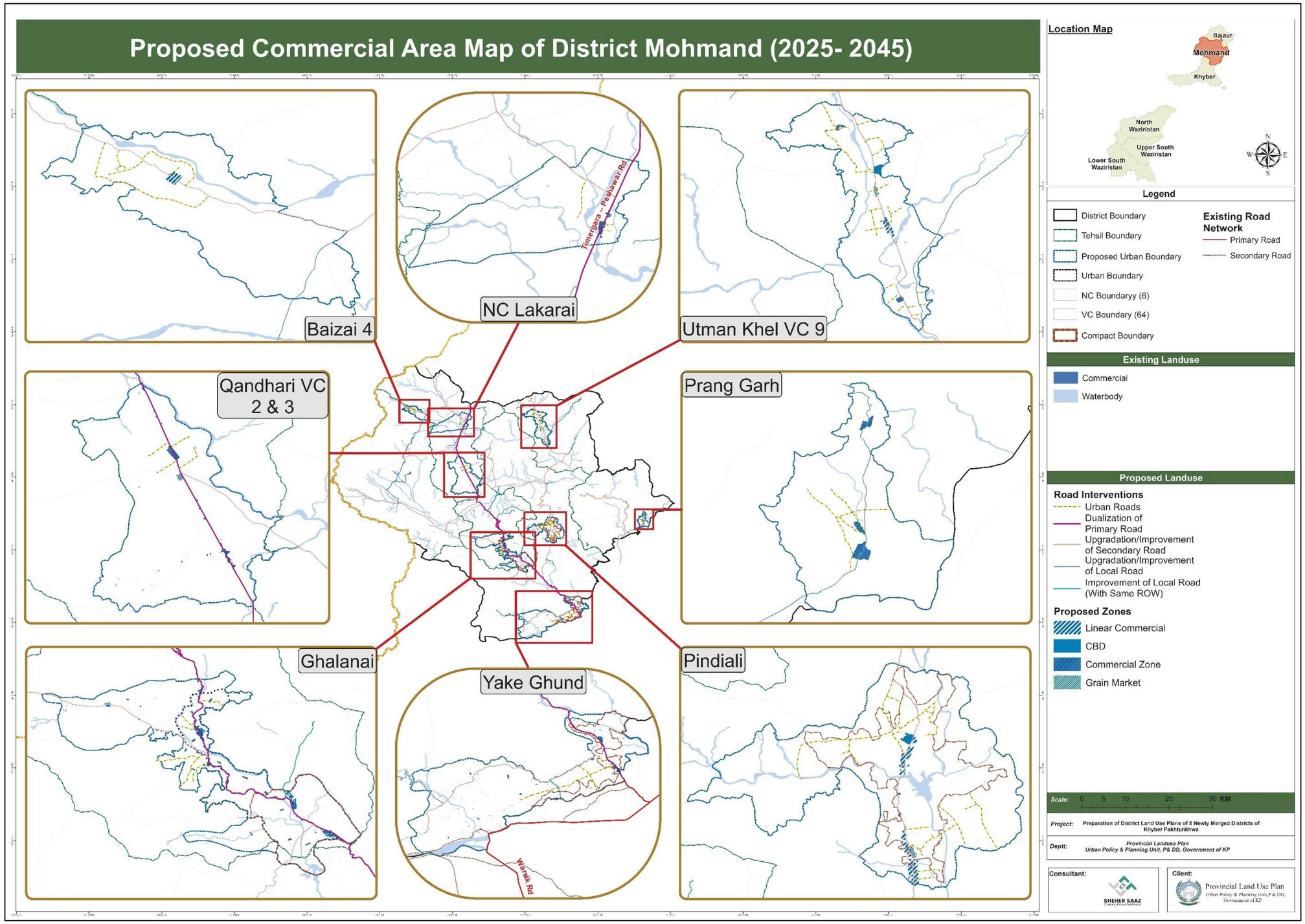
- ***Lakarai Potential Settlement:***

Lakarai, identified as a potential settlement, has been assigned 14.38 acres for a Proposed Commercial Zone and 3.47 acres for a Grain Market along the Mohmand Agency Road, totaling about 17.86 acres of commercial land.

The Proposed Commercial Zone is planned to host retail, service, and administrative functions, meeting the daily needs of the expanding local population and supporting the settlement's emerging urban role. The Grain Market, as an independent facility, aims to promote organized agricultural trade, bolster local farming livelihoods, and increase the value of agro-based economic activities.

Together, these commercial allocations decrease reliance on Ghalanai for vital goods and services, enhance access for nearby communities, create local jobs, and support sustainable economic growth focused on routes. The integration of commercial and agricultural facilities is designed to help Lakarai grow in a way that balances urban development with the preservation of its agricultural roots, strengthening its long-term economic stability within the district.

Map 33: Proposed Commercial Zones-District Mohmand



6.2.5 Future Strategies, Constraints, and Recommendations

The future development is divided into three phases to ensure it can be controlled and refined.

- ***Short Term***

The building laws of KPK need to be put into immediate action, according to which certain road width will be standardized and will help in traffic inflow and is one of the major Short Term Development Project.

Table 38: Commercial Regularizations for the major road

S. No	Types	Name of Road	Setback and Height building	Commercial Buffer	TOD Buffer
1	**Type A**	Ring road	Setback=50 feet (Mandatory) Height of building = 100 feet OR The setback=60 feet (Optional) Height of building = 160 feet	Approx. 250 Feet	----
2	**Type-B**	Major Arterial Roads	Setback=25 feet (Mandatory) Height of building=80 feet OR The setback = 30 feet (Optional) Height of building = 120 feet	Approx. 250 Feet	Approx. 650 Feet (except Nasir Bagh Road)
3	**Type-C**	All canals, patrolling, and other roads,	(ROW + Setback) *1.5		

Type A Roads (e.g., Motorway)

- Commercial Development Buffer:250 feet on both sides
- Mandatory Setback: 50 feet
- Maximum Building Height: 100 feet
- Incentive for Increased Setback: If the setback is increased to 60 feet (optional), the building height can be extended to 160 feet.
- Objective: Encourages greater setbacks to promote vertical development while maintaining urban aesthetics and smooth traffic flow.

Type B Roads (e.g., Mohmand Agency Road)

- Commercial Development Buffer: 250 feet on both sides
- Mandatory Setback: 25 feet

- Maximum Building Height: 80 feet
- Incentive for Increased Setback: If the setback is increased to 30 feet (optional), the building height can go up to 120 feet.
- Objective: Ensures a balance between urban density and road functionality by maintaining clear sightlines and preventing congestion along these major corridors.

Type C Roads (e.g., Canal Patrolling Roads and Other Roads)

- Building Height Formula: (Right of Way (ROW) + Setback) * 1.5

Objective: Links permissible building height directly to ROW and setback, ensuring proportional vertical development. This regulation accommodates the unique characteristics of canal-side roads, maintaining a balance between commercial activity, environmental considerations, and spatial planning. Adhering to the Ghalanai Master Plan is essential, as it will facilitate the establishment of the district's first major linear commercial development while significantly enhancing local GDP growth.

- ***Medium Term***

Table 39: Medium Term Development

Settlement / Type	Commercial Allocation	Justification / Function
Ghalanai – Urban Centre	73.21 acres (Proposed Commercial Zone)	Supports current and projected commercial demand (retail, offices, mixed-use); focuses growth on the district's primary urban node; promotes efficient land use, accessibility, and agglomeration; reinforces Ghalanai as the district's economic core.
Yeka Ghund – Potential Urban Centre	14.90 acres (CBD) + 12.65 acres (Commercial Zone) + 3.32 acres (Grain Market); total 30.87 acres	CBD provides higher-order commercial and service functions; Commercial Zone meets daily population needs; Grain Market strengthens agriculture and local agro-based trade; allocations support route-based commerce and regional connectivity.
Utman Khel – Potential Urban Centre	18.97 acres (CBD) + 16.80 acres (Commercial Zones) + 24.87 acres (Linear Commercial) + 5.97 acres (Grain Market)	CBD concentrates higher-level commercial and service functions; Commercial Zones support daily retail; Linear Commercial encourages corridor-based trade; Grain Market preserves agriculture and strengthens rural-urban economic ties; allocations ensure balanced growth and accessibility.
Pindiali – Potential Urban Centre	57.57 acres (Linear Commercial) + 11.83 acres (CBD) + 7.14 acres (Grain Market); total 84.55 acres	Linear Commercial promotes corridor-based trade along key transport routes; CBD concentrates higher-order services; Grain Market supports agriculture; allocations leverage strategic location (43.5 km from

		Ghalanai) and serve nearby settlements, fostering economic integration and growth.

- ***Long Term***

Table 40: Long Term Development

Settlement / Type	Commercial Allocation	Justification / Function
Prang Ghar – Potential Settlement	17.58 acres (Proposed Commercial Zone)	Meets daily retail and service needs; capitalizes on tourism from MOTO SHAH Dam (4 km away) to stimulate visitor-oriented commerce; supports hospitality, food services, and shops, boosting long-term local economic activity.
Qandahari VC-2 & VC-3 – Potential Urban Centre	19.02 acres (Commercial Zone) + 9.88 acres (Grain Market); total 28.9 acres	Commercial Zone addresses population needs; Grain Market supports agro-trade and preserves agriculture; reduces reliance on Ghalanai; promotes local employment and integrated urban-rural economic growth.
Baizai-4 – Potential Settlement	12.96 acres (Linear Commercial)	Promotes corridor-based trade along transport routes; provides accessible retail and services; strengthens regional connectivity; encourages route-oriented development and sustainable growth while maintaining settlement character.
Lakarai – Potential Settlement	14.38 acres (Commercial Zone) + 3.47 acres (Grain Market); total 17.86 acres	Commercial Zone meets retail, service, and administrative needs; Grain Market strengthens agriculture and local livelihoods; allocations reduce dependence on Ghalanai, create jobs, and support sustainable economic growth integrating urban and agricultural development.

6.3 INDUSTRIAL ZONES

6.3.1 Heavy, Medium and Light Industrial Zones/Small Industries Estates

According to the 2022 development statistics, Mohmand District had 167 operational industrial units in 2020-21, a significant decrease from the 513 units recorded in 2010. The district's industrial sector is primarily focused on marble production, with marble industries playing a major role in the region's development.

Industries can be categorized into three primary types based on scale, capital investment, and technological intensity: small, medium, and large. Small industries employ fewer than 50 people and have lower investment levels. Medium industries employ between 50 and 250 people and require moderate investment. Large industries, on the other hand, employ over 250 people and necessitate significant capital.

6.3.2 Classification of Industries by Type

The industries are divided into three primary types based on their scale, capital investment, and technological intensity: light, medium, and heavy industries.

- **Light Industries:** Characterized by relatively small-scale operations, lower capital investment, and a focus on consumer goods, light industries typically employ labor-intensive processes.
- **Medium Industries:** These industries require a moderate level of capital investment and technology. They often produce intermediate goods used by other industries or consumer durables.
- **Heavy Industries:** Characterized by large-scale operations, substantial capital investment, and complex technological processes, heavy industries primarily focus on basic industrial goods. These industries are often resource-intensive and play a crucial role in supporting the broader economy.

Mohmand District boasts a solid industrial base with considerable potential for further development. While most industries are concentrated in the Mohmand Economic Zone, Ghalanai urban center also hosts several industrial units. According to the Ghalanai master plan, the Ghalanai urban center encompasses 23 marble industries, 2 ice factories, and 2 scrap factories, spread over 37 acres. These industries are pivotal to the local economy, offering significant livelihood opportunities for residents. A detailed survey of the industrial units in the urban center identified various types of industries, including small-scale workshops focused on woodworking, metalwork, and concrete blocks.

These industrial units are essential to the growth and development of both the Ghalanai urban center and the surrounding region. The marble industry, in particular, plays a key role in the local economy, not only within the urban center but also throughout Mohmand District. It employs a large number of skilled and unskilled workers. With access to local raw materials and the production of both raw blocks and finished products like marble tiles, the industry supports a strong supply chain and caters to customers across the province and in major cities nationwide.

6.3.3 Existing Industrial Zones and Estates

Mohmand district is home to the Mohmand Economic Zone (MEZ), an industrial estate that covers 350 acres. Managed by the Khyber Pakhtunkhwa Economic Zones Development and Management Company (KPEZDMC), the MEZ is strategically positioned to provide access to Peshawar, Charsadda, Bajaur, Khyber districts, and shares a significant border with Afghanistan.

The MEZ is vital to the economic development of KP, particularly due to the abundant dimension stone reserves in Mohmand and Bajaur districts. The zone also benefits from an established marble and granite cluster along Warsak Road in Peshawar. The existing infrastructure within the MEZ offers substantial opportunities for investors by creating a favorable environment for Pakistan's dimension stone industry. With the development of the Mohmand Economic Zone, gaps in the dimension stone sector's value chain are expected to be addressed, driving further growth and advancement in the industry.

6.3.4 Number of Industries by Types, Units and Employments

6.3.4.1 Industries by Types and Units

According to the Census of Manufacturing Industries 2015-16, Khyber Pakhtunkhwa (KP) boasted a diverse industrial landscape, encompassing a total of 75 distinct industries composing of 3,357 manufacturing units employing a daily workforce of 125,412 individuals. The sector's economic impact in the province is substantial, with industrial costs totaling 294 billion rupees and employment costs reaching 42 billion rupees. Moreover, the manufacturing sector contributed 264 billion rupees to the national GDP at market price and 166 billion rupees at basic price. A detailed breakdown of key industrial sectors, employment figures, and GDP contributions is presented in the Table below.

Table 41: Industrial Statistics of Khyber Pakhtunkhwa

Industry Type	Number of Units	Average Daily Persons Engaged	Employment Cost	Industrial Cost	Contribution to GDP at Market Prices	Contribution to GDP at Basic Prices
All	3,357	125,412	412	294	264	166
Food Products	309	10,281	23	75	14.9	12.2
Other Non-Metallic Mineral Products	2,145	57,180	17	55.3	79.3	66.5
Furniture	360	6,005	0.98	3.33	1.88	1.81
Rubber & Plastic Products	83	4,776	1.09	11.8	0.10	0.089
Chemicals &	70	3,240	0.76	6.04	3.85	3.03

Chemical Products						

Source: Census of Manufacturing Industries, 2015-16, Pakistan Bureau of Statistics

Over the three-year period from 2021 to 2024, the number of industrial units in District Mohmand has shown slight fluctuations. In 2021–2022, a total of 183 industrial units were recorded, out of which 180 units were operational, while 3 units were closed. The following year, 2022–2023, saw a marginal increase in the total number of units to 184, but the number of running units decreased to 176, and closed units rose to 8, indicating temporary or seasonal shutdowns.

By 2023–2024, the total number of industrial units slightly declined to 173, with all 173 units operational and none reported as closed, reflecting an improvement in industrial stability and reactivation of previously non-functional units.

Table 42: Existing Industrial Units in Mohmand

District	2021-2022			2022-2023			2023-2024		
Mohmand	Total	Running Unit	Closed Unit	Total	Running Unit	Closed Unit	Total	Running Unit	Closed Unit
	183	180	3	184	176	8	173	173	0

Source: Calculated by Consultants

The industrial landscape of District Mohmand is characterized by a mix of extractive, processing, and manufacturing units, reflecting the district's growing industrial base. As of 2023–2024, a total of 173 industrial units are operational across various sectors.

Among these, marble factories constitute the largest share, with 88 units, highlighting the district's prominence in the marble and stone-processing sector. The talc powder industry also holds significant importance, comprising 62 operational units, which collectively contribute to both local employment and export potential.

Other notable industries include stone crushers/crush plants (11 units), foundry and steel (5 units), and small-scale brick kilns (2 units), flour mills (1 unit), ghee/edible oil units (2), and ice factories (2). The predominance of marble and talc-based industries underscores Mohmand's reliance on its mineral resources, while the presence of diverse small-scale industries reflects gradual industrial diversification within the district.

Table 43: Type of Industries in Mohmand

Sr. No	Type of Industry	Number of Units
1	Brick Kilns / Bhatha Khasht	2
2	Flour Mills	1
3	Foundry / Steel	5
4	Ghee / Edible Oil	2
5	Ice Factory	2
6	Marble Factory	88
7	Stone Crushers/Crush Plants	11
8	Talc Powder	62

Total Industry Units	173

Source: Calculated by Consultants

6.3.4.2 Employment in Industrial Sector

The employment landscape in Mohmand District is characterized by a high reliance on informal economic activities, with no urban population recorded in the census. The labor force participation rate is notably high at 48.2%, with a substantial 87.5% of the employed population engaged in informal economic activities. This reliance on informal livelihoods is prevalent across the district, emphasizing the challenges associated with job creation, formalization, and poverty reduction in a predominantly rural setting.

The formal sector, representing only 12.5% of the workforce, underscores the limited formal job opportunities within the district. The industrial sector, while contributing 24.2% to overall employment, reflects the broader economic structure of Mohmand, where industrial jobs are evenly distributed across rural areas. Despite the dominance of the informal sector, the district's overall unemployment rate stands at 6.7%, indicating a significant portion of the population is employed, albeit in less secure and unregulated positions.

These statistics highlight the critical need for interventions aimed at enhancing formal employment opportunities and supporting the informal sector through capacity-building and skill development initiatives. Additionally, policies designed to improve the business environment and attract investment are essential for fostering job creation and promoting sustainable economic growth in Mohmand District.

Table 44: Employment Statistics by Industry Sector – Mohmand District

Indicator	Total	Urban	Rural
Population Over 18 Years of Age (person)	213,778	-	213,778
Labor Force (person)	295,000	-	295,000
Employed People (person)	85,600	-	85,600
Unemployment Rate (%)	6.7	-	6.7
Employment by Industry (%)	24.2	-	24.2
Activity Status (Formal) (%)	12.5	-	12.5
Activity Status (Informal) (%)	87.5	-	87.5

Source: Labour Force Statistics Survey, 2020-21

6.3.5 Existing & Future Industrial Programs

The district is undergoing a period of development with several initiatives aimed at boosting its economy and improving the livelihood of its residents.

1. **Establishment of Economic Zones in Newly Merged Districts under Public-Private Partnership (PPP)**

The project aims to establish economic zones in the newly merged districts, including Mohmand, under a public-private partnership (PPP) model. With a total cost of 0.005 million and an allocation of 0.001 million for the fiscal year 2022-23, this initiative is expected to create a conducive environment for industrial activities by attracting private sector investments. The economic zones are intended to serve as hubs for industrial growth, facilitating the development of manufacturing and processing industries. This initiative is

crucial for integrating Mohmand into the broader economic framework of the region and enhancing its industrial output.

2. **Interest-Free Micro-lending Activities to Support Small-Scale Entrepreneurs (IFML) in Merged Districts**

The Interest-Free Micro-lending Activities (IFML) project, with a total cost of 93.4 million and an allocation of 25.5 million for FY 2022-23, is designed to support small-scale entrepreneurs in the newly merged districts, including Mohmand. The project provides interest-free loans to entrepreneurs, enabling them to start or expand their businesses. This initiative is particularly important in a region like Mohmand, where access to formal financial services is limited. By empowering small-scale entrepreneurs, the IFML project aims to stimulate economic activity, create jobs, and reduce poverty in the district. The focus on interest-free micro-lending also ensures that financial burdens on entrepreneurs are minimized, allowing for sustainable business growth.

3. **Development of Infrastructure for Mohmand Marble City (Completion of Balance Works)**

Mohmand Marble City is a flagship industrial development project in the district, aimed at establishing a dedicated industrial zone for marble processing. With a total cost of 1,349 million and an allocation of 203.8 million for FY 2022-23, this project focuses on the completion of balance infrastructure works necessary for the operationalization of the Marble City. The development of Mohmand Marble City is expected to capitalize on the district's rich marble reserves, providing a significant boost to the local economy through increased industrial activity and employment opportunities.

4. **Interest-Free Microfinance Schemes (IFMS) for Entrepreneurship Development in Merged Areas (AIP)**

The Interest-Free Microfinance Schemes (IFMS) under the Accelerated Implementation Program (AIP) are another crucial initiative aimed at fostering entrepreneurship in the newly merged districts, including Mohmand. With a total cost of 2007 million and an allocation of 65.8 million for FY 2022-23, the IFMS project provides interest-free microfinance to aspiring entrepreneurs. This initiative is designed to address the financial constraints faced by entrepreneurs in Mohmand, particularly in a region where formal banking and financial services are limited. By providing access to capital without the burden of interest, the IFMS project aims to encourage the establishment of new businesses, enhance income-generating activities, and promote economic self-sufficiency among the residents of Mohmand.

6.3.6 Current Industrial Area Gap

The current industrial area gap in District Mohmand has been calculated as follows:

Table 45: Current Industrial Area Gap – Mohmand District

Urban & Rural Population	**581,894**
Industrial Labor Force @5%	29094.72
Industrial Area Required (@40 Worker Per Acre)	727.37
Current Area Under Industries	304.99
Industrial Area Deficiency	422.38

Source: Calculated by Consultant, 2025

It is evident from the above calculations that the district is currently facing an industrial land deficit of 423 acres. This significant shortfall highlights the urgent need for expansion through the establishment of new industrial estates and zones. Unless this deficiency is addressed alongside future industrial land requirements, the district will face increasing constraints on industrial growth, job creation, and economic diversification.

6.3.7 Future Industrial Area Requirement

The projection indicates that an additional 413 acres of land will be required for industrial use across District Mohmand up to the year 2045. This requirement is divided into two planning horizons:

Short-Term (2025–2030): Approximately 92 acres will be needed to accommodate small-scale industrial expansion in existing growth centers, particularly near Ghalanai, Yake Ghund, and Prang Ghar, where accessibility and proximity to major roads support economic activity.

Long-Term (2031–2045): An additional 321 acres are projected to be required as industrial activity intensifies, with potential for dedicated industrial estates near resource-rich and logistic corridors such as Warsak Road and the Mohmand Economic Zone (MEZ) area.

Table 46: Future Industrial Area Requirements

Parameters	Short-Term Plan (2025-2030)	Long Term-Term Plan (2031-2045)	Total (2025-2045)
Additional Population	***73406***	***256708***	**330114**
Industrial Labor Force (@5%)	3670.31	12835.38	**16506**
Industrial Area Required	91.76	320.88	**413**

Source: Calculated by Consultant, 2025

6.3.8 Proposed Development Approach

a) Short-Term Strategy (2025–2030)

Cluster-Based Industrial Expansion: Focus on developing small industrial clusters linked with local resources such as marble processing, construction materials, and light engineering workshops.

Infrastructure Readiness: Ensure basic infrastructure (roads, electricity, and water) in designated industrial zones to attract small enterprises.

Skill Development Programs: Establish partnerships with vocational institutes to align local labor skills with emerging industrial needs.

Land Use Zoning Enforcement: Introduce industrial zoning regulations that restrict industrial activities to designated areas to minimize conflicts with residential and agricultural land uses.

b) Long-Term Strategy (2031–2045)

Establishment of Mohmand Industrial Estate: Develop a centralized industrial estate integrated with the Mohmand Economic Zone (MEZ) and CPEC-linked routes for improved trade connectivity.

Sustainable Industrial Practices: Promote eco-friendly manufacturing by adopting cleaner technologies and proper waste management systems.

Value Chain Development: Strengthen linkages between the industrial, agricultural, and mining sectors to promote local value addition and employment generation.

Public-Private Partnerships (PPP): Encourage private sector investment in infrastructure and facility development within industrial parks.

6.3.9 Proposed Locations for New Industrial Areas

6.3.9.1 Proposed Industrial Estate/Zones

To identify the need for an industrial area, the area is calculated using an individual recommended NRM standard based on the population. It includes two steps:

Industrial Demand = (Pn * Labour Force)/ Person per Acre

Where;

Pn = Population

Industrial Labor Force = 5%

Person per Acre = 40

According to this, we have the following requirements:

Table 47: Industrial Requirement for Urban Settlements

Area	Requirement (acres)
Ghalanai	58.66
Yake Ghund	100.77
Pindiali	100.22
Utman Khel Vc-2&9	79.59
Qandhari Vc-3&2	39.64
Prang Ghar	22.05
Lakarai	13.22
Baizai-4	13.79

Source: District Mohmand Proposed Land Use Plan, 2025

Table 48: Proposed Industrial Zones – Urban Settlements

Settlements	Areas (acres)
Ghalanai	58.66
Yake Ghund	-Already Mohmand (SEZ)

Pindiali	52.70
Utman Khel Vc-2&9	122.57
Qandhari VC 3-2	N/A
Prang Ghar	17.80
Lakarai	86.43
Baizai-4	27.21

➢ *Rationale and Objectives*

The proposed Industrial Estates aim to:

- Promote **organized industrialization** by consolidating scattered small industries into designated, serviced zones.
- Ensure **environmental safety** and compliance through pre-defined buffer areas separating industrial and residential zones.
- Generate **employment opportunities** for local youth and returning migrants by attracting light-to-medium scale enterprises.
- Utilize Mohmand's **strategic location** along the Peshawar–Torkham trade route to enhance regional connectivity and export potential.

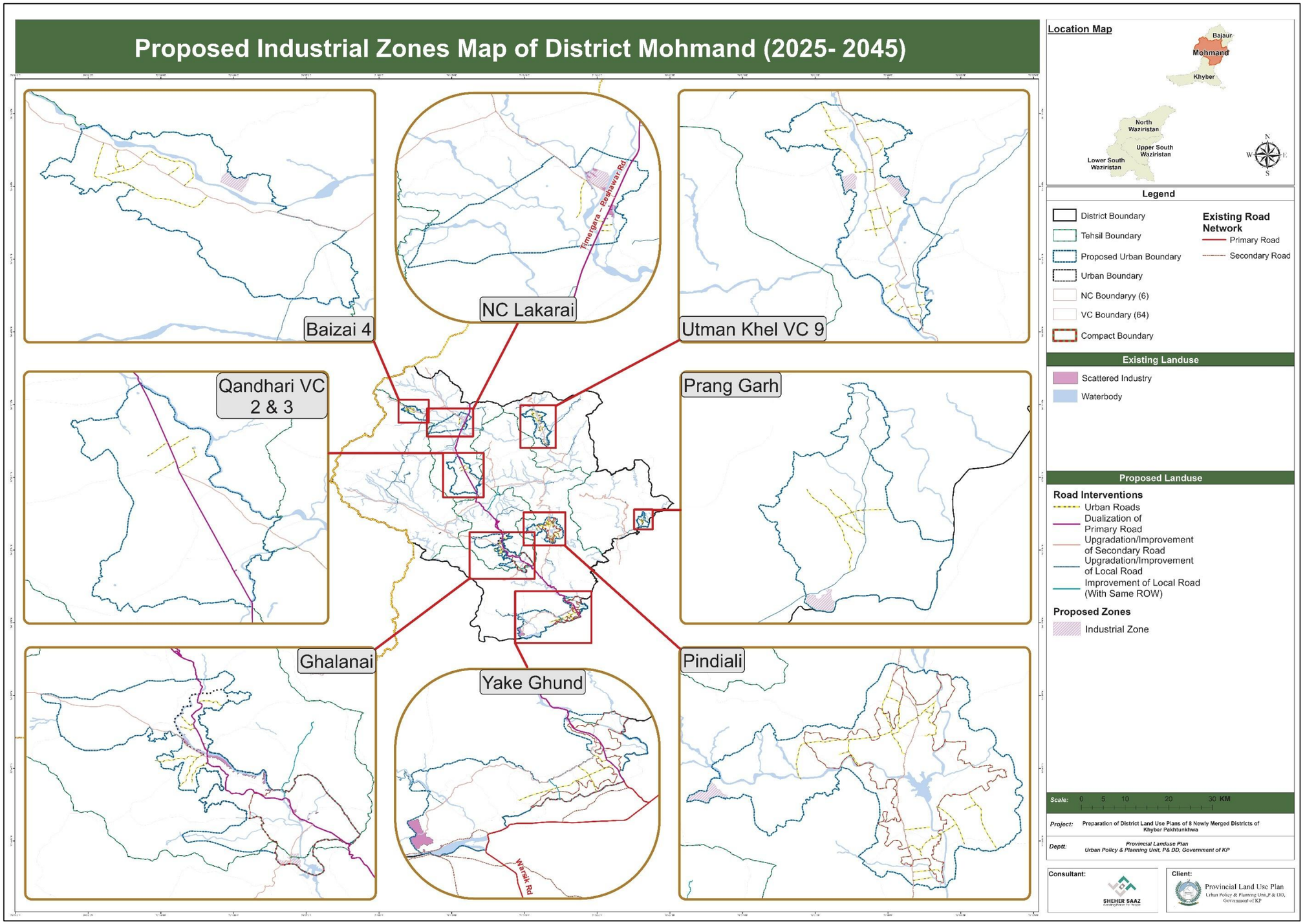
➢ *Location-Specific Planning*

Table 49: Type of Industries Proposed in District Mohmand

Settlement / Area	Minerals Identified	Proposed Industrial Typology	Suitable Industries	Planning & Zoning Remarks
Ghalanai	Limestone, Emerald, Iron Ore	Heavy + Medium + Light Industry	Cement & lime units, iron ore processing, aggregates, gemstone cutting & polishing	District HQ; strict segregation of heavy industry with buffers; gemstone units near urban/commercial areas
Yake Ghund (Yeka Ghund)	Base Metals	Medium to High-Value Industry (SEZ-based)	Metal processing, fabrication, beneficiation, export-oriented manufacturing	Integrated with Mohmand Special Economic Zone (MSEZ), with an emphasis on downstream value addition.
Pindiali	Chromite	Medium to Heavy Industry	Chromite beneficiation, ferro-alloy inputs, refractory materials	Strategic mineral zone with managed processing and dedicated transport routes.

Utman Khel (VC-2 & VC-9)	Marble (large quantity), Nephrite	Medium & Light Industry (Stone Cluster)	Marble cutting, polishing, tiles, slabs, nephrite handicrafts	Identified as stone-processing cluster; SME-focused; export-oriented
Prang Ghar	Magnesite, Serpentine, Base Metals, Soapstone	Medium Industry (Industrial Minerals)	Refractories, talc/soapstone powder, ceramics, insulation materials	Requires strong environmental controls due to chemical/industrial mineral processing
Lakarai	Marble	Medium & Light Industry	Marble processing, decorative stone, construction materials	Potential settlement; planned expansion with supporting infrastructure
Baizai-4	Copper, Chromite, Marble	Medium to Heavy Industry (Multi-mineral)	Copper beneficiation, chromite processing, marble products, mineral logistics	Corridor-based development; suitable for multi-mineral industrial estate

Map 34: Proposed Industrial Zones- District Mohmand



6.4 SOCIAL INFRASTRUCTURE

6.4.1 Educational Facilities

6.4.1.1 Existing Educational Institutions

District Mohmand faces significant educational challenges, reflected in its low literacy rates and stark gender disparities. The overall literacy rate of 31.28% lags considerably behind the provincial average of 51.09%. Males have a literacy rate of 46.85%, which is well below the KPK male average of 64.57%, while female literacy is alarmingly low at 15.10%, less than half of the KPK female average of 37.15%. These figures underscore the pervasive socio-cultural, economic, and infrastructural barriers preventing equitable access to education, especially for females.

The reasons for non-enrollment further illuminate the socio-economic and cultural impediments. Cultural limitations account for 31.1% of barriers, mainly restricting girls' education due to traditional gender roles. Additionally, poverty and costly education collectively contribute more than 42.8%, highlighting financial constraints that limit many families from sending children, especially girls, to school. Furthermore, 13.4% cite lack of nearby schooling facilities, and 3.4% point to insecurity, particularly affecting remote areas.

Examining the educational infrastructure, the district has a total of 386 functional boys' schools across all levels but only 217 for girls. Primary schools account for the majority of this gap, with 310 functional boys' schools versus 165 for girls, and a significant number of non-functional schools, especially for girls (27 primary schools non-functional). This infrastructure disparity grows at higher educational levels where girls' access shrinks drastically for example, only 13 functional high schools for girls compared to 30 for boys, and a mere one higher secondary school for girls against three for boys. This reflects entrenched gender inequality in access to education at all levels.

Enrollment figures corroborate this divide; there are substantially more boys enrolled in boys' schools than girls in girls' schools at each educational stage. For instance, primary boys' institutions have 28,230 boys enrolled compared to 14,101 girls in girls' primary schools. The pattern continues through middle, high, and higher secondary levels, showing gender-segregated schooling with boys vastly outnumbering girls.

Classroom and facility availability reflect similar inequities. Boys' schools have nearly double the classrooms (1,296) compared to girls' schools (680), which limits capacity and quality of education for female students. Boys' schools also have slightly more auxiliary rooms, which support teaching effectiveness through specialized spaces.

Teacher-student ratios vary across levels but indicate high student loads at primary levels (1:43 overall) and more manageable ratios at middle (1:8), high (1:18), and higher secondary (1:16) levels. While the ratios improve at advanced levels, the high student-teacher ratio at primary level, especially for boys (1:44), highlights the need for more teachers to enhance early education quality.

6.4.1.2 Accessibility Analysis

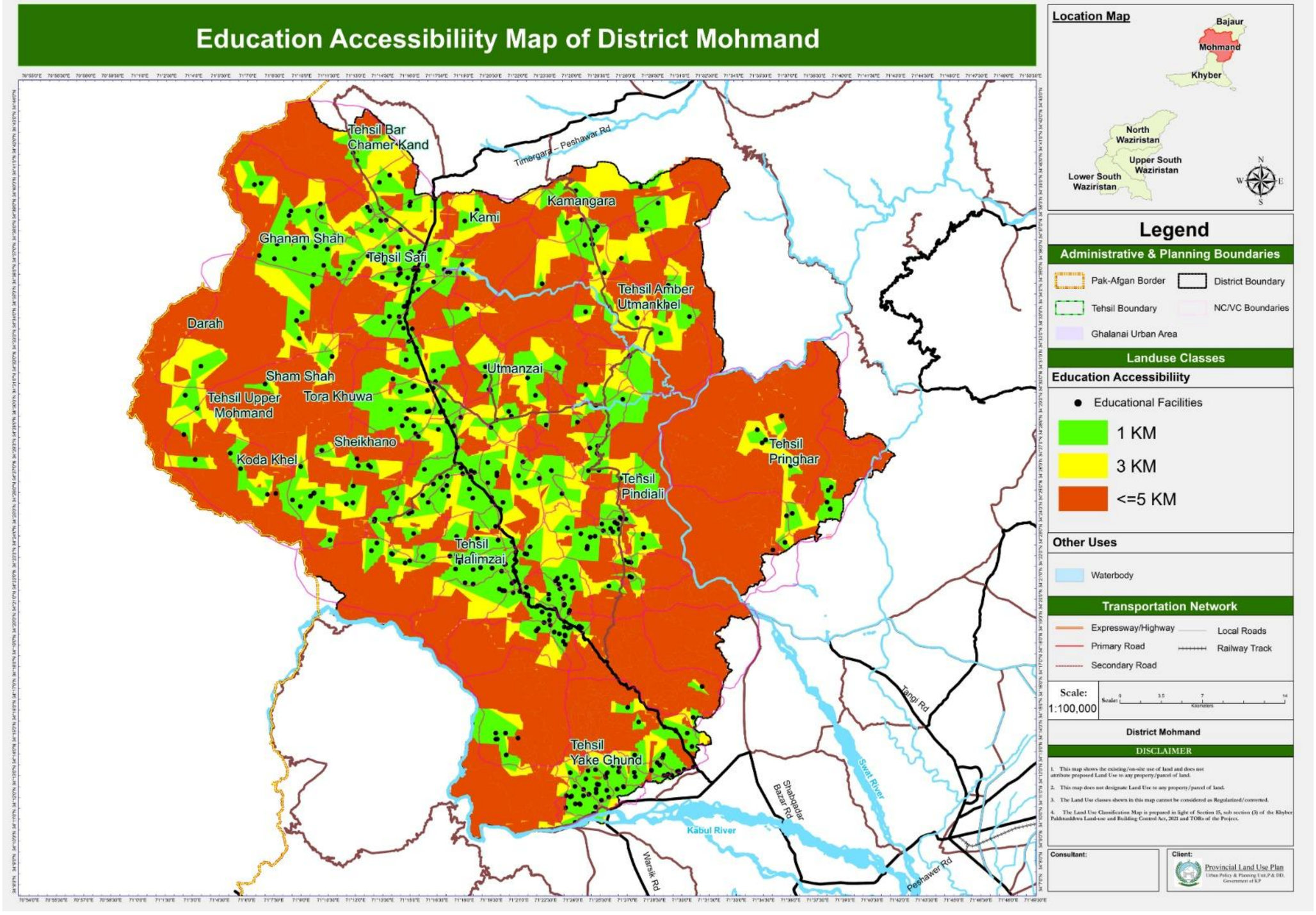
Accessibility to educational institutions is assessed through two approaches: walkability distance and driving distance. For walkability, different speeds are considered based on age groups, since younger children and older students have varying mobility levels. For primary school students, a speed of 3.5 km/h is used, which corresponds to an effective walking range of 600–800 m. For secondary and high school students, a standard adult speed of 5.0 km/h is applied, giving a reasonable walking range of 800 m–1 km. These buffers represent the maximum distance students can realistically cover on foot without difficulty[4].

In contrast, for vehicular accessibility, a speed of 30 km/h is assumed to reflect the mixed road conditions common in urban and peri-urban areas of Mohmand District. At this speed, a 10-minute travel time translates to a service radius of approximately 6 km, which represents the effective catchment of schools when accessed by vehicles[5].

The walkable distance shows that many areas cannot access public educational institutes, however, if driving distance is used almost entire study area can access the available public educational institutes. This does not change the fact that with respect to the population, the number of schools are quite low, and more are required in the next twenty years. The following maps show accessibility of public educational institutions with respect to walkability and driving[6]. The analysis indicates that while the majority of settlements have access to educational facilities, certain areas remain underserved with limited accessibility. To address this imbalance, proposed educational zones have been designed to meet the calculated requirements and ensure that facilities are more equitably distributed and easily accessible to the community.

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Map 35: Existing Educational Facilities Accessibility – District Mohmand



6.4.1.3 National and International Education Policies and Planning Standards

6.4.1.3.1 National Standards

- ***National Reference Manual (NRM)***

According to the NRM standards, a primary school is required for a population of 7500. A middle school is required for a population of 17000, and a high school is required for a population of 74000. For a college, a population of 170,000-400,000 is required.

Standards for Allocation of New Education Facilities

According to the National Reference Manual for Planning and Infrastructure Standards, primary schools should be strategically positioned within existing or well-planned residential areas to ensure effective service to the community. Ideally, these schools should be within walking distance of homes but located away from busy roads to ensure safety. Secondary schools should be easily reachable by both vehicle and foot and should also be situated away from high-traffic roads to maintain security.

Both primary and secondary schools are considered essential residential amenities, and their locations should be carefully planned during the development of new housing schemes and areas. Colleges, universities, and other higher education institutions, which offer undergraduate and graduate programs, are best located in the Town Center to facilitate accessibility and integration into the community. The table below shows the location guidelines for establishing a new education institute.

Table 50: Location Guidelines for New Educational Institutes

Sr. No.	Educational Institution Type	Location Guidelines
1	Primary School	• Near existing and planned housing schemes • Located within walking distance from home • Commonly situated centrally within residential areas and away from busy roads • Catchment area for urban schools: 0.5-1 km • Catchment area for rural schools: up to 2.2 km
2	Secondary School	• Must have easy and good vehicular access and safe walking routes • Located away from schools of the opposite gender • Situated far from the main busy roads with fast and heavy traffic • Positioned on roads with favorable linkages to their catchment area • Catchment area for urban schools: 1.25-2 km • Catchment area for rural schools 5-10km
3	Intermediate College	• Catchment area for urban school - boys: 2.75-4 km • Catchment area for rural school - boys: 10-15 km • Catchment area for urban school - girls: 3.25-5 km
4	Degree College	Large City
5	University	Metropolitan City Area

Source: National Reference Manual of Planning and Infrastructure Standards (NRM)

- **Khyber Pakhtunkhwa Education Facility Planning Framework**

The planning, establishment, and upgradation of education facilities in Khyber Pakhtunkhwa are governed by provincial education policies, with specific provisions for backward and hilly areas. These policies define quantitative enrolment thresholds, population triggers, distance criteria, land requirements, and minimum infrastructure standards, ensuring equitable access to education while avoiding duplication of facilities.

Table 51: Education Planning Framework - KP Specific

Facility Type	Trigger / Eligibility Criteria	Distance / Catchment Criteria	Land Requirement	Key Infrastructure Requirements
Primary School (New)	Catchment population ≥ 800, ensuring minimum 80 students	No primary school within 1.5 km (waived if nearest school is overcrowded)	Urban: 1–2 Kanal Rural: 2 Kanal	6 classrooms, admin block, lavatories, water supply, electricity/solar, boundary wall (8 ft), play area
Primary School (Additional)	Village population > 5,000, existing school overcrowded and no expansion space	Distance condition waived	Same as above	Same as above
Secondary School (Grade VI–XII) ***(Backward & Hilly Areas)***	Feeder enrolment: • Class V: ≥50 boys / 40 girls • Class VIII: ≥25 boys / 20 girls • Class X: ≥100 boys / 80 girls • Minimum total: 175 boys / 140 girls	No secondary school within 5 km (waived if overcrowded); feeder schools within 2.5 km	Urban: 4 Kanal Rural: 8 Kanal	Academic blocks, labs, admin spaces; vertical construction (≤50% covered area)
Middle to High School Upgradation ***(Backward & Hilly Areas)***	Class VIII enrolment: • Proposed school: ≥10 boys / 8 girls • Feeder schools: ≥15 boys / 12 girls • Minimum Class IX intake: 25 boys / 20 girls	No high school within 3 km (waived if overcrowded); feeder schools within 2 km	9,000 sq ft available for expansion	3 classrooms, library, IT & science labs, exam hall, staff rooms
High to Higher Secondary Upgradation ***(Backward & Hilly Areas)***	• Class X enrolment (including feeder schools): ≥100 boys / 80 girls	No HSSC / college within 10 km (girls: 5 km); waived in urban areas	10,000 sq ft additional area	4 classrooms, Physics/Biology/Chemistry/IT labs; vertical construction

General Planning and Design Provisions

All education facilities must comply with general provisions relating to safety, accessibility, learning environment, and disaster resilience. These include solar power provision, emergency exits, accessibility for physically challenged students, ICT and multimedia facilities, boundary walls, play areas, and site selection based on school mapping and EMIS data. Furniture, fixtures, and equipment are to be provided in accordance with notified standards.

6.4.1.3.2 International Policies and Planning Frameworks

Internationally, education planning is increasingly based on evidence-driven, catchment-oriented frameworks rather than fixed "1 school per population" ratios. Countries such as Australia, the United States, New Zealand, and Qatar employ official policies and guidelines to ensure that new schools and expansions are aligned with projected enrolment, demographic trends, and community needs.

In Australia, the NSW Education Facilities Standards and Guidelines (EFSG) and Queensland's School Site Selection Guidelines determine school size and land requirements based on enrolment forecasts, with primary schools typically accommodating up to 1,000 students on 1.5–2 hectares and secondary schools up to 2,000 students on 2.5–4 hectares. The United States combines federal environmental siting guidelines (EPA) with state-level enrolment and land formulas, ensuring schools are sited safely with sufficient land area (e.g., primary schools 5–8 acres, secondary schools 10–25 acres) based on projected student numbers. New Zealand's network planning similarly forecasts school-age populations within defined catchments, with primary schools typically serving 400–500 students and secondary schools 800–1,200 students per catchment.

Qatar's National Master Plan (QNMP) integrates both population catchments and urban density to guide school provision. Primary school catchments range from 15,000–25,000 people, with walking distances of 750–1,500 meters, while secondary schools serve 30,000–60,000+ residents with access distances up to 2,250 meters. Across all four countries, planning emphasizes flexibility, catchment-based enrolment forecasting, land adequacy, accessibility, and safety, ensuring that schools are neither under- nor over-utilized. These international practices provide a robust framework for ensuring equitable access to education and can serve as benchmarks for comparing or aligning local policies, such as the KP education standards, with global best practices.

Table 52: International Education Policies and Planning standards[7][8][9]

Country / Policy	School Level	Planning Metric	Enrolment / Capacity Standard	Site / Land Requirement	Catchment / Distance
Australia – NSW (EFSG)	Primary	Classroom & facilities per student	1,000 students per school	1.5–2 ha	Catchment defined by local intake; adjustments for high-density urban areas
	Secondary	Classroom & facilities per student	2,000 students per school	2.5–4 ha	Catchment-based enrolment planning

[7] Qatar Education Master Plan https://www.sciencedirect.com/science/article/pii/S1195103624000156
[8] World Bank Guidelines for School https://documents.worldbank.org/en/publication/documents-reports/documentdetail/156591468333603141/guidelines-for-school-location-planning
[9] Internation education standard classification https://unesdoc.unesco.org/ark:/48223/pf0000098243?posInSet=8&queryId=31bdb56d-f010-4069-8db9-20ceeed2a618

Australia – Queensland	Primary	Forecast enrolment	80–100% utilization triggers new planning	1.5–2 ha	Defined local catchment
	Secondary	Forecast enrolment	80–100% utilization triggers new planning	2.5–4 ha	Catchment boundaries determine access
USA – Federal (EPA)	Primary / Secondary	Safety-based siting	N/A	N/A	Minimum distances from hazards: roads, fuel stations, high-voltage lines
USA – State (e.g., NYSED)	Primary	Land & enrolment sizing	100 students per 1 acre land + 5 acres base	5–8 acres	Feeder schools and local population
	Secondary	Land & enrolment sizing	1,500–2,000 students per school	10–25 acres	Feeder schools and projected enrolment
New Zealand – MoE Network Planning	Primary	Forecast enrolment	400–500 students per catchment	1–1.5 ha	Catchment-based enrolment planning
	Secondary	Forecast enrolment	800–1,200 students per catchment	2–3 ha	Catchment-based enrolment planning
Qatar – QNMP	Primary	Population-based catchment	15,000–25,000 per primary school (density dependent)	1–2 ha (urban)	Walking distance 750–1,500 m
	Secondary	Population-based catchment	30,000–60,000 per secondary school	4–5 ha	Walking distance 1,500–2,250 m

6.4.1.4 Future Requirement

To ensure adequate educational infrastructure for the growing population, a future requirement assessment was conducted using population projections and standard benchmarks defined in the National Reference Manual (NRM). These standards specify that one primary school is required for every 7,500 people, one middle school for every 17,000 people, and one high school for every 74,000 people. Additionally, one college is recommended for every 170,000 to 400,000 people, with a mid-range benchmark of one college per 250,000 population applied for this analysis.

At the primary education level, the current population of approximately 581,894 in 2025 imposes a requirement of 78 primary schools based on the NRM standard of one school per 7,500 individuals. However, the existing number of primary schools is significantly lower at

514, resulting in a current gap of 436 schools. With the population projected to increase to 912,008 by 2045, an additional 44 primary schools will be needed to accommodate the growing number of students and ensure compliance with minimum service standards.

In the middle school category, the current requirement for 81 schools far exceeds the 34 existing institutions, leaving a deficit of 47 schools. The future demand, driven by a population increase of 330,114 by 2045, anticipates the need for 19 more middle schools to maintain adequate educational access, based on the norm of one middle school per 17,000 individuals.

High schools currently number 45 in the district against a requirement of 82 schools, reflecting a substantial shortfall of 37 institutions. With projected population growth, an additional 4 high schools will be necessary to meet the future demand, according to the NRM standard of one high school per 74,000 people.

Collegiate education facilities also lag behind population needs. There are currently only 4 colleges in the district against an estimated requirement of 3 based on population, showing a minor shortfall of 1 college. As the population expands, the future demand is expected to rise modestly, although specific projections depend on demographic changes and higher education enrollment trends.

Table 53: Future Educational Facilities Requirement

Facility	Current Requirement (2025)				Future Requirement (2025-2045)			NRM Standard
	Existing Facilities (numbers)	Population 2025	Current requirement	Current Gap (2025)	Population 2045	Increase in Population	Future Requirement (2025-2045)	
Primary	514	581894	78	No gap	912,008	330,114	44	1 for 7500
Middle	81		34	No gap			19	1 for 17000
High	45		8	No gap			4	1 for 74000
College	4		3	No gap			2	1 for 170,000 - 400,000

Source: Calculated by Consultant based on the population projection of the district and NRM Standards

Note: *These facility requirements are calculated based on population projections and national-level planning standards. Actual needs may vary due to factors such as the spatial distribution of the population, literacy trends, migration, and access barriers.*

6.4.1.4.1 Urban Centre, Potential Urban Centre and Potential Settlement

The assessment of education facilities across urban centres, potential urban centres, and potential settlements indicates that most areas currently have more institutions than the minimum population-based requirements, resulting in no existing gaps at any education level.

In Ghalanai (Urban Centre), the existing stock of 48 primary, 10 middle, 4 high schools, and 2 higher secondary/colleges exceeds both current (2025) and projected (2045) requirements. Even with a projected population of 73,704 by 2045, no additional education facilities are required, indicating a surplus across all categories.

Table 54: Existing and Future Education Requirement for Urban Centre

Urban Centre							
Educational Facilities	***Existing facilities***	***Pop 2025***	***Current Requirements***	***Existing Gap***	***Pop 2045***	***Requirements 2045***	***Total Future Requirement***
Ghalanai							
Primary	48	46012	6	*N/A*	73,704	10	*N/A*
Middle	10		3	*N/A*		4	*N/A*
High	4		1	*N/A*		1	*N/A*
Higher Secondary /College	2		0	*N/A*		0	*N/A*

Note: Ghalanai currently has 42 primary schools, 7 middle schools, 3 high schools, and 2 colleges, which exceed the requirements based on the projected population for 2025. This indicates that there is no existing gap or backlog in education facilities for the current year. Furthermore, when future requirements up to 2045 are assessed by combining existing gaps with projected demand, Ghalanai continues to show a surplus of 32 primary schools, 3 middle schools, 2 high schools, and 2 colleges. Overall, the existing education infrastructure is adequate in terms of quantity; however, priority should be given to upgrading and modernizing existing school buildings, incorporating advanced teaching technologies, renewable energy solutions such as solar panels, and improving water supply and sanitation systems to enhance the overall quality of education facilities.

Among potential urban centers, Yake Ghund and Pindiali show surplus primary and secondary facilities at present; however, by 2045, additional middle schools will be required (one in Yake Ghund and up to three in Pindiali) to cater to growing populations. Utman Khel VC-2 & 9 demonstrates a more pronounced future need, requiring three additional primary schools, four middle schools, and one high school by 2045. In contrast, Qandahari VC-3 & 2 remains adequately served with no future requirements due to modest population growth.

Yake Ghund currently has 41 primary schools, 7 middle schools, 9 high schools, and 3 higher secondary/colleges. Based on the projected population of 50,541 for 2025, this indicates that there is no existing gap in any category of educational facilities. When future requirements

are assessed for 2045, with a projected population of 80,614, there continues to be a surplus of 34 primary schools, 4 middle schools, 8 high schools, and 3 higher secondary/colleges, indicating that the current infrastructure is sufficient to meet both present and future demand.

Pindiali currently has 14 primary schools, 4 middle schools, and 2 high schools. For the projected 2025 population of 40,364, there is no gap in educational facilities. By 2045, with a projected population of 80,180, the future requirement shows a minor demand for 2 additional primary schools, 3 middle schools, and no additional high schools or colleges. Overall, Pindiali's educational infrastructure is largely adequate, though planning should consider limited expansion to accommodate future population growth.

Utman Khel VC-2&9 presently has 9 primary schools and 2 middle schools. For the projected population of 28,547 in 2025, there is no gap in existing facilities. By 2045, when the population is expected to reach 63,675, there is a small requirement for 3 additional primary schools, 4 middle schools, and 1 high school. The current education infrastructure is sufficient for the near term, with modest expansion needed to meet future demand.

Qandahari VC-3&2 currently has 25 primary schools, 3 middle schools, and 2 high schools. Based on the projected population of 22,347 for 2025, there is no existing gap, and the future requirement for 2045, with a population of 31,714, indicates a continued surplus in all categories. This demonstrates that the existing educational facilities are adequate to serve the community's needs for the foreseeable future.

Table 55: Existing and Future Education Requirement for Potential Urban Centre

Potential Urban Centre							
Educational Facilities	***Existing facilities***	***Pop 2025***	***Current Requirements***	***Existing Gap***	***Pop 2045***	***Requirements 2045***	***Total Future Requirement***
Yake Ghund							
Primary	41	50541	7	*N/A*	80,614	11	*N/A*
Middle	7		3	*N/A*		5	1
High	9		1	*N/A*		1	*N/A*
Higher Secondary /College	3		0	*N/A*		0	*N/A*
Pindiali							
Primary	14	40364	5	*N/A*	80,180	11	2
Middle	4		2	*N/A*		5	3
High	2		1	*N/A*		1	0
Higher Secondary /College	0		0	0		0	0
Utman Khel Vc-2&9							
Primary	9	28547	4	*N/A*	63,675	8	3
Middle	2		2	0		4	4
High	0		0	0		1	1
Higher Secondary /College	0		0	0		0	0

Qandahari Vc-3&2							
Primary	25	22347	3	*N/A*	31,714	4	*N/A*
Middle	3		1	*N/A*		2	0
High	2		0	*N/A*		0	*N/A*
Higher Secondary /College	0		0	0 (*No Gap*)		0	0

Within potential settlements, existing facilities are largely sufficient at present. However, future projections indicate selective needs: Prang Ghar will require one additional middle school, while Utman Khel–type settlements reflect gradual demand escalation. Baizai-4 and Lakarai remain adequately served with no additional future requirements across all education levels.

Table 56: Existing and Future Education Requirement of Potential Settlement

Potential Settlement							
Educational Facilities	***Existing facilities***	***Pop 2025***	***Current Requirements***	***Existing Gap***	***Pop 2045***	***Requirements 2045***	***Total Future Requirement***
Baizai -4							
Primary	6	7158	1	*N/A*	11,031	1	*N/A*
Middle	1		0	*N/A*		1	0
High	0		0	0		0	0
Higher Secondary /College	0		0	0		0	0
Lakarai							
Primary	11	7452	1	*N/A*	10,575	1	*N/A*
Middle	2		0	*N/A*		1	*N/A*
High	0		0	0		0	0
Higher Secondary /College	0		0	0		0	0
Prang Ghar							
Primary	3	11092	1	*N/A*	17,639	2	0
Middle	1		1	0		1	1
High	1		0	*N/A*		0	*N/A*
Higher Secondary /College	0		0	0		0	0

Source: Calculated by Consultant

Baizai-4 currently has 6 primary schools and 1 middle school. For the projected population of 7,158 in 2025, there is no gap in educational facilities. Looking ahead to 2045, when the population is expected to reach 11,031, the total future requirement remains well-covered with only minor projected needs, indicating a continued surplus of 5 primary schools and no additional middle, high, or higher secondary/college facilities. This shows that the existing infrastructure is sufficient to meet both current and future demand.

Lakarai presently has 11 primary schools and 2 middle schools. Based on the projected 2025 population of 7,452, there is no existing gap in any category of education. By 2045, with a population projection of 10,575, the infrastructure still maintains a surplus, with 9 primary

schools and 1 middle school exceeding the future requirements. No high schools or higher secondary/college facilities are required at present or in the projected future.

Prang Ghar currently has 3 primary schools, 1 middle school, and 1 high school. For the 2025 population of 11,092, there is no significant gap in educational facilities. By 2045, with a projected population of 17,639, there is a minimal requirement for 2 primary schools and 1 middle school, while the high school remains sufficient. No higher secondary/college facilities are required. Overall, Prang Ghar's education infrastructure is largely adequate, with only minor adjustments needed to accommodate future population growth.

6.4.1.4.2 Rural areas (Cluster-wise)

Mohmand District is predominantly rural in character, with dispersed settlements, limited accessibility, and an uneven distribution of educational facilities. Excluding urban centers and potential urban settlements, rural areas of the district require a context-specific planning approach to address existing deficiencies and future educational needs. Therefore, multiple planning criteria and officially recognized standards were applied to assess the education gap at the district and regional levels.

To address spatial inequities in service provision, both primary and high school requirements were assessed for current deficits and future population growth. Existing educational facilities were identified at the NC/VC level, and a ***cluster-based planning approach*** was adopted by grouping multiple VCs. These clusters were formed to ensure coverage of unserved and underserved rural populations across Mohmand District. The rationale and spatial logic of clustering are discussed in detail in the Rural Development Plan chapter.

- ***Primary Schools***

For primary schools, the current requirement was assessed using the KP Elementary and Secondary Education (KP-ESED) standard of ***1 primary school per 1,000 population***, which is considered appropriate for rural settlements in Khyber Pakhtunkhwa due to smaller catchment sizes and limited mobility. The existing number of schools within each VC and cluster was compared against this standard to identify the present gap. Future requirements were then calculated based on incremental population growth, following the same KP-ESED criterion. A minimum land requirement of ***1 acre per primary school*** was applied to ensure adequate space for classrooms, playgrounds, and basic facilities. The total requirement at the cluster level was derived by combining the existing gap with future demand, representing the actual need for primary schools in rural Mohmand District.

Table 57: Existing and Future Education Requirement Cluster wise (Primary Schools)

Tehsil	Cluster	VC/NC name	Total Population 2025	Existing Educational Facility (Primary School)	Requirement as per KPES Dpt. (1 per 1000)	Current Requirement	Total Population 2045	Future Requirement (Incremental Population) for primary school as per KPES Standard	Total Requirement (Gap+Future)
Yake Ghund Tehsil	Cluster 1	VC Tarakzai 6	5575	3	6	3	8778	3	6
Pindiali Tehsil	Cluster 2	Burhan Khel VC 1,Burhan Khel VC 2	15704	1	16	15	30997	15	30
Pindiali Tehsil	Cluster 3	Issa Khel VC 2, Issa Khel VC 4, Tamanzai VC 1	24766	19	25	6	48886	24	30
Pindiali Tehsil	Cluster 4	Dawezai VC 1, Tamanzai VC 2, Issa Khel VC 3	23354	6	23	17	46099	23	40
Pindiali Tehsil	Cluster 5 (Model Village)	Dawezai VC 2, Dawezai VC 3	21412	3	21	18	42265	21	39
Amber Tehsil	Cluster 6	Utman Khel VC 5, Utman Khel VC 8	15227	7	15	8	33888	19	27
Amber Tehsil	Cluster 7	Utman Khel VC 1, Utman Khel VC 4	18963	7	19	12	42203	23	35
Paranghar Tehsil	Cluster 8	Laman Utman Khel VC 3	11049	4	11	7	15493	4	11
Halimzai Tehsil	Cluster 9	Kuz Kadi Khel VC-1, Kuza Kadi VC-2	13393	22	13	N/A	21429	8	N/A
Halimzai Tehsil	Cluster 10	Bar Kadi Khel VC-2, Kamali Haimzai VC-2	18281	14	18	4	29250	11	15
Halimzai Tehsil	Cluster 11	Bar Kadi Khel VC-1, Durba Khel VC-2, Kamali Halimzai VC-1	23719	16	24	8	37950	14	22
Upper Mohmand Tehsil	Cluster 12	Baizai-VC-1, Baizai-VC-2, Baizai-VC-3, Baizai-VC-4, Khewazai VC-1, Khewazai VC-2	36897	47	37	N/A	42442	6	N/A
Safi Tehsil	Cluster 13	Masood VC-3, VC Chamarkand, VC Sheikh Baba	25377	11	25	14	36012	11	25
Safi Tehsil	Cluster 14	Sagi VC-1, Sagi VC-2	20053	6	20	14	28456	8	22
Safi Tehsil	Cluster 15	Gurbaz VC, Masood VC-1, Masood VC-2	26195	26	26	N/A	37173	11	11

➢ *High Schools*

For high schools, planning was carried out using the ***NRM average standard of one high school per 15,000 population for boys' and girls' schools*** in rural areas. This standard is appropriate for Mohmand District, where settlements are scattered, population densities are low, and higher-level educational facilities are typically accessed over larger catchment areas.

High schools were planned at the cluster level rather than at individual VC level to optimize land use, public investment, and accessibility while ensuring coverage of unserved and underserved rural populations. The clustering approach allows a single high school to serve multiple VCs within a reasonable service area, which is consistent with rural settlement patterns in Khyber Pakhtunkhwa.

The minimum land requirement for a high school was taken as 5 to 8 Kanals, extendable up to ***2 to 5 acres***, depending on enrollment capacity, availability of separate facilities for boys and girls, and future expansion needs. This land standard ensures adequate provision of academic blocks, playgrounds, circulation space, and supporting facilities.

In addition to population-based standards, qualitative planning factors were also considered, including the existing physical condition of school buildings, spatial distribution of facilities within clusters, accessibility through the road network, and overall service coverage. These factors were integrated to ensure that high school planning outcomes are realistic, equitable, and responsive to the socio-spatial context of rural Mohmand District.

Table 58: Existing and Future Education Requirement Cluster wise (High Schools)

Tehsil	Cluster	VC/NC name	Total Population 2025	Existing Educational Facility (High School)	Requirement as per NRM Standard (1 per 15000)	Current Requirement	Total Population 2045	Future Requirement (Incremental Population) for high school as per NRM Standard	Total Requirement (Gap+Future
Yake Ghund Tehsil	Cluster 1	VC Tarakzai 6	5575	0	0	0	8778	0	1
Pindiali Tehsil	Cluster 2	Burhan Khel VC 1,Burhan Khel VC 2	15704	0	1	1	30997	1	2
Pindiali Tehsil	Cluster 3	Issa Khel VC 2, Issa Khel VC 4, Tamanzai VC 1	24766	1	2	1	48886	2	2
Pindiali Tehsil	Cluster 4	Dawezai VC 1, Tamanzai VC 2, Issa Khel VC 3	23354	1	2	1	46099	2	2
Pindiali Tehsil	Cluster 5 (Model Village)	Dawezai VC 2, Dawezai VC 3	21412	0	1	1	42265	1	3
Amber Tehsil	Cluster 6	Utman Khel VC 5, Utman Khel VC 8	15227	0	1	1	33888	1	2
Amber Tehsil	Cluster 7	Utman Khel VC 1, Utman Khel VC 4	18963	0	1	1	42203	2	3
Paranghar Tehsil	Cluster 8	Laman Utman Khel VC 3	11049	1	1	0	15493	0	0
Halimzai Tehsil	Cluster 9	Kuz Kadi Khel VC-1, Kuza Kadi VC-2	13393	2	1	N/A	21429	1	N/A
Halimzai Tehsil	Cluster 10	Bar Kadi Khel VC-2, Kamali Haimzai VC-2	18281	1	1	0	29250	1	1
Halimzai Tehsil	Cluster 11	Bar Kadi Khel VC-1, Durba Khel VC-2, Kamali Halimzai VC-1	23719	0	2	2	37950	1	3
Upper Mohmand Tehsil	Cluster 12	Baizai-VC-1, Baizai-VC-2, Baizai-VC-3, Baizai-VC-4, Khewazai VC-1, Khewazai VC-2	36897	4	2	N/A	42442	0	N/A
Safi Tehsil	Cluster 13	Masood VC-3, VC Chamarkand, VC Sheikh Baba	25377	0	2	2	36012	1	2
Safi Tehsil	Cluster 14	Sagi VC-1, Sagi VC-2	20053	1	1	0	28456	1	1
Safi Tehsil	Cluster 15	Gurbaz VC, Masood VC-1, Masood VC-2	26195	2	2	0	37173	1	0

6.4.1.5 Proposed Future Educational Zones

Educational facilities proposed under this master plan are an integral part of the broader institutionalization and economic development strategies. These facilities are expected to significantly improve literacy rates, which in turn will contribute to enhanced economic growth and overall social development.

The rationale and reasons for proposing new educational facilities in District Mohmand are grounded in addressing the current educational disparities, meeting the growing population's needs, and fostering socio-economic development through improved access to quality education.

District Mohmand continues to face considerable educational challenges, including low literacy rates, significant gender gaps, and limited infrastructure, particularly for girls. The district's total literacy rate is substantially below the provincial average, with female literacy especially lagging due to socio-cultural barriers and economic constraints. These challenges are compounded by insufficient educational institutions and resources, resulting in unequal access to schooling.

The proposal for expanding educational facilities aims to bridge these gaps by increasing the availability and functionality of schools at all levels primary, middle, high, and higher secondary. Providing additional schools will accommodate the rising student population due to demographic growth, reducing overcrowding and improving student-teacher ratios. Special emphasis on girls' schools will promote gender parity by addressing cultural and infrastructural obstacles that currently limit female education.

Furthermore, enhancing educational infrastructure aligns with the strategic objectives of the District Education Office and government policies focused on community engagement, teacher development, and out-of-school children's inclusion. New facilities will support improved enrollment, retention, and learning outcomes, contributing to raising overall education standards.

Investments in education are also integral to broader socio-economic development goals, as education equips individuals with the skills and knowledge essential for employment, health, and civic participation. By establishing accessible, safe, and quality educational environments, the district can foster inclusive growth and empower its youth.

6.4.1.5.1 Urban Centre, Potential Urban Centre and Potential Settlement

The analysis of educational land use across urban centres and potential settlements highlights both existing provision and proposed expansion needs for the period 2025–2045. In Ghalanai, the existing educational land covers 23.25 acres, with an additional 84.99 acres proposed, bringing the total to 108.24 acres. Among potential urban centres, Yake Ghund has 63.05 acres existing and 11.70 acres proposed (total 74.75 acres), Pindiali 2.68 acres existing and 42.60 acres proposed (total 45.28 acres), Utman Khel VC-2&9 2.83 acres existing and 33.76 acres proposed (total 36.59 acres), and Qandahari VC-3&2 6.09 acres existing and 13.87 acres proposed (total 19.96 acres). For potential settlements, Baizai-4 has 1.30 acres existing and 5.20 acres proposed (total 6.50 acres), Masood-3 117.32 acres existing and 7.97 acres

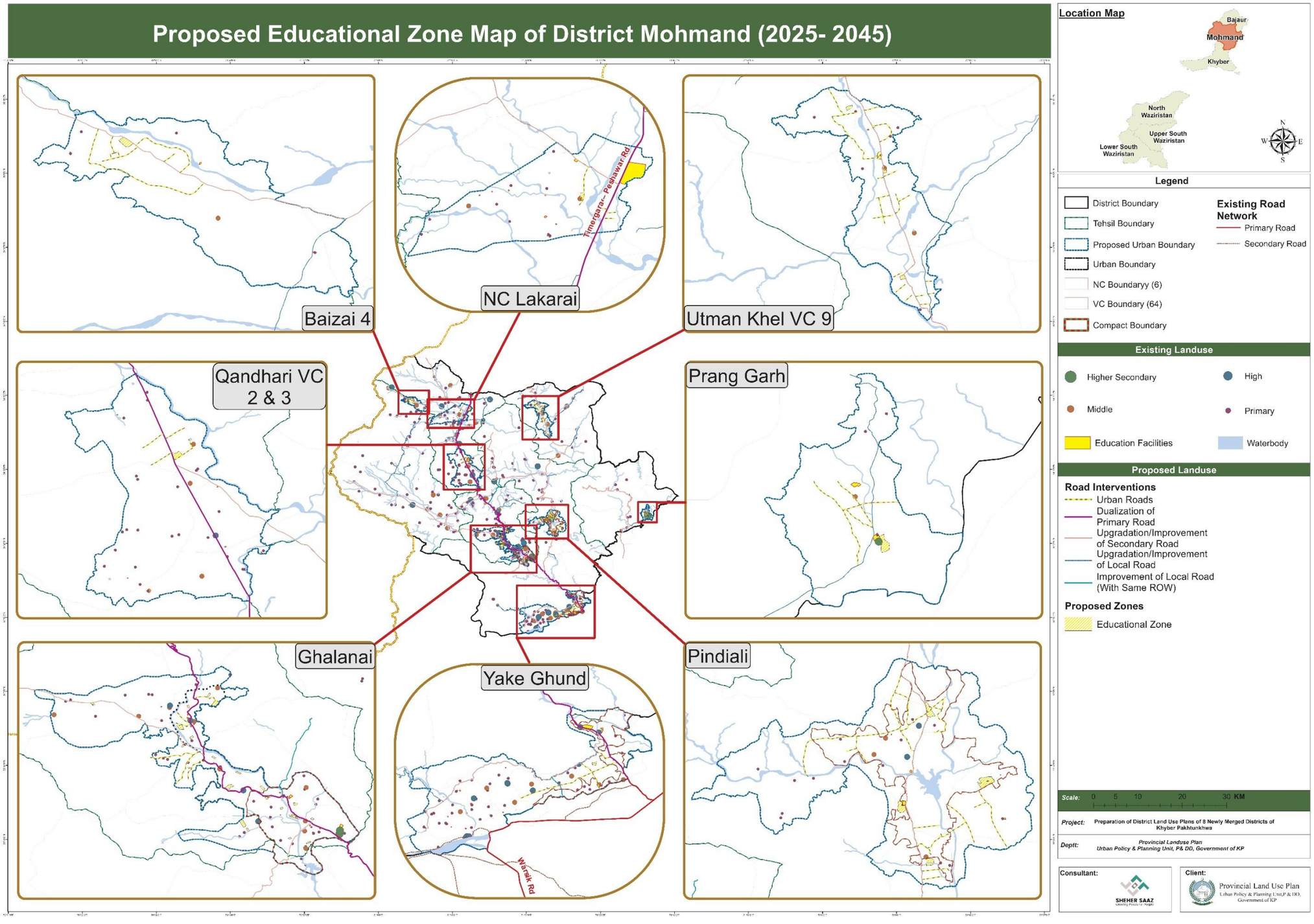
proposed (total 125.29 acres), and Prang Ghar 4.71 acres existing and 5.01 acres proposed (total 9.71 acres). This demonstrates a strategic effort to expand educational zones in line with projected population growth, ensuring sufficient land allocation for schools and related facilities across both urban and emerging settlements.

Table 59: Proposed Zone for Educational Facilities – 2045

Urban Centre/Settlements	*Existing Education (Acres)*	*Proposed Educational Zones (Acres)*	*Total Education (2025-2045) (Acres)*
Urban Centre			
Ghalanai	23.25	84.99	108.24
Potential Urban Centre			
Yake Ghund	63.05	11.70	74.75
Pindiali	2.68	42.60	45.28
Utman Khel Vc-2&9	2.83	33.76	36.59
Qandahari Vc-3&2	6.09	13.87	19.96
Potential Settlement			
Baizai -4	1.30	5.20	6.50
Lakarai	117.32	7.97	125.29
Prang Ghar	4.706	5.01	9.71

Source: Developed by Consultant

Map 36: Proposed Educational Zones - District Mohmand



6.4.1.5.2 Rural areas (Cluster-wise)

Based on the above assessment, educational zones were proposed at both cluster and VC levels to address existing service gaps and improve accessibility in rural Mohmand District. In several clusters, more than two educational zones were proposed due to spatial constraints and settlement dispersion.

The criteria for zoning proposals were based on a GIS-based assessment of existing land use, supported by an evaluation of physical features such as water bodies, rangelands, and hilly terrain. Where such physical constraints were present, multiple educational zones were proposed within a cluster to ensure reasonable access and equitable educational coverage. This approach was particularly applied in clusters with fragmented settlements and natural barriers that limit movement.

An accessibility analysis was conducted using the road network, with priority given to areas that were unserved or had a very low ratio of educational facilities. Proposed educational zones were generally located along existing main roads to enhance accessibility. Where only kacha roads or informal paths existed, road upgradation was proposed as part of the planning process to ensure safe and reliable access to educational facilities.

During the planning of ***Cluster 11*** comprising Bar Kadi Khel VC-1, Durba Khel VC-2, and Kamali Halimzai VC-1 in Halimzai Tehsil, it was identified that a ***high school with approximately 30 acres of land already exists***. Further assessment revealed that a significant portion of this land remains vacant. Therefore, instead of proposing new educational zones, the planning approach emphasized the upgradation of the existing high school. Given the availability of land, it is recommended that middle and primary schools also be developed within the same premises. Shared facilities such as a common playground, library, and sports complex are proposed to serve the entire cluster efficiently and to promote integrated educational development.

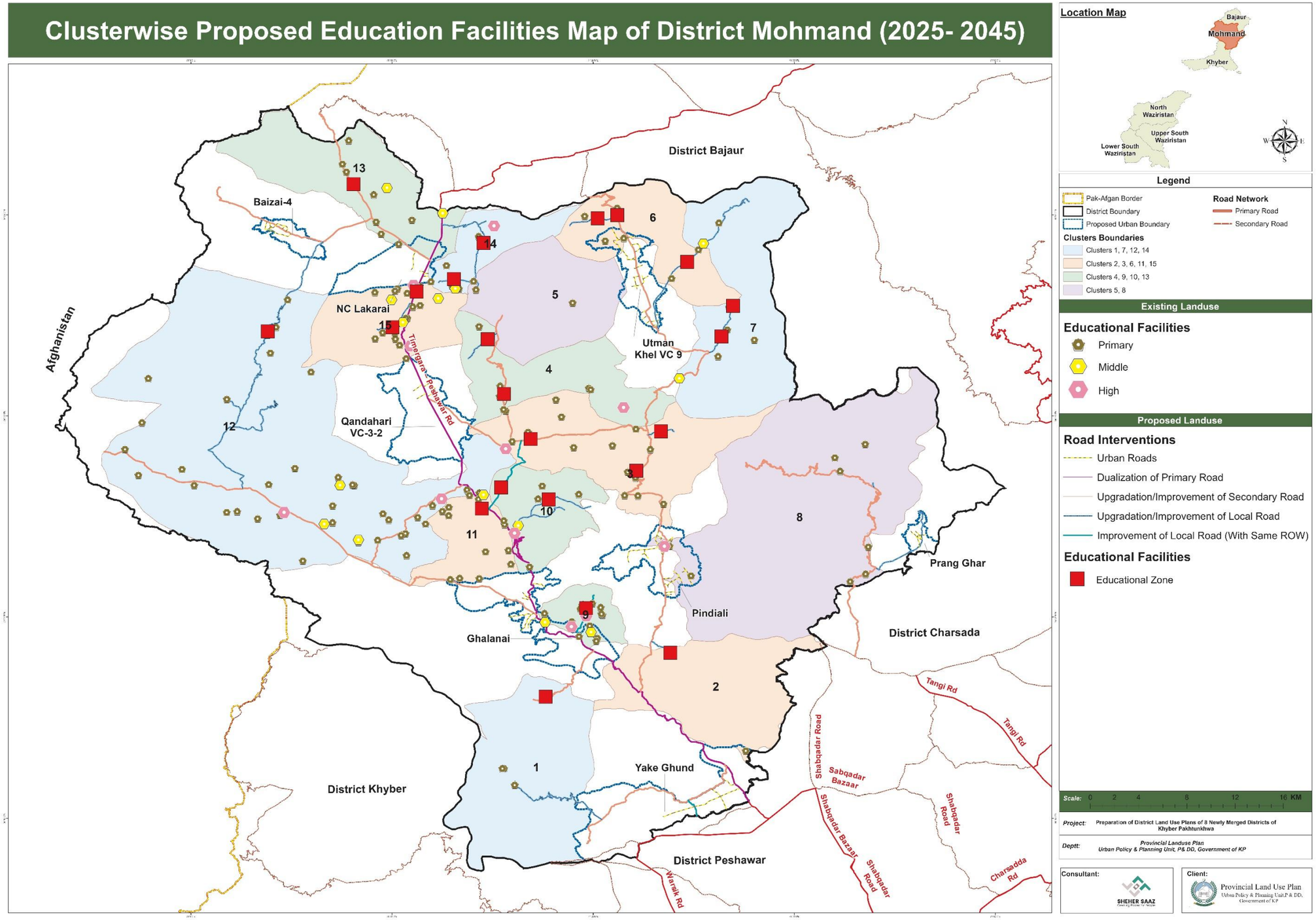
For remote and severely underserved clusters, a ***centralized educational zone*** was proposed at strategically located VCs to maximize coverage and accessibility. This approach was applied in **Cluster 12** (Baizai VC-1, VC-2, VC-3, VC-4; Khewazai VC-1 and VC-2) and **Cluster 13** (Masood VC-3, Chamarkand VC, and Sheikh Baba VC), where dispersed settlements and limited infrastructure necessitate a central service location.

In terms of land allocation, zones proposed on areas of **less than 2 acres** are intended for **lower-order educational facilities**, primarily primary schools. Zones **exceeding 4 acres** are reserved for **higher-order educational facilities**, such as high schools and degree colleges, allowing for future expansion and the provision of supporting infrastructure. Detailed area-wise proposals and corresponding educational facilities are presented in the table below.

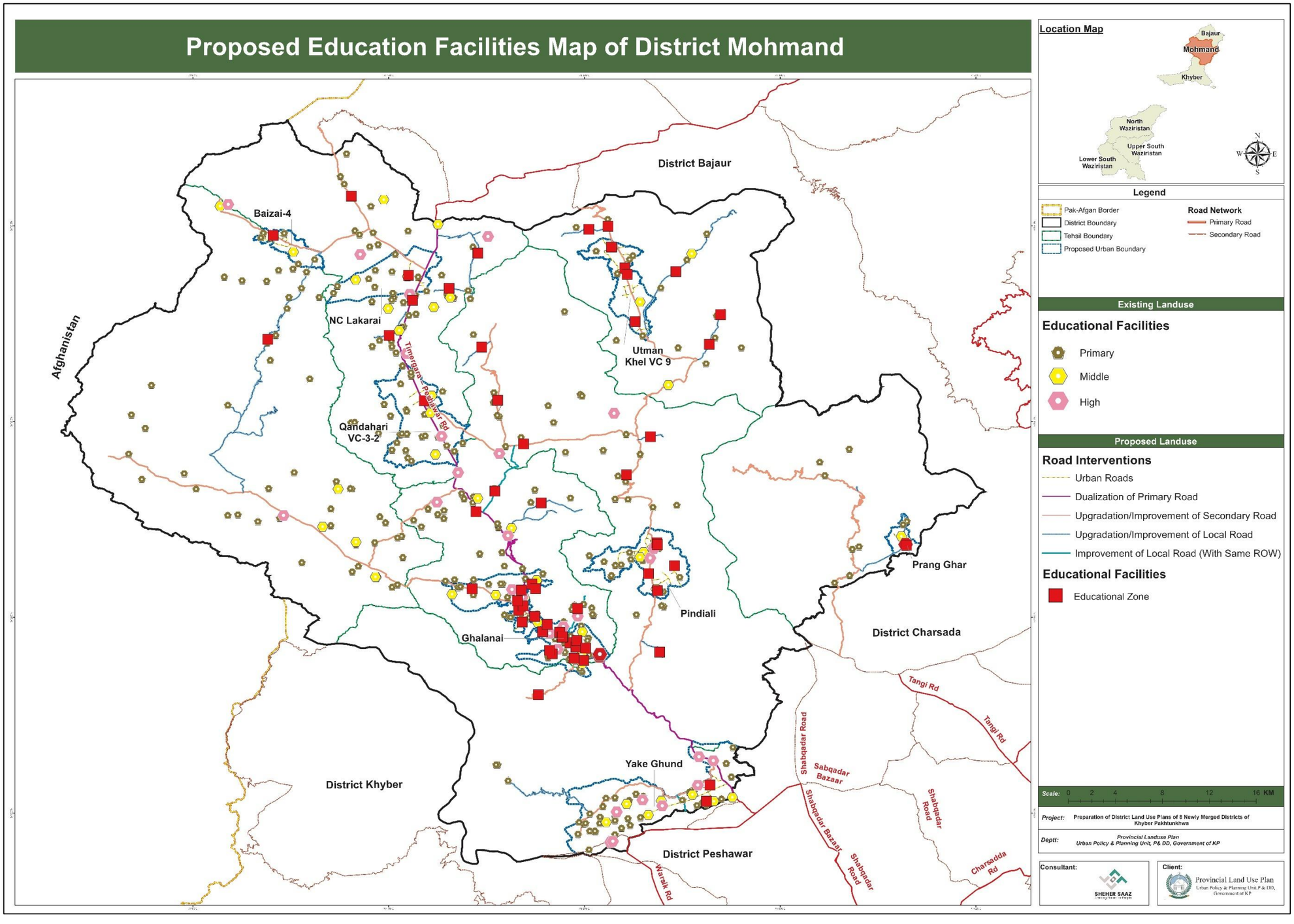
Table 60: Proposed Educational Zones (Clusterwise)

Tehsil	Cluster	VC/NC name	Proposed Zones	Proposed Zones (Acres)
Yake Ghund Tehsil	Cluster 1	VC Tarakzai 6	Educational Zone 1	0.97
Pindiali Tehsil	Cluster 2	Burhan Khel VC 1,Burhan Khel VC 2	Educational Zone 1	0.70
	Cluster 3	Issa Khel VC 2, Issa Khel VC 4, Tamanzai VC 1	Educational Zone 1	1.11
			Educational Zone 2	1.27
			Educational Zone 3	2.58
	Cluster 4	Dawezai VC 1, Tamanzai VC 2, Issa Khel VC 3	Educational Zone 1	2.53
			Educational Zone 2	1.00
Amber Tehsil	Cluster 6	Utman Khel VC 5, Utman Khel VC 8	Educational Zone 1	1.29
			Educational Zone 2	3.63
			Educational Zone 3	3.02
	Cluster 7	Utman Khel VC 1, Utman Khel VC 4	Educational Zone 1	1.15
			Educational Zone 2	1.95
Halimzai Tehsil	Cluster 9	Kuz Kadi Khel VC-1, Kuza Kadi VC-2	Educational Zone 1	1.79
	Cluster 10	Bar Kadi Khel VC-2, Kamali Haimzai VC-2	Educational Zone 1	2.24
			Educational Zone 2	3.76
	Cluster 11	Bar Kadi Khel VC-1, Durba Khel VC-2, Kamali Halimzai VC-1	Educational Zone 1	29.36
Upper Mohmand Tehsil	Cluster 12	Baizai-VC-1, Baizai-VC-2, Baizai-VC-3, Baizai-VC-4, Khewazai VC-1, Khewazai VC-2	Central Educational Zone 1	1.73
Safi Tehsil	Cluster 13	Masood VC-3, VC Chamarkand, VC Sheikh Baba	Central Educational Zone 1	6.23
	Cluster 14	Sagi VC-1, Sagi VC-2	Educational Zone 1	2.76
			Educational Zone 2	3.78
	Cluster 15	Gurbaz VC, Masood VC-1, Masood VC-2	Educational Zone 1	2.27
			Educational Zone 2	2.97

Map 37: Proposed Educational Zones (Cluster-wise)



Map 38: Proposed Educational Facilities Map – Overall District Mohmand



6.4.1.6 Zoning Regulations for Educational Zone

Permitted Uses	Permitted on appeal uses
• Educational and Research Institutions • Offices of Social and Cultural Organizations • Public Utilities and Buildings • Taxi Stands, Bus Halts • Approved Parking Provisions • Day Cares • Research centers • Libraries	• Food courts • Religious Institutions • Petrol and gas filling Station • Parks, Memorials and Monuments

6.4.1.7 Recommendations

- **Infrastructure Development:**

Substantial investment is needed to construct additional classrooms, science and computer labs, and multipurpose halls in both boys' and girls' schools. Priority should be given to areas with high enrollment pressure and limited physical space to ensure equitable access across all tehsils.

- **Upgradation of Girls' Schools:**

Special focus should be placed on upgrading existing girls' schools at the primary and middle levels to high schools, particularly in underserved rural areas. This will reduce the gender gap and improve female literacy rates.

Rehabilitation of Non-functional Schools:

Immediate action should be taken to rehabilitate and functionalize non-operational schools through minor repairs, provision of staff, and necessary resources. This approach will maximize the use of existing infrastructure and expand educational access without excessive capital costs.

- **Provision of Basic Facilities:**

All educational institutions should be equipped with essential amenities such as clean drinking water, boundary walls, sanitation, and electricity. These facilities are crucial to ensure a safe and conducive learning environment, especially for female students.

- **Teacher Recruitment and Capacity Building:**

Recruitment of qualified teachers, coupled with regular professional training and capacity-building programs, should be prioritized. Improving the teacher-student ratio will directly enhance the quality of education in both urban and rural areas.

- **Equitable Budget Allocation:**

The district education budget should be increased and distributed equitably among all tehsils, with transparent monitoring mechanisms to ensure effective utilization of funds for infrastructure, maintenance, and learning materials.

- **Community Engagement and Awareness:**

Community mobilization campaigns should be introduced to promote the importance of education—especially for girls—and to overcome cultural and social barriers. Involving local elders, parent-teacher councils, and religious leaders can improve school participation and retention.

- **Integration of Modern Learning Approaches:**

Introduction of digital classrooms, e-learning resources, and science laboratories should be considered in pilot schools to align education with modern standards and enhance learning outcomes.

- **Monitoring and Evaluation Framework:**

A strong monitoring and evaluation system should be established at both the district and tehsil levels to track school performance, teacher attendance, and student outcomes. Regular reporting will ensure accountability and guide future planning decisions.

- **Accessibility and Inclusivity:**

Schools should be planned within walkable distance as per NRM standards (600m–1km) to improve accessibility. Inclusive education must also be promoted by providing facilities for differently-abled students.

6.4.2 Health Facilities

6.4.2.1 Existing Health Institutions

The existing health facilities in District Mohmand face significant challenges in meeting the healthcare needs of its growing population. The district currently has only three hospitals with a total of 158 beds and a medical staff of 91 doctors. This results in a population-to-bed ratio of approximately 3,207 persons per bed, which is one of the highest among merged districts and considerably less favorable than neighboring districts such as Orakzai, where the ratio stands at 952. This discrepancy highlights a critical shortage of healthcare infrastructure and resources in Mohmand.

The District Headquarters Hospital in Ghalanai serves as the primary healthcare facility, providing essential medical services to the population. Supplementing this are 19 dispensaries, 3 Rural Health Centers (RHCs) with a combined 24 beds, 3 tuberculosis clinics, and 24 Basic Health Units (BHUs) distributed throughout the district. These facilities collectively managed to treat over 344,000 patients in 2021, reflecting the high demand and strain on existing health resources.

In the urban and peri-urban zones of Ghalanai, healthcare services are provided by five BHUs, the District Headquarter Hospital (DHQ), one private general hospital, and two private medical centers, including Amaan General and Al-Adil Medical Center and Maternity Home. Despite this network, the healthcare capacity remains inadequate to address the evolving health challenges posed by the increasing population.

Immunization coverage is another area of concern. Despite the availability of essential vaccines such as BCG, OPV, and Hepatitis-B, many children do not complete the full immunization schedule due to vaccine hesitancy influenced by fears of infertility, distrust in vaccines and healthcare workers, religious beliefs, and security concerns. The immunization gap is particularly pronounced among parents with low or no education, exacerbating the risk of preventable diseases. Major diseases impacting the district include malaria, tuberculosis, hepatitis, diarrhoea, acute respiratory infections, and COVID-19, placing additional demands on the healthcare system.

6.4.2.2 Accessibility Analysis

Accessibility to health facilities was evaluated using a network-based spatial analysis in ArcGIS Pro to represent realistic travel conditions along the existing road network. A geodatabase network dataset was developed with road length (meters) as the impedance attribute, and topological errors were corrected to ensure accurate routing. All existing health facilities were mapped as point features and snapped to the nearest road segments to enable precise distance calculations.

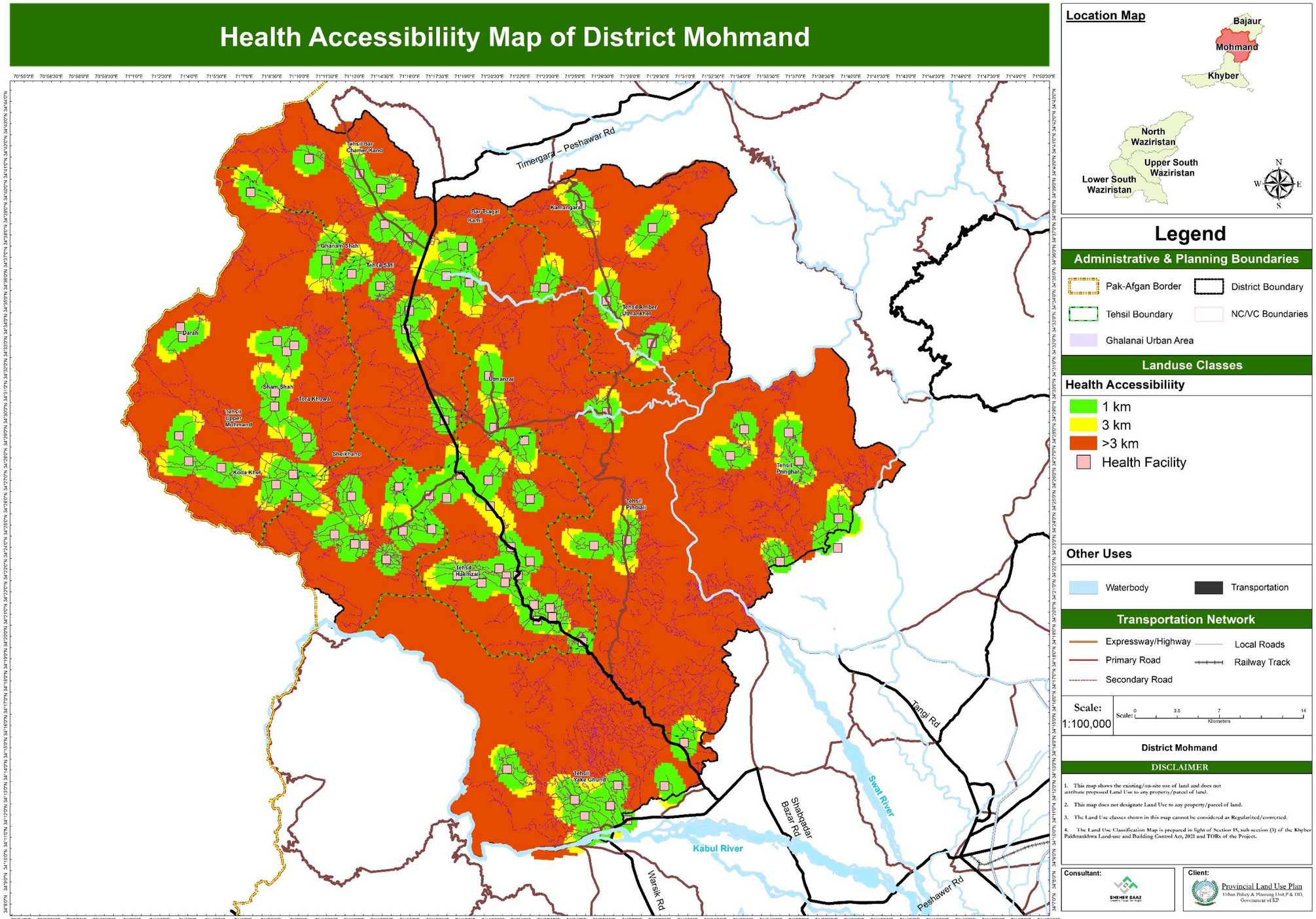
The analysis was conducted using the Service Area tool within the Network Analyst extension, applying a “toward facilities” travel direction. Two network distance thresholds 1 km and 3 km were used to define primary and extended service catchments. Service areas were generated as non-overlapping polygon rings, with overlapping catchments dissolved to represent

combined health service coverage. A 1,000-meter trim distance was applied to account for populations residing away from road centrelines.

Health facility accessibility was classified into three levels: **High Accessibility** (within 1 km), **Moderate Accessibility** (1–3 km), and **Low Accessibility** (beyond 3 km). These zones were intersected with administrative boundaries to quantify coverage and identify underserved areas. Locations outside all service areas were identified as accessibility gaps, highlighting priority zones for future health facility provision and infrastructure improvement.

The following maps show accessibility of public health facilities with respect to walkability and driving;

Map 39: Existing Health Facilities Accessibility – District Mohmand



6.4.2.3 National Standards

6.4.2.3.1 National reference manual (NRM)

Health facility standards in Pakistan are based on population thresholds to ensure equitable and efficient healthcare service delivery across all regions. A Basic Health Unit (BHU) is recommended for every 10,000 people, functioning as the primary level of care for outpatient treatment, maternal and child health services, and preventive care. For more comprehensive services, a Rural Health Centre (RHC) is required for every 73,000 people, offering minor surgical procedures, inpatient care, and diagnostic support. While dispensaries do not follow a defined population standard, they are typically established in remote or underserved areas to provide basic outpatient care. At the secondary level, one District Headquarters Hospital (DHQ) is required per district. At the same time, a Tehsil Headquarters Hospital (THQ) is established in each tehsil to serve as a referral point for BHUs and RHCs, delivering specialized care. General Hospitals are located in major urban areas, offering tertiary-level care and a broad range of specialist services. These standards serve as a guideline for identifying service delivery gaps and planning new health infrastructure to meet the needs of both rural and urban populations.

Table 61: Requirement for New Health Institute in the District

Type of Health Facility	Standard
Basic Health Unit (BHU)	1 BHU for 10,000 people
Rural Health Centre (RHC)	1 for 73,000 people
Dispensary	1 for 15,000
District Headquarters Hospital (DHQ)	1 per district
Tehsil Headquarters Hospital (THQ)	1 per tehsil (1 hospital for 0.5 to 1 million people)
General Hospital	In Large Cities
Hospital Beds	3 for 1000 people

Source: National Reference Manual of Planning and Infrastructure Standards (NRM)

6.4.2.3.2 Khyber Pakhtunkhwa Health Facility Planning Framework

As per the Kp policies, the establishment of a Basic Health Unit (BHU) is planned to serve a catchment population of 15,000–20,000 in urban areas and 10,000–15,000 in rural areas, within a 7–10 km service radius. Each BHU requires 10.75 kanals of land, along with basic infrastructure including road access, electricity, and water supply. The facility should be located 7–10 km away from another BHU or higher-level health facility, and the availability of basic educational facilities in the area is considered supportive.

For up-gradation of a BHU to a Rural Health Center (RHC), the proposed catchment population increases to 45,000–60,000, with a wider service area of 25–35 km. The up-gradation requires 10.75 kanals of additional adjacent land, a minimum OPD load of 50–60 patients per day, and access via a metallic road, along with reliable electricity and water supply. The presence of at least one college or higher secondary school and a post office is desirable, while the upgraded

RHC should be located 25–35 km from the nearest RHC or Civil Hospital to ensure balanced healthcare coverage.

Table 62: Proposed Criteria for Establishment of BHU and Up-gradation to RHC[10]

Sr. No.	Criteria	BHU Establishment Standards	BHU Up-gradation to RHC Standards
1	Catchment Population	Urban: **15,000 – 20,000** Rural: **10,000 – 15,000**	**45,000 – 60,000**
2	Catchment Area	**7 – 10 km** radius	**25 – 35 km** radius
3	Land Availability	**10.75 Kanals**	**10.75 Kanals** (adjacent to existing BHU)
4	Road Access	Road access required	**Metallic road** required
5	Electricity & Water	Required	Required
6	OPD Load	Not applicable	Minimum **50–60 patients/day per BHU**
7	Distance from Nearest Health Facility	**7 – 10 km** from another BHU or higher-level facility	**25 – 35 km** from nearest RHC or Civil Hospital

The proposal has been prepared using National Reference Manual (NRM) standards, given that a detailed assessment of existing health facilities was not feasible at this stage. It is therefore recommended that a comprehensive evaluation of current BHUs including population coverage, service demand, land availability, and infrastructure be undertaken. Based on this evaluation, BHU up-gradation to RHCs should follow the outlined criteria, ensuring that facilities meet the required population thresholds, service radius, OPD load, and access to utilities, thereby supporting effective and balanced healthcare service delivery.

- **Primary Healthcare Facilities in Khyber Pakhtunkhwa**

Healthcare services in Khyber Pakhtunkhwa are delivered through a tiered system of facilities to ensure comprehensive coverage and accessibility. **Basic Health Units (BHUs) and dispensaries** serve as the first point of contact, primarily catering to populations of 15,000–20,000, offering essential primary healthcare including maternal and child care, immunization, and common ailment management. **24/7 BHUs and MCH centres** provide round-the-clock services, including delivery care, for a larger catchment of 30,000–40,000 people. **Rural Health Centres (RHCs)** serve 40,000–60,000 or more, offering a broader range

[10] Source: Secondary Data collected from Department

of services including emergency care, minor surgical procedures, inpatient care, and support to linked BHUs. At the higher level, **first level hospitals** provide specialist consultations, diagnostic services, and hospital admissions on referral from primary care, ensuring continuity and equity of healthcare delivery. This tiered system is structured to maintain service accessibility, operational efficiency, and effective referral linkages across the province.

Table 63: Healthcare Facility Types and Services – Khyber Pakhtunkhwa[11]

Facility Type	Population Served / Catchment	Operating Hours	Key Services & Functions	
Basic Health Unit (BHU) / Civil Dispensary / General Practitioner Clinic	~15,000–20,000 (per Union Council/Ward)	8 hours / 6 days a week	• Maternal & child care (static & outreach) • Immunization- Family planning- Management of diarrhoea, pneumonia, common ailments • Control of communicable diseases • Health education- Management & logistic support to LHWs & community-based providers	Dispensaries are older type facilities mainly in urban areas; BHUs are primarily rural; first formal point of contact for primary healthcare
24/7 BHU / MCH Centre / Medical Centre	30,000–40,000	24/7	• Expanded primary healthcare services- Round-the-clock delivery services- Maternal & child health- Requires adequate infrastructure, human resources, equipment & supplies	Upgradation of BHUs for 24/7 delivery care is being implemented in Khyber Pakhtunkhwa; MCH centres and private clinics also provide 24/7 services
Rural Health Centre (RHC) / Health Centre / Nursing Home	40,000–60,000 or more	24/7	• Comprehensive primary healthcare • Basic inpatient care (20 beds)- BEmONC services • Emergency management (injuries, accidents) • Selected minor surgical procedures (stitching, abscess drainage, circumcision) • First aid & referral services • Clinical, logistical, managerial support to linked BHUs, LHWs, MCH Centres, Dispensaries- Laboratory & X-ray services- Medico-legal, basic surgical, dental, ambulance services	Typically links 5–8 BHUs for referral; private sector equivalents exist in urban areas; ambulance services under Rescue 1122
First Level Hospital	Intermediate care on referral from primary care	24/7	• Specialist consultation- Hospital admissions- Technical, therapeutic, diagnostic services- Basic specialist services per standardized categories (A–D)	Previously known as DHQ/THQ hospitals; standardized since 2002 to ensure 1 bed per 2,500 population; infrastructure & equipment upgradation conducted through ADP

6.4.2.3.3 Comparative Analysis of NRM and KP Health Department Standards

[11] Essential Package of Health Services with localized evidence/ UHC Benefit Package of Khyber Pakhtunkhwa, Health Department, Khyber Pakhtunkhwa, 2022

The National Reference Manual (NRM) and the population-based standards of the Khyber Pakhtunkhwa Health Department differ primarily in their approach to healthcare planning and service provision. NRM standards are more conservative and planning-oriented, as they apply lower population thresholds per facility, resulting in higher facility and capacity requirements. In contrast, KP Health Department standards are designed around minimum service delivery needs, allowing higher population thresholds per facility and therefore indicating lower numerical requirements.

For primary healthcare facilities such as Basic Health Units, NRM prescribes one BHU per 10,000 population, while the KP Health Department allows one BHU per 17,500 population. This makes NRM more sensitive to population growth and spatial accessibility, whereas KP standards focus on maintaining essential service coverage. In the case of Rural Health Centres and Maternal and Child Health facilities, both standards broadly align, although KP Health Department standards typically adopt slightly lower population thresholds, emphasizing service delivery efficiency rather than long-term capacity expansion.

Dispensaries show minor variation between the two frameworks, with NRM generally recommending a higher number of facilities due to stricter population ratios, while KP standards permit fewer units without compromising basic outpatient coverage. At the hospital level, NRM defines clear population thresholds for major hospitals, whereas KP Health Department standards rely more on administrative and functional considerations rather than fixed population criteria.

A significant distinction is observed in hospital bed standards, where NRM recommends a substantially higher bed-to-population ratio, reflecting future demand, service intensity, and emergency preparedness. KP Health Department standards, on the other hand, prescribe lower bed ratios that represent minimum operational requirements. Overall, NRM standards are more suitable for long-term spatial planning and infrastructure forecasting, while KP Health Department standards are more appropriate for assessing immediate service adequacy and operational planning.

Table 64: Comparison of NRM and Khyber Pakhtunkhwa Health Department Standard

Health Facility Type	NRM Population Standard	Khyber Pakhtunkhwa Health Department Standard
Basic Health Unit (BHU)	1 BHU per 10,000 population	1 BHU per 17,500 population
Rural Health Centre (RHC)	1 RHC per 73,000 population	1 RHC per 50,000 population
Maternal & Child Health (MCH) Facility	1 MCH per 73,000 population	1 MCH per 50,000 population
Dispensary	1 Dispensary per 15,000 population	1 Dispensary per 17,500 population
DHQ / Public Hospital	1 Hospital per 0.5 – 1.0 million population	No fixed population-based standard
Hospital Beds	3 beds per 1,000 population	1 bed per 2,500 population

6.4.2.4 Future Requirement

As of 2025, the population stands at approximately 581,894. The district currently has 25 Basic Health Units (BHUs) but requires 58 BHUs to provide adequate primary care services, reflecting a current shortfall of 33 BHUs. With the projected population rise to 912,008 by 2045, an additional 33 BHUs will be required to maintain acceptable service levels according to established healthcare standards.

For Rural Health Centers (RHCs), there are presently 3 functional centers against a current requirement of 8, an existing deficit of 5 centers. The future need remains at 5 additional centers, aligned with population growth and healthcare demand.

Maternal and Child Health (MCH) centers are currently grossly inadequate with only 8 facilities available, while the required number is 36, resulting in a deficit of 28 centers. Although future projections indicate a decrease in the gap to 4 centers, considerable expansion is necessary to meet service demands.

Dispensaries number 19 but require 39 to adequately provide outpatient care and medication services, marking a current gap of 20 units. Population growth will increase this need by 22 more dispensaries by 2045.

Public hospitals currently total 3, which slightly exceeds the immediate requirement of 1, resulting in a surplus of 2 hospitals. Nevertheless, given the population increase, at least one additional hospital will be essential to effectively serve the expanded population by 2045.

Bed capacity across all health facilities is drastically insufficient, with only 182 beds available compared to a current requirement of 1,746 beds. This shortfall of 1,564 beds will become more acute with an expected population increase of 330,114, requiring nearly 1,000 additional beds by 2045 to align with healthcare standards and ensure adequate inpatient care.

Table 65: Future Requirement of Health Facilities in District Mohmand

Facility	Current Requirement (2025)				Future Requirement (2025-2045)		
	Existing Facilities (numbers)	Population 2025	Current requirement	Current Gap (2025)	Population (2045)	Increase in Population	Total Requirement (2025-2045)
BHU	25	581894	58	33	912,008	330,114	33
RHC	3		8	5			5
MCH	36		8				4
Dispensary	19		39	20			22
Public Hospitals	3		1	0			1
Bed in all Facilities	182		1746	1564			990

Source: Calculated by Consultants

6.4.2.4.1 Urban Centers, Potential Urban Centers and Settlements

The assessment of health facilities in the *urban center* of District Mohmand such as Ghalanai and *potential urban centre* such as Yake Ghund, Pindiali, Utman Khel Vc-2&9, Qandahari Vc-3&2 and *potential settlements* such as Baizai -4, Lakarai, Prang Ghar highlights a mixed situation where limited infrastructure is in place, but future population growth will require proportional expansion. Despite being more accessible than rural regions, these urban areas still face significant gaps in primary and secondary healthcare facilities when measured against NRM Standards.

To ensure equitable access to primary and secondary healthcare services across Mohmand District, the future healthcare requirements have been projected for both urban centers and potential urban settlements based on population growth from 2025 to 2045. The analysis includes Basic Health Units (BHUs), Rural Health Centers (RHCs), Maternal and Child Health (MCH) facilities, dispensaries/clinics, public hospitals, and bed capacity.

Urban Centers:

Ghalanai currently has 4 Basic Health Units (BHUs), 2 Maternal and Child Health (MCH) centers, 6 dispensaries, and 1 District Headquarters/Public Hospital, with a total requirement of 138 hospital beds.

The health infrastructure in Ghalanai has been assessed against the National Reference Manual (NRM) and the Khyber Pakhtunkhwa Health Department standards to evaluate adequacy and future requirements for 2025 and 2045. The comparison shows that NRM standards are generally stricter, using lower population thresholds per facility and identifying higher needs, while KP standards reflect minimum service delivery requirements.

For Basic Health Units, NRM requires one per 10,000 population, resulting in higher projected needs and gaps compared to the KP standard of one per 17,500 population. Rural Health Centres show similar requirements under both standards, highlighting a critical gap in secondary care. Maternal and Child Health facilities and dispensaries are generally adequate or surplus under both frameworks, indicating reasonable primary healthcare coverage. At the hospital level, NRM defines population-based thresholds for DHQs, whereas KP standards rely on functional considerations, with no additional hospitals required. Hospital bed standards differ significantly, with NRM prescribing three beds per 1,000 population versus KP's one bed per 2,500 population, reflecting NRM's stronger focus on future capacity and service intensity.

Table 66: Health Requirement of Urban Centre

Ghalanai												
Urban Area	*Health facilities*	*Existing facilities*	*Pop 2025*	*Pop 2045*	*NRM Standards*			*Health Department Standards, Khyber Pakhtunkhwa*			*Population Based Standards*	
					Existing Requirement 2025	*Gap*	*Future Requirement 2045*	*Existing Requirement 2025*	*Gap*	*Future Requirement 2045*	*NRM*	*KP Health Standards*
Ghalanai	BHU	*4*	46012	73,704	5	1	7	3	N/A	4	10,000	17,500
	RHC	*0*			1	1	1	1	1	1	73,000	50,000

	MCH	***2***			1	N/A	1	1	N/A	1	73,000	50,000
	Dispensary	***6***			3	N/A	5	3	N/A	4	15,000	17,500
	DHQ/Public Hospitals	***1***			0	N/A	0	0	N/A	0	0.5 to 1 million	N/A
	Beds				138	138	221	18	18	29	3 for 1000 people	1 per 2,500

Potential Urban Centers:

The health infrastructure of the potential urban centers: Yake Ghund, Pindiali, Utman Khel VC-2&9, and Qandahari VC-3&2 has been assessed against the National Reference Manual (NRM) standards and the Khyber Pakhtunkhwa Health Department population-based benchmarks to evaluate adequacy, gaps, and future requirements. Across all centers, NRM standards are generally stricter, using lower population thresholds per facility, resulting in higher projected requirements, while KP Health Department standards reflect minimum operational needs.

For Basic Health Units (BHUs), NRM requires five units in 2025 for Yake Ghund, four for Pindiali, three for Utman Khel, and two for Qandahari, increasing to eight, eight, six, and three units, respectively, by 2045. Existing BHUs are below these requirements in all centers, with gaps ranging from one to three facilities. Under KP standards, the required BHUs are fewer five for Yake Ghund, five for Pindiali, four for Utman Khel, and two for Qandahari indicating smaller gaps or adequacy in most cases.

Rural Health Centres (RHCs) and Maternal & Child Health (MCH) facilities also show differences between the standards. For 2025, NRM requires one RHC and one MCH in Yake Ghund and Pindiali, and one each in Utman Khel by 2045, while Qandahari requires none initially. KP standards require slightly more units in some cases, highlighting a practical approach to service delivery. Dispensaries are generally adequate under both standards, though NRM requirements are higher, ranging from one in Qandahari to five in Pindiali and Yake Ghund by 2045. DHQ or major public hospitals are not required under either standard in any of the centres due to their relatively small populations. For hospital beds, NRM prescribes three beds per 1,000 population, resulting in requirements ranging from 95 in Qandahari to 242 in Yake Ghund by 2045, while KP standards require fewer beds, from 13 in Qandahari to 32 in Yake Ghund.

Table 67: Health Requirement of Potential Urban Centre

Potential Urban Centres													
Yake Ghund													
Urban Area	**Health facilities**	**Existing facilities**	**Pop 2025**	**Pop 2045**	**NRM Standards**			**Health Department Standards, Khyber Pakhtunkhwa**			**Population Based Standards**	
					Existing Requirement 2025	**Gap**	**Future Requirement 2045**	**Existing Requirement 2025**	**Gap**	**Future Requirement 2045**	**NRM**	**KP Health Standards**
Yake Ghund	BHU	**2**	50541	80,614	5	3	8	3	1	5	10,000	17,500
	RHC	**1**			1	0	1	1	0	2	73,000	50,000
	MCH	**1**			1	0	1	1	0	2	73,000	50,000
	Dispensary	**2**			3	1	5	3	1	5	15,000	17,500
	DHQ/Public Hospitals	**0**			0	0	0	0	0	0	0.5 to 1 million	N/A
	Beds				152	152	242	20	20	32	3 for 1000 people	1 per 2,500 people
Pindiali												
Urban Area	**Health facilities**	**Existing facilities**	**Pop 2025**	**Pop 2045**	**NRM Standards**			**Health Department Standards, Khyber Pakhtunkhwa**			**Population Based Standards**	
					Existing Requirement 2025	**Gap**	**Future Requirement 2045**	**Existing Requirement 2025**	**Gap**	**Future Requirement 2045**	**NRM**	**KP Health Sandards**
Pindiali	BHU	**2**	40364	80,180	4	2	8	2	0	5	10,000	17,500
	RHC	**0**			1	1	1	1	1	2	73,000	50,000
	MCH	**0**			1	1	1	1	1	2	73,000	50,000
	Dispensary	**0**			3	3	5	2	2	5	15,000	17,500
	DHQ/Public Hospitals				0	0	0	0	0	0	0.5 to 1 million	N/A

	Beds				121	121	241	16	16	32	3 for 1000 people	1 per 2,500
Utman Khel Vc-2&9												
Urban Area	***Health facilities***	***Existing facilities***	***Pop 2025***	***Pop 2045***	***NRM Standards***			***Health Department Standards, Khyber Pakhtunkhwa***			***Population Based Standards***	
					Existing Requirement 2025	***Gap***	***Future Requirement 2045***	***Existing Requirement 2025***	***Gap***	***Future Requirement 2045***	***NRM***	***KP Health Standards***
Utman Khel Vc-2&9	BHU	***1***	28547	63,675	3	2	6	2	1	4	10,000	17,500
	RHC	***0***			0	0	1	1	1	1	73,000	50,000
	MCH	***0***			0	0	1	1	1	1	73,000	50,000
	Dispensary	***0***			2	2	4	2	2	4	15,000	17,500
	DHQ/Public Hospitals	***0***			0	0	0	0	0	0	0.5 to 1 million	N/A
	Beds				86	86	191	11	11	25	3 for 1000 people	1 per 2,500
Qandahari Vc-3&2												
Urban Area	***Health facilities***	***Existing facilities***	***Pop 2025***	***Pop 2045***	***NRM Standards***			***Health Department Standards, Khyber Pakhtunkhwa***			***Population Based Standards***	
					Existing Requirement 2025	***Gap***	***Future Requirement 2045***	***Existing Requirement 2025***	***Gap***	***Future Requirement 2045***	***NRM***	***KP Health Standards***
Qandahari Vc-3&2	BHU	***2***	22347	31,714	2	0	3	1	N/A	2	10,000	17,500
	RHC	***0***			0	0	0	0	0	1	73,000	50,000
	MCH	***0***			0	0	0	0	0	1	73,000	50,000
	Dispensary	***0***			1	1	2	1	1	2	15,000	17,500
	DHQ/Public Hospitals	***0***			0	0	0	0	0	0	0.5 to 1 million	N/A
	Beds				67	67	95	9	9	13	3 for 1000 people	1 per 2,500

Potential Urban Settlements:

In Baizai-4, there are currently no formal health facilities, including BHUs, RHCs, MCH centers, dispensaries, or public hospitals. For the 2025 population of 7,158, the settlement requires one BHU, indicating an existing gap. By 2045, with the population projected to reach 11,031, the total requirement increases to two BHUs and one dispensary, along with 55 hospital beds, reflecting a growing need for basic healthcare services.

Lakarai also lacks primary healthcare facilities such as BHUs, RHCs, MCH centers, and dispensaries, although two public hospitals are present, which exceed current and future requirements. For the 2025 population of 7,452, there is a requirement for one BHU, while by 2045, with a projected population of 10,575, the total requirement rises to two BHUs and one dispensary, supported by 54 hospital beds.

In Prang Ghar, the existing health infrastructure includes one BHU, with no other healthcare facilities currently available. This meets the 2025 requirement for a population of 11,092. However, by 2045, as the population increases to 17,639, the settlement will require two BHUs and two dispensaries, along with 86 hospital beds, indicating the need for incremental expansion of primary healthcare services.

Table 68: Health Requirement of Potential Settlement

Potential Settlement													
Baizai -4													
Urban Area	**Health facilities**	**Existing facilities**	**Pop 2025**	**Pop 2045**	**NRM Standards**			**Health Department Standards, Khyber Pakhtunkhwa**			**Population Based Standards**	
					Existing Requirement 2025	**Gap**	**Future Requirement 2045**	**Existing Requirement 2025**	**Gap**	**Future Requirement 2045**	**NRM**	**KP Health Standards**
Baizai -4	BHU	**0**	7158	11,031	1	1	1	0	0	1	10,000	17,500
	RHC	**0**			0	0	0	0	0	0	73,000	50,000
	MCH	**0**			0	0	0	0	0	0	73,000	50,000
	Dispensary	**0**			0	0	1	0	0	1	15,000	17,500
	DHQ/Public Hospitals	**0**			0	0	0	0	0	0	0.5 to 1 million	N/A
	Beds				21	21	33	3	3	4	3 for 1000 people	1 per 2,500
Lakarai												
Urban Area	**Health facilities**	**Existing facilities**	**Pop 2025**	**Pop 2045**	**NRM Standards**			**Health Department Standards, Khyber Pakhtunkhwa**			**Population Based Standards**	
					Existing Requirement 2025	**Gap**	**Future Requirement 2045**	**Existing Requirement 2025**	**Gap**	**Future Requirement 2045**	**NRM**	**KP Health Standards**
Lakarai	BHU	**0**	7452	10,575	1	1	1	0	0	1	10,000	17,500
	RHC	**0**			0	0	0	0	0	0	73,000	50,000
	MCH	**0**			0	0	0	0	0	0	73,000	50,000
	Dispensary	**0**			0	0	1	0	0	1	15,000	17,500
	DHQ/Public Hospitals	**2**			0	N/A	0	0	N/A	0	0.5 to 1 million	N/A

	Beds				22	22	32	3	3	4	3 for 1000 people	1 per 2,500
Prang Ghar												
Urban Area	***Health facilities***	***Existing facilities***	***Pop 2025***	***Pop 2045***	***NRM Standards***			***Health Department Standards, Khyber Pakhtunkhwa***			***Population Based Standards***	
					Existing Requirement 2025	***Gap***	***Future Requirement 2045***	***Existing Requirement 2025***	***Gap***	***Future Requirement 2045***	***NRM***	***KP Health Standards***
Prang Ghar	BHU	***1***	11092	17,639	1	0	2	1	0	1	10,000	17,500
	RHC	***0***			0	0	0	0	0	0	73,000	50,000
	MCH	***0***			0	0	0	0	0	0	73,000	50,000
	Dispensary	***0***			1	1	1	1	1	1	15,000	17,500
	DHQ/Public Hospitals	***0***			0	0	0	0	0	0	0.5 to 1 million	N/A
	Beds				33	33	53	4	4	7	3 for 1000 people	1 per 2,500

6.4.2.4.2 Rural areas (Cluster-wise)

For the assessment of health facilities in rural areas of Mohmand District, excluding urban centers and potential urban settlements, a standards-based planning approach was adopted to identify existing gaps and future requirements at the district and cluster levels. Due to the predominantly rural character of the district, dispersed settlements, and limited accessibility, both current and future health facility requirements were evaluated using recognized national and provincial standards.

The current requirement of basic health facilities was assessed using two reference standards to ensure a balanced and realistic evaluation. The NRM standard of ***one health facility per 10,000 population*** was applied as a benchmark for optimal service provision in rural areas, while the ***Khyber Pakhtunkhwa Health Department standard of one facility per 17,500 population*** was used to reflect prevailing provincial practice and implementation capacity. Existing health facilities were identified at the NC/VC level, and clusters were formed to assess service coverage and accessibility across multiple VCs.

The gap analysis was carried out by comparing the existing number of facilities with the current requirement under both standards. This allowed identification of underserved and unserved areas within each cluster. For future requirements, projected incremental population was calculated and applied to the NRM standard, as it provides a more comprehensive planning threshold for long-term service delivery in rural districts.

The total health facility requirement for each cluster was determined by combining the existing gap and future demand, calculated in accordance with the NRM standard. This total requirement represents the actual need for health facilities to achieve adequate service coverage and equitable access across rural Mohmand District.

Table 69: Existing and Future Health Requirement (Cluster wise)

Tehsil	Cluster	VC/NC name	Total Population 2025	Existing Health Facility (BHU/CD)	Requirement as per NRM Standard (1 per 10,000)	Requirement as per KPK health dept. (1 per 17,500)	Current Gap Analysis (as per NRM)	Total Population 2045	Future Requirement as per NRM Standard (1 Per 10000)	Future Requirement as per KPK Health Dpt (1 Per 17500)	Total Requirement (Current Gap+Future) AS per NRM
Amber Tehsil	Cluster 1	Utman Khel VC 1, Utman Khel VC 4	18963	0	2	1	2	42203	4	2	6
Pindiali Tehsil	Cluster 2	Burhan Khel VC 1,Burhan Khel VC 2	15704	0	2	1	2	30997	3	2	5
Pindiali Tehsil	Cluster 3	Issa Khel VC 2, Issa Khel VC 4, Tamanzai VC 1	24766	1	2	1	1	48886	5	3	6
Pindiali Tehsil	Cluster 4	Dawezai VC 1, Tamanzai VC 2, Issa Khel VC 3	23354	0	2	1	2	46099	5	3	7
Pindiali Tehsil	Cluster 5 (Model Village)	Dawezai VC 2, Dawezai VC 3	21412	0	2	1	2	42265	4	2	6
Amber Tehsil	Cluster 6	Utman Khel VC 5, Utman Khel VC 8	15227	0	2	1	2	33888	3	2	5
Yake ghund Tehsil	Cluster 7	VC Tarakzai 6	5575	1	1	0	0	8778	1	1	0
Paranghar Tehsil	Cluster 8	Laman Utman Khel VC 3	11049	1	1	1	0	15493	2	1	2
Halimzai Tehsil	Cluster 9	Kuz Kadi Khel VC-1, Kuza Kadi VC-2	13393	4	1	1	N/A	21429	2	1	N/A
Halimzai Tehsil	Cluster 10	Bar Kadi Khel VC-2, Kamali Haimzai VC-2	18281	4	2	1	N/A	29250	3	2	1
Halimzai Tehsil	Cluster 11	Bar Kadi Khel VC-1, Durba Khel VC-2, Kamali Halimzai VC-1	23719	2	2	1	0	37950	4	2	4
Upper Mohmand Tehsil	Cluster 12	Baizai-VC-1, Baizai-VC-2, Baizai-VC-3, Baizai-VC-4, Khewazai VC-1, Khewazai VC-2	36897	8	4	2	N/A	42442	4	2	0
Safi Tehsil	Cluster 13	Masood VC-3, VC Chamarkand, VC Sheikh Baba	25377	6	3	1	N/A	36012	4	2	0
Safi Tehsil	Cluster 14	Sagi VC-1, Sagi VC-2	20053	2	2	1	0	28456	3	2	3
Safi Tehsil	Cluster 15	Gurbaz VC, Masood VC-1, Masood VC-2	26195	4	3	1	N/A	37172	4	2	2

6.4.2.5 Proposed Future Health Zone

6.4.2.5.1 Urban Centers, Potential Urban Centers and Settlements

Through this spatial allocation and future-oriented planning, District Mohmand's health sector is positioned to transition from a basic, limited network toward a comprehensive and resilient healthcare system, capable of serving its growing population efficiently by 2045.

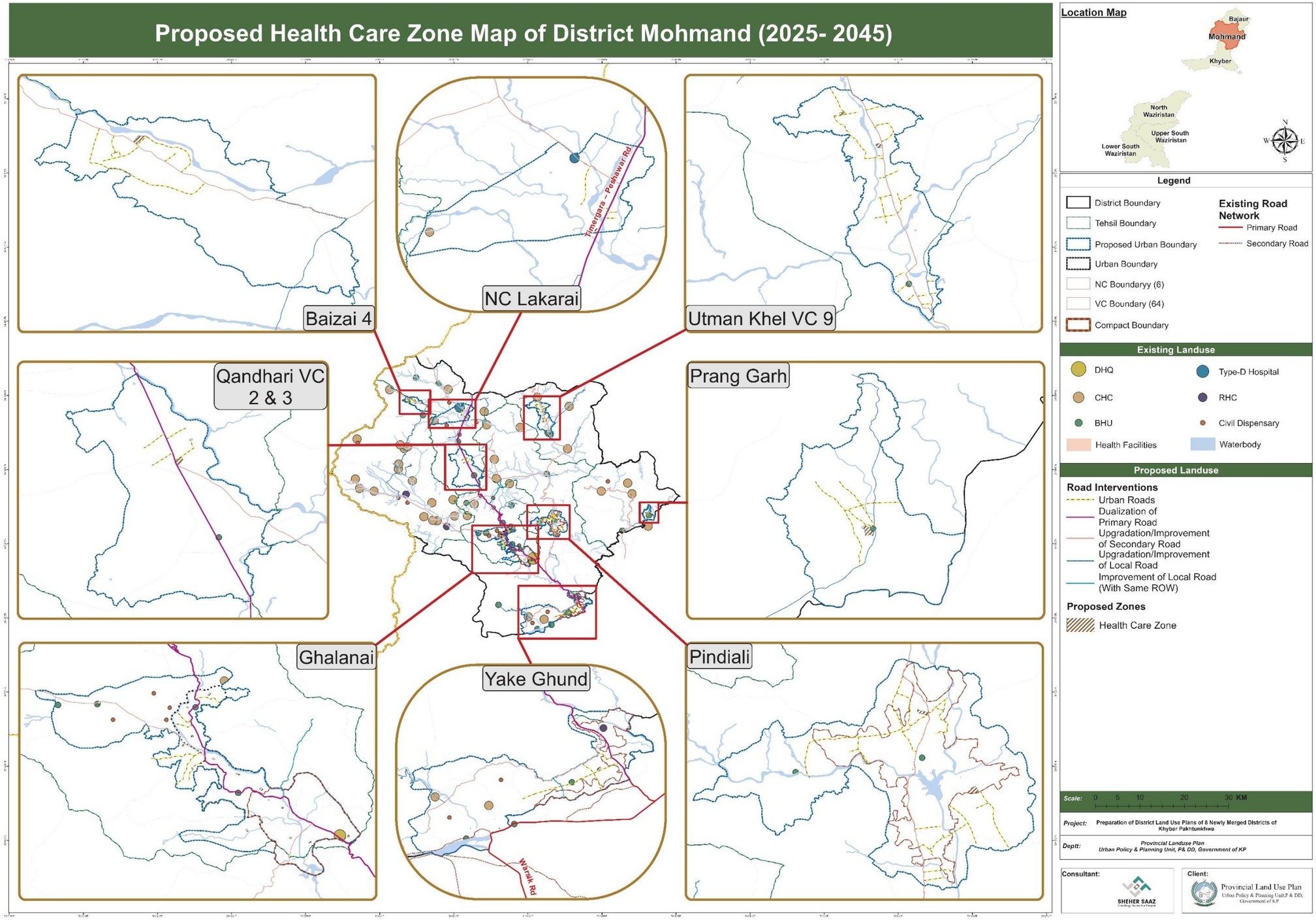
The analysis of health infrastructure land use across urban centers and potential settlements highlights both existing provision and proposed expansion for the period 2025–2045. In Ghalanai, the existing health land covers 23.25 acres, with 19.90 acres proposed, totaling 43.15 acres. Among potential urban centers, Yake Ghund has 7.20 acres existing and 7.11 acres proposed (total 14.31 acres), Pindiali 0.12 acres existing and 20.33 acres proposed (total 20.45 acres), Utman Khel VC-2&9 0.32 acres existing and 9.51 acres proposed (total 9.84 acres), and Qandahari VC-3&2 1.30 acres existing and 9.60 acres proposed (total 10.90 acres). For potential settlements, Baizai-4 has no existing health land and 3.27 acres proposed, Lakarai has 8.34 acres existing and 4.81 acres proposed (total 13.15 acres), and Prang Ghar 0.81 acres existing and 3.18 acres proposed (total 3.99 acres). This demonstrates a planned expansion of health zones to match population growth and future service requirements, ensuring adequate land allocation for health facilities across both urban centers and emerging settlements.

Table 70: Existing and Proposed Health facilities

Urban center/Settlements	*Existing Health (Acres)*	*Proposed Health Zones (Acres)*	*Total Education (2025-2045) (Acres)*
Urban Centre			
Ghalanai	23.25	19.90	43.15
Potential Urban Centre			
Yake Ghund	7.20	7.11	14.31
Pindiali	0.12	20.33	20.45
Utman Khel Vc-2&9	0.32	9.51	9.84
Qandahari Vc-3&2	1.30	9.60	10.90
Potential Settlement			
Baizai -4	N/A	3.27	3.27
Lakarai	8.34	4.81	13.15
Prang Ghar	0.81	3.18	3.99

Source: Developed by Consultant

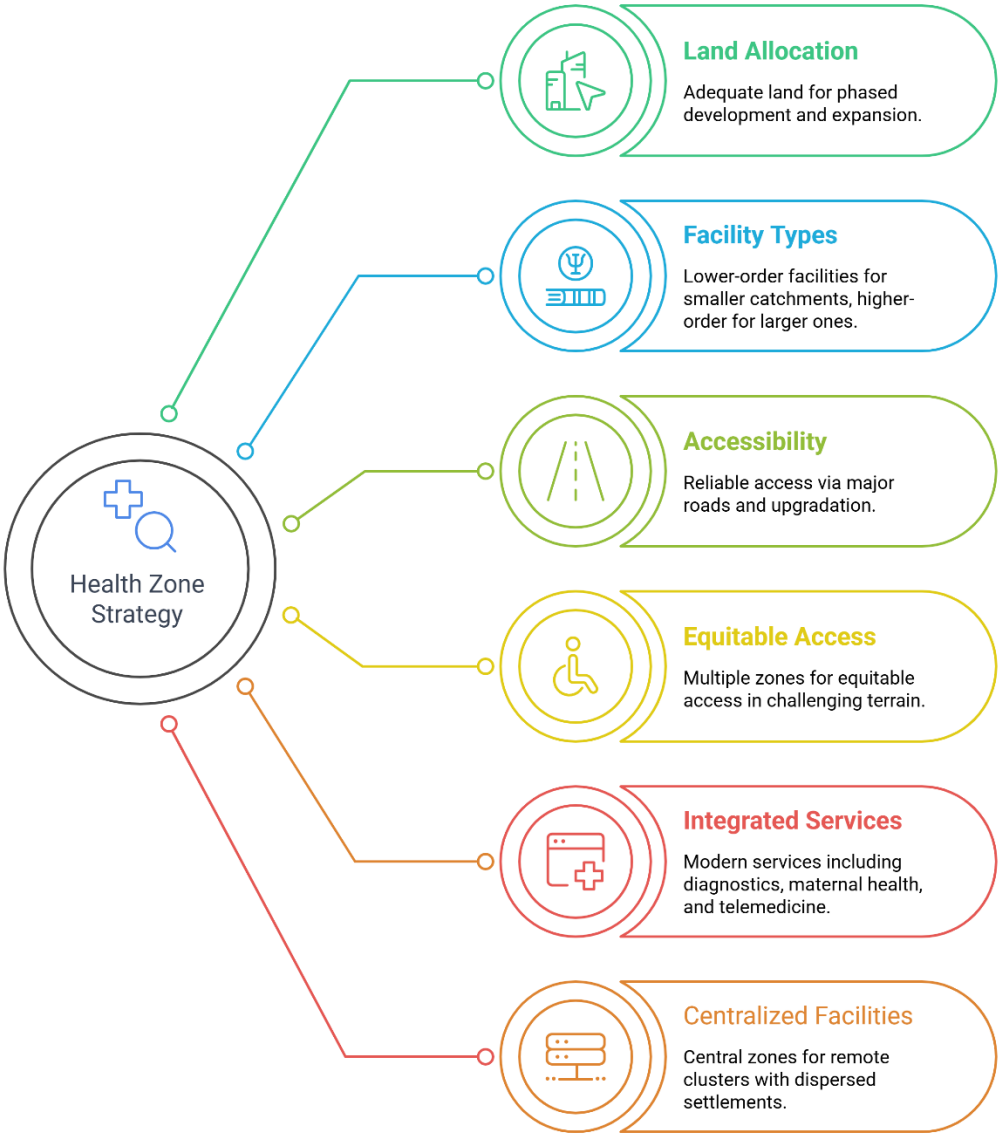
Map 40: Proposed Health Care Zones – District Mohmand



6.4.2.5.2 Rural areas (Cluster-wise)

Based on the health facility gap and accessibility assessment, health zones were proposed at cluster and VC levels to improve spatial coverage and reduce dependency on urban centers. The proposed average land allocation for health zones ranges between 2 to 3 acres, which is considered adequate for phased development, functional zoning, and future expansion in rural settings.

Figure 5: Proposed Health zone strategies for Rural areas



Zones with land areas of less than 1 acre to up to 2 acres are recommended for lower-order health facilities, primarily Basic Health Units (BHUs), as these facilities serve smaller catchments and focus on primary healthcare services. Zones exceeding 2 acres are proposed for higher-order health facilities, including Rural Health Centres (RHCs) and hospitals, which require larger footprints to accommodate inpatient services, diagnostics, staff housing, circulation space, and emergency access.

An accessibility analysis was conducted using the existing road network to identify unserved and underserved areas within each cluster. Health zones were accordingly proposed along major roads to ensure reliable and year-round access. In locations where access is currently through kacha roads or informal paths, road upgradation has been proposed as part of the health planning strategy to enhance service reach and emergency response capability.

In areas affected by physical barriers such as water bodies, rugged terrain, or hilly landscapes, multiple health zones were proposed within the same cluster to ensure equitable access for all settlements. This approach recognizes the mobility constraints of rural populations, particularly women, children, and elderly residents, and supports decentralized service provision where single-facility coverage is not feasible.

For clusters with remote locations or dispersed settlements, central health zones were proposed at strategically located focal points to serve multiple VCs efficiently. These central zones are intended to accommodate higher-order health facilities, allowing a concentration of services at one accessible location and reducing reliance on distant urban centres such as Ghalanai. This strategy is particularly applicable in clusters where population thresholds do not justify multiple facilities under future projections but where accessibility remains a critical concern.

Accordingly, central health facilities were proposed in Cluster 13 (Masood VC-3, Chamarkand VC, Sheikh Baba VC) and Cluster 12 (Baizai VC-1, VC-2, VC-3, VC-4; Khewazai VC-1 and VC-2). In these clusters, the central zone approach ensures that basic and secondary healthcare services remain accessible to all residents despite limited future demand at the individual VC level.

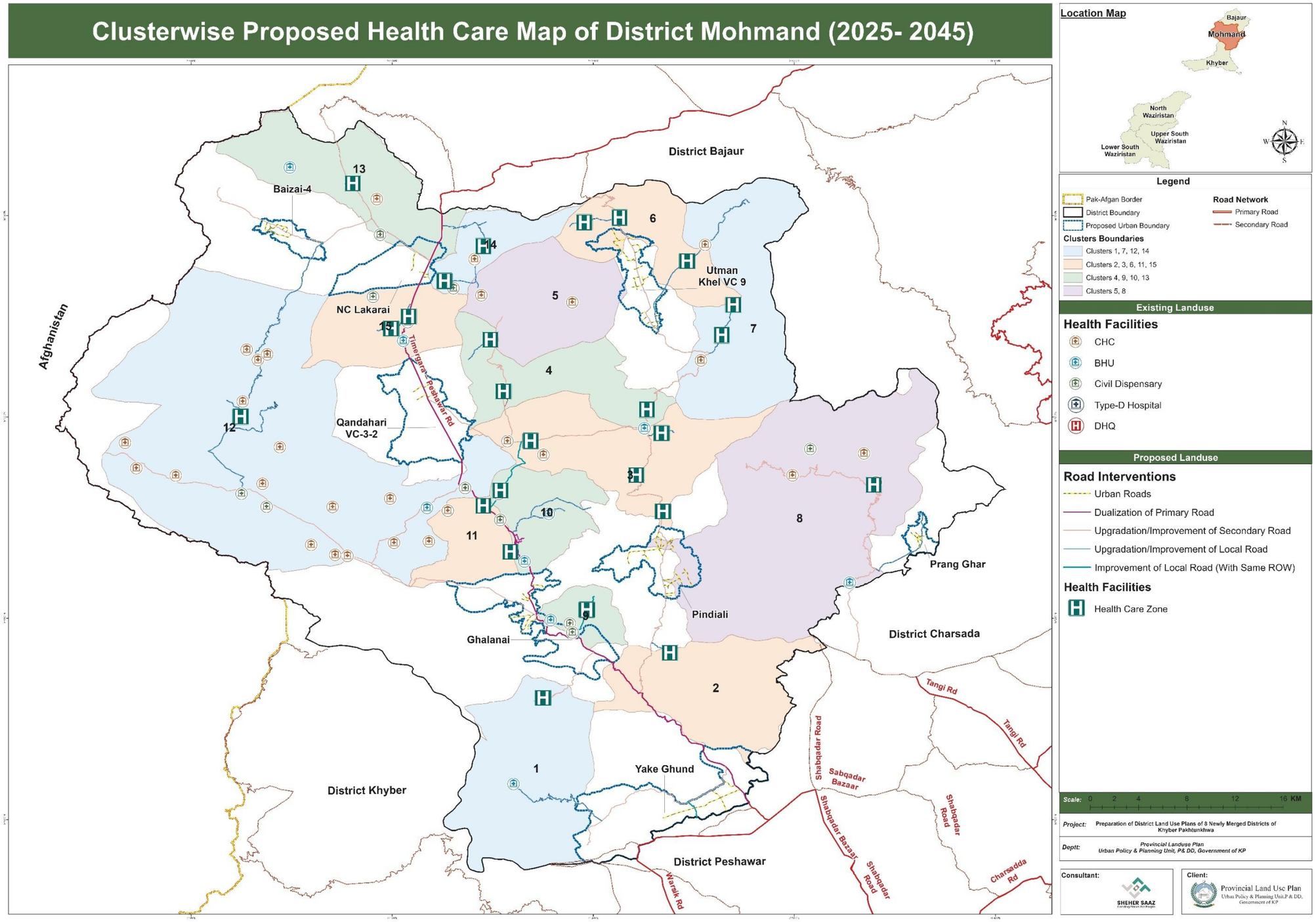
The proposed health zones are envisioned to support modern and scalable healthcare delivery, including basic diagnostic services, maternal and child health units, emergency response facilities, and tele-medicine capabilities. Coordination with the KP Health Department, Rescue 1122, and district administration is recommended to strengthen referral systems, staffing, and operational sustainability. This integrated approach aims to establish a resilient health service network for Mohmand District that is accessible, equitable, and responsive to local needs.

Table 71: Proposed Health Zones (Clusterwise)

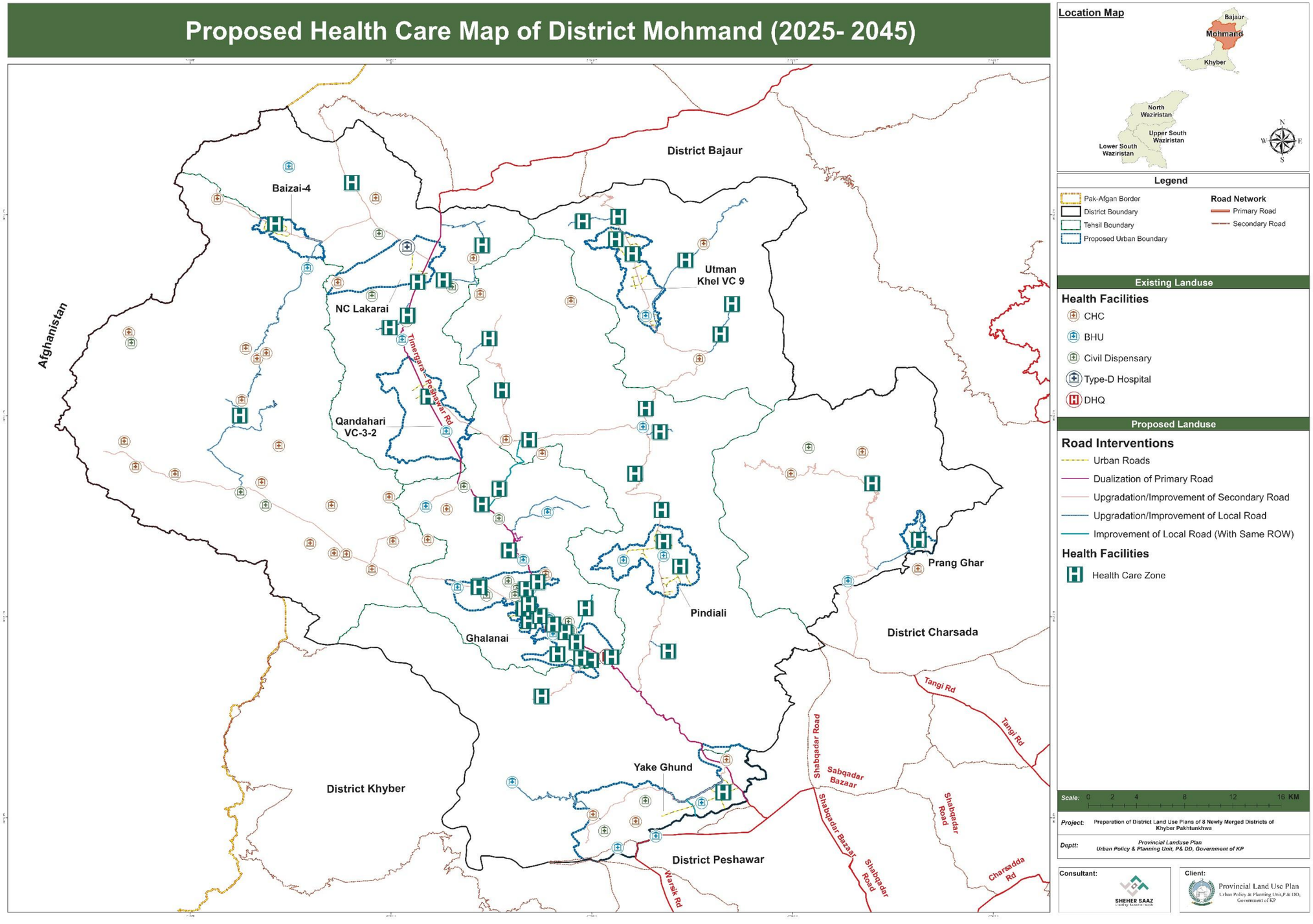
Tehsil	Cluster	VC/NC name	Proposed Zones	Proposed Zones (Acres)
Amber Tehsil	Cluster 1	Utman Khel VC 1, Utman Khel VC 4	Health Care Zone 1	1.00
Pindiali Tehsil	Cluster 2	Burhan Khel VC 1,Burhan Khel VC 2	Health Care Zone 1	0.80
	Cluster 3	Issa Khel VC 2, Issa Khel VC 4, Tamanzai VC 1	Health Care Zone 1	1.21
			Health Care Zone 2	1.12
			Health Care Zone 3	1.21
			Health Care Zone 4	1.17

	Cluster 4	Dawezai VC 1, Tamanzai VC 2, Issa Khel VC 3	Health Care Zone 1	2.16
			Health Care Zone 2	1.39
			Health Care Zone 3	2.26
Amber Tehsil	Cluster 6	Utman Khel VC 5, Utman Khel VC 8	Health Care Zone 1	1.75
			Health Care Zone 2	0.97
			Health Care Zone 3	1.57
Yake ghund Tehsil	Cluster 7	VC Tarakzai 6	Health Care Zone	1.15
			Health Care Zone	3.98
Paranghar Tehsil	Cluster 8	Laman Utman Khel VC 3	Health Care Zone 1	0.95
Halimzai Tehsil	Cluster 9	Kuz Kadi Khel VC-1, Kuza Kadi VC-2	Health Care Zone 1	2.73
	Cluster 10	Bar Kadi Khel VC-2, Kamali Haimzai VC-2	Health Care Zone 1	2.32
	Cluster 11	Bar Kadi Khel VC-1, Durba Khel VC-2, Kamali Halimzai VC-1	Health Care Zone 1	3.71
			Health Care Zone 2	3.17
Upper Mohmand Tehsil	Cluster 12	Baizai-VC-1, Baizai-VC-2, Baizai-VC-3, Baizai-VC-4, Khewazai VC-1, Khewazai VC-2	Health Care Zone 1	3.78
Safi Tehsil	Cluster 13	Masood VC-3, VC Chamarkand, VC Sheikh Baba	Health Care Zone 1	4.31
	Cluster 14	Sagi VC-1, Sagi VC-2	Health Care Zone 1	3.68
			Health Care Zone 2	5.48
	Cluster 15	Gurbaz VC, Masood VC-1, Masood VC-2	Health Care Zone 1	2.82
			Health Care Zone 2	2.42

Map 41: Proposed Health Zones (Cluster-wise)



Map 42: Proposed Health Care Facilities – Overall District Mohmand



6.4.2.6 Zoning Regulations for Health Zone

Permitted Uses	Permitted on appeal Uses
• Hospitals • Burn Units • Basic Health Units • Teaching Hospital • Medical Research Centres • Staff Residencies • Community facilities • Parking lots • Urban Forest • Religious Place • Veterinary Hospital • Clinical Laboratory • Day care centre or Pre schools • Support facilities (bus stops, parking lots, civil dispensaries and small green spaces)	• Playlands & Amusement Parks • Hostels • Hotels & Restaurants • Banks • Gymnasiums & Clubs • Cinema • Petrol Pumps • Banks

6.4.3 Public/Civic Amenities Zone

The provision of public amenities across the urban centres, potential urban centres, and emerging settlements has been assessed to evaluate existing capacity and future land requirements up to 2045. The analysis reflects both current availability and proposed additions, ensuring equitable access to civic, social, and community facilities in line with projected population growth.

Ghalanai, as the designated urban centre, currently has 78.37 acres allocated for public amenities, which is considered adequate for the planning horizon, with no additional land proposed, maintaining a total of 78.37 acres.

Among the potential urban centres, Yake Ghund has 11.66 acres of existing public amenities, with an additional 11.54 acres proposed, bringing the total to 23.20 acres by 2045. Pindiali, which currently has a limited provision of 0.64 acres, requires a significant expansion, with 10.78 acres proposed to achieve a total of 11.42 acres. Similarly, Utman Khel VC-2 & 9 will see an increase from 9.71 acres to 18.89 acres, while Qandahari VC-3 & 2 will expand from 1.18 acres to 12.66 acres, addressing existing deficiencies.

Within potential settlements, new allocations are proposed to support emerging growth. Baizai-4 requires 5.99 acres of public amenities, where no such facilities currently exist. Lakarai, which already accommodates a substantial 86.72 acres, will be supplemented with 3.47 additional acres, raising the total to 90.19 acres. Prang Ghar will expand from 9.78 acres to 13.25 acres through the addition of 3.47 acres.

Table 72: Proposed Area for Public/Civic Amenities Zones - 2045

Urban centre/Settlements	*Existing Public Amenities (Acres)*	*Proposed Public Amenities (Acres)*	*Total Public Amenities (2025-2045) (Acres)*
Urban Centre			
Ghalanai	78.37	-	78.37
Potential Urban Centre			
Yake Ghund	11.66	11.54	23.20
Pindiali	0.64	10.78	11.42
Utman Khel Vc-2&9	9.71	9.18	18.89
Qandahari Vc-3&2	1.18	11.48	12.66
Potential Settlement			
Baizai -4	-	5.99	5.99
Lakarai	86.72	3.47	90.19
Prang Ghar	9.78	3.47	13.25

Source: Developed by Consultant

The zones will include government and semi-government offices such as the District Secretariat, Town Hall, Tehsil complexes, and local municipal offices, along with social welfare institutions, community centers, museums, and auditoriums. Supporting uses such as guest houses, athletic clubs, gyms, fitness centers, research and development facilities, and small hotels or motels may also be allowed to complement civic functions. Essential services such

as police stations, fire stations, post offices, shelter homes, panahgahs (public shelters), and convention centers will also form part of the civic fabric.

Overall, the proposed Civic and Public Amenities Zones in overall district Mohmand represents a forward-looking planning approach for District Mohmand promoting coordinated service delivery, integrated governance, and citizen-friendly accessibility while preparing the district to meet future administrative and social service demands.

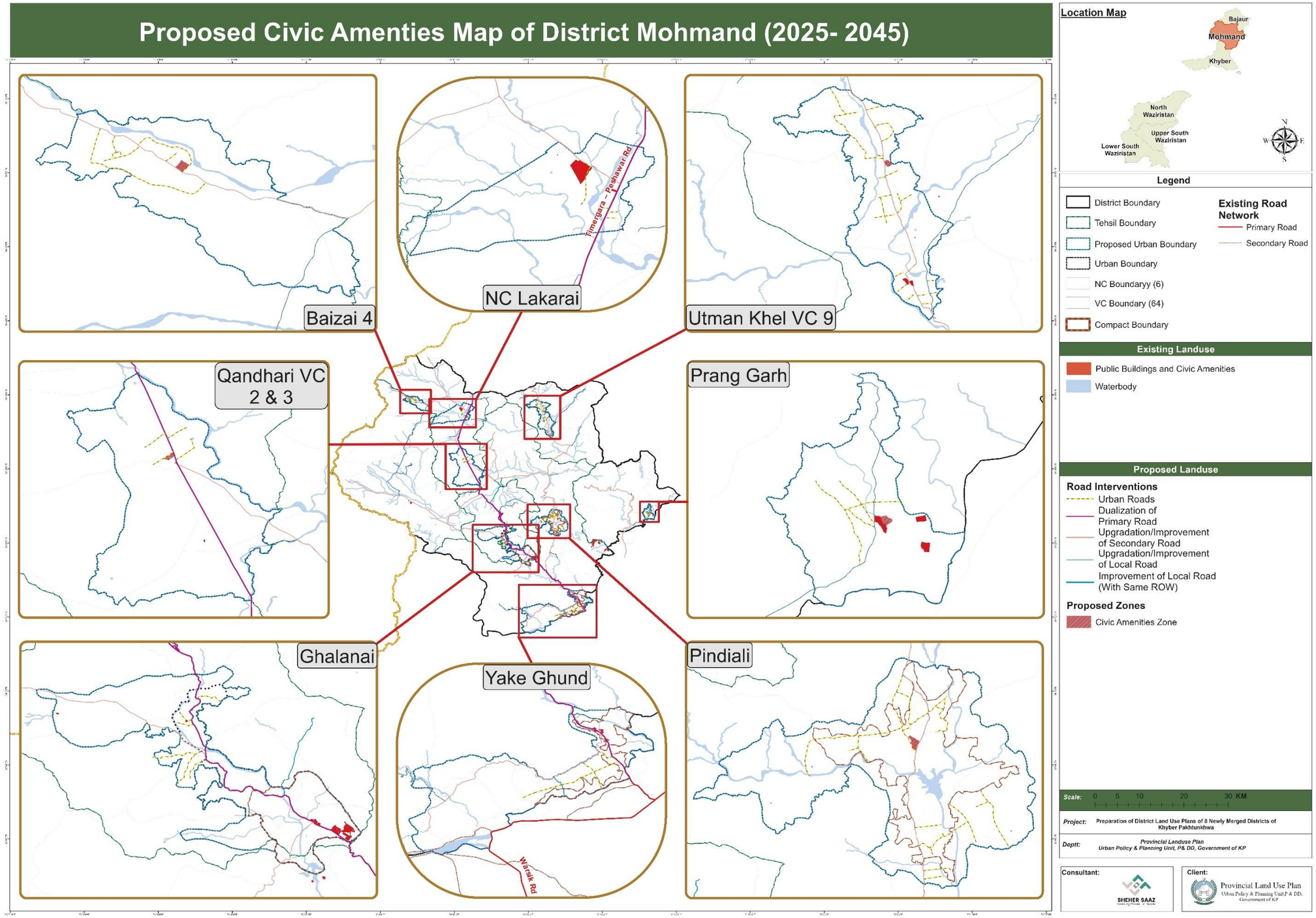
6.4.3.1 Zoning Regulations for Public/Civic Amenities Zone

The zoning regulations ensure that only allied and compatible functions are permitted within this zone, preventing uses that may conflict with the administrative and community-oriented nature of the area. This controlled land-use approach will enhance the efficiency of governance, improve accessibility for residents, and ensure proper utilization of urban land.

Table 73: Zoning Regulations for Public/Civic Amenities Zone

Permitted Uses	Allied Permissible Uses	Prohibited Uses
Government or semi-government offices (District Secretariat, Town Hall etc.)	Hotel or Motel	Other than permitted and permissible
Social welfare institution such as community center, art gallery, museum and auditorium	Guest house	
Local and zonal municipal office	Athletic club, gymnasium, fitness center or indoor sport facility	
Police station, fire station or post office	Research and development centers	
Shelter home		
Panahgahs		
Convention center		

Map 43: Proposed Public/Civic Amenities Zones



6.4.4 Graveyards

6.4.4.1 Existing Graveyards

Graveyards in District Mohmand hold deep historical, cultural, and social significance, reflecting the region's tribal traditions and ancestral connections. Some burial sites are believed to date back to the Gandhara civilization, particularly those near Zarif Koruna and other archaeological localities, revealing the district's ancient heritage. Local cemeteries also serve as sacred spaces where tribal elders and respected community figures are buried, maintaining strong cultural reverence and continuity of tradition.

Currently, around 101.96 acres of land across the district are designated for graveyards, with approximately 50.84 acres actively used for burials. However, comprehensive data on the total number and distribution of cemeteries across tehsils remains limited due to the absence of a centralized record or management system. Prominent burial sites include Dosai Graveyard (Munda Khar Road), Ghundai Graveyard (Ghanam Shah), and Barakhel Graveyard (Sham Shah), among several smaller community graveyards scattered throughout rural settlements.

Despite their historical and cultural importance, these sites face multiple challenges. The most pressing issue is space limitation, as existing graveyards are nearing full capacity without adequate provision for future expansion. In several areas, graveyard lands have been encroached upon for agriculture or informal construction, undermining the sanctity of these sites and occasionally leading to disputes among communities. Poor maintenance further aggravates the problem many graveyards suffer from overgrown vegetation, unclear boundaries, and unmarked graves, diminishing their dignity and accessibility.

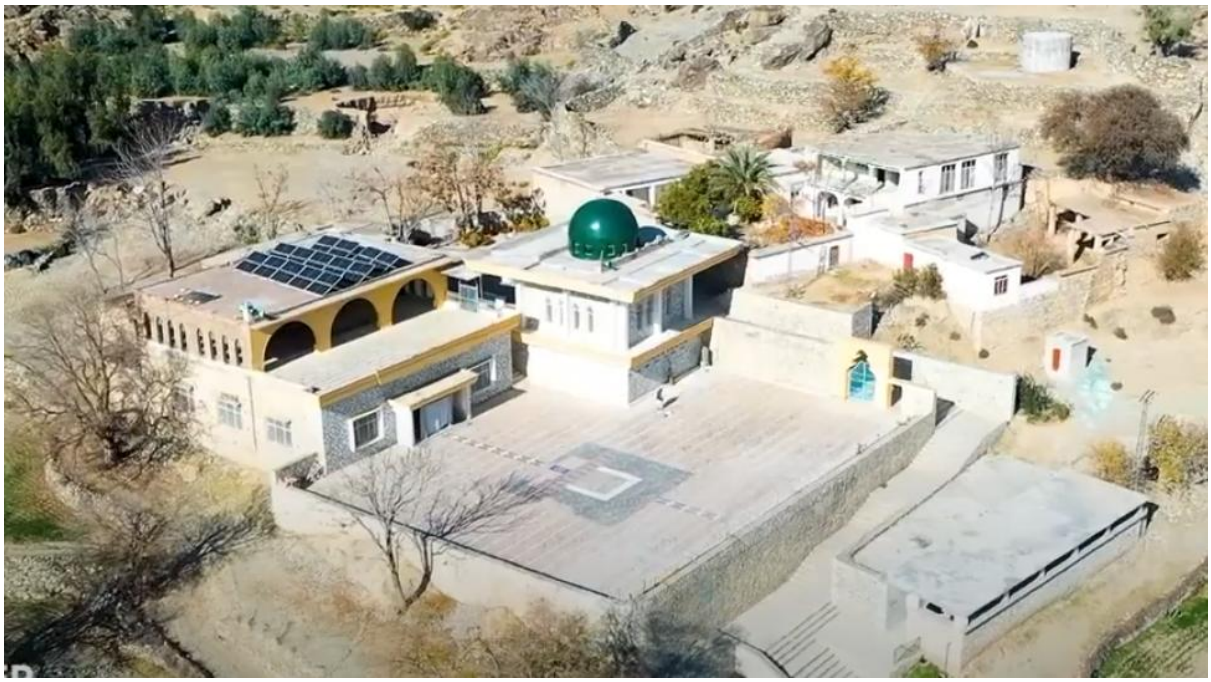
The situation is particularly critical for minority communities, especially Christians and Sikhs, who lack dedicated burial and cremation facilities within the district. Christian families are often compelled to transport their deceased over long distances to Peshawar for burial, incurring high costs. Although land for a Christian cemetery near Ghalanai Headquarters was allocated, it remains largely underdeveloped due to lack of fencing and infrastructure. Similar constraints persist for Sikh residents, who have no local crematoriums[12].

From a spatial and planning perspective, the district faces competing land-use pressures, where agriculture, housing, and infrastructure expansion limit available land for new burial sites. The absence of a structured land-use plan for cemeteries results in uncoordinated growth and inequitable access to burial space across tehsils.

Beyond functional needs, several of Mohmand's graveyards and shrines also hold potential for heritage and cultural tourism, such as the shrine of Haji Sahib Turangzai, which already draws regional visitors. If managed respectfully, these heritage sites can be integrated into cultural tourism circuits, showcasing the district's historical depth while preserving its sacred landscapes.

[12] https://tnnenglish.com/minority-burial-woes-challenges-and-governmental-commitments-in-khyber-pakhtunkhwa

Figure 6: Shrine of Haji Sahib Turangzai - District Mohmand



6.4.4.2 National Standards and Future Requirements for New Graveyards

District Mohmand's health and mortality profile emphasizes the need for graveyards. The under-five mortality rate is 31 per 1,000 live births, and neonatal mortality is 20 per 1,000, both contributing to a considerable number of child and infant burials. Limited skilled birth attendance (69%) and low antenatal care coverage (27.7%) add to maternal and infant deaths. Although immunization coverage is high (98%), healthcare remains limited. These gaps maintain a significant mortality burden, making the provision of sufficient burial capacity a crucial planning priority. According to the National Reference Manual for Infrastructure and Planning, the burial requirement is usually estimated using average mortality rates, burial rotation schedules, and spatial standards for graves. These standards provide a scientific basis for calculating the land required for future cemetery development.

6.4.4.3 Grave Dimensions

As shown in the Table below, grave sizes vary by age category. An adult grave typically requires 7 feet by 4 feet (2.13 × 1.22 meters), while children and infants require proportionally smaller spaces. These standard dimensions facilitate the estimation of the total area required for each burial plot, including allowances for circulation paths and spacing between graves.

Category	Dimensions (Feet)	Dimensions (Meters)
Adults	7' × 4'	2.13 × 1.22
Children under 12	6' × 3'	1.83 × 0.91
Infants	4' × 3'	1.22 × 0.91

Source: National Reference Manual for Infrastructure and Planning

6.4.4.4 Land Requirement Estimation

Based on planning norms, a mortality rate of 12 deaths per 1,000 people per year and a grave rotation time of 40 years are assumed for urban graveyards. This results in 480 graves per

1,000 people over one rotation cycle. Each grave, including circulation and non-burial space, occupies an average of 54 square feet, leading to a total requirement of ***0.595 acres per 1,000 people.*** Using an urban density of 35 persons per acre, the required land for graveyards is calculated at 20.8 acres per 1,000 acres of urban space. This equates to 2.1% of the total urban area that should be reserved for graveyard use, as detailed in the Table below.

Parameter	*Value / Calculation*
Mortality rate	12 per 1000 persons
Rotation time for graveyard	40 years
Graves required for one rotation	40 years × 12 deaths/year = 480 graves
Gross size of each grave	9 ft × 6 ft = 54 sq. ft. (includes circulation & other uses)
Total area required per 1000 persons	54 sq. ft × 480 graves = 25,920 sq. ft = 0.595 acres
Urban density	35 persons per acre
Area required for 1000 acres of urban space	0.595 acres × 35 = 20.8 acres
Percentage of urban area dedicated to graveyards	2.1%

Source: National Reference Manual for Infrastructure and Planning

These planning standards must be applied proactively by district authorities when preparing land-use plans, urban expansion strategies, and community-level service allocations. Given the cultural and religious significance of burial grounds, ensuring the timely provision of well-located and adequately sized graveyards should be a key priority for future urban and rural development.

6.4.4.5 Proposed Graveyards

The total area currently designated for graveyard facilities in District Mohmand varies across urban centres and settlements and totals significantly less than the projected requirements based on population growth. In Ghalanai, 79.44 acres exist, with 22.13 acres proposed, bringing the total to 101.56 acres by 2045. Yake Ghund currently has 7.20 acres, with 11.43 acres proposed (total 18.63 acres), while Pindiali has 20.01 acres existing and 25.46 acres proposed (total 45.47 acres). Utman Khel VC-2&9 has 27.84 acres existing and 12.31 acres proposed (total 40.15 acres), and Qandahari VC-3&2 has 33.98 acres existing and 7.21 acres proposed (total 41.19 acres). Among potential settlements, Baizai-4 has 2.58 acres existing and 4.80 acres proposed (total 7.38 acres), Lakarai has 9.57 acres existing and 5.87 acres proposed (total 15.44 acres), and Prang Ghar has 8.08 acres existing with no additional proposed area (total 8.08 acres).

The proposed sites have been strategically identified near existing settlements to ensure equitable access across all tehsils, while minimizing conflicts with agricultural or residential land use. A key focus of the proposal is social inclusivity, dedicated land portions have been allocated to accommodate minority communities, such as Christians and Sikhs, enabling them to access dignified burial and cremation facilities within the district. This inclusive approach reflects a strong commitment to cultural harmony and community welfare.

In addition to meeting future space requirements, the proposal emphasizes the rehabilitation and protection of existing graveyards through boundary demarcation, fencing, and maintenance programs. These interventions aim to safeguard burial sites from encroachment

and ensure that they remain organized, accessible, and respectful of cultural and religious traditions.

Furthermore, historical and culturally significant graveyards, many of which date back to the Gandhara period or are associated with tribal heritage, warrant special attention. It is recommended that such sites be documented, preserved, and protected as cultural heritage assets. Designating them as heritage cemeteries under a local preservation framework would not only conserve their historical value but could also promote heritage-based tourism and community pride. Interpretive signage, controlled access, and community-led management programs should be introduced to ensure their sustainable upkeep without compromising sanctity.

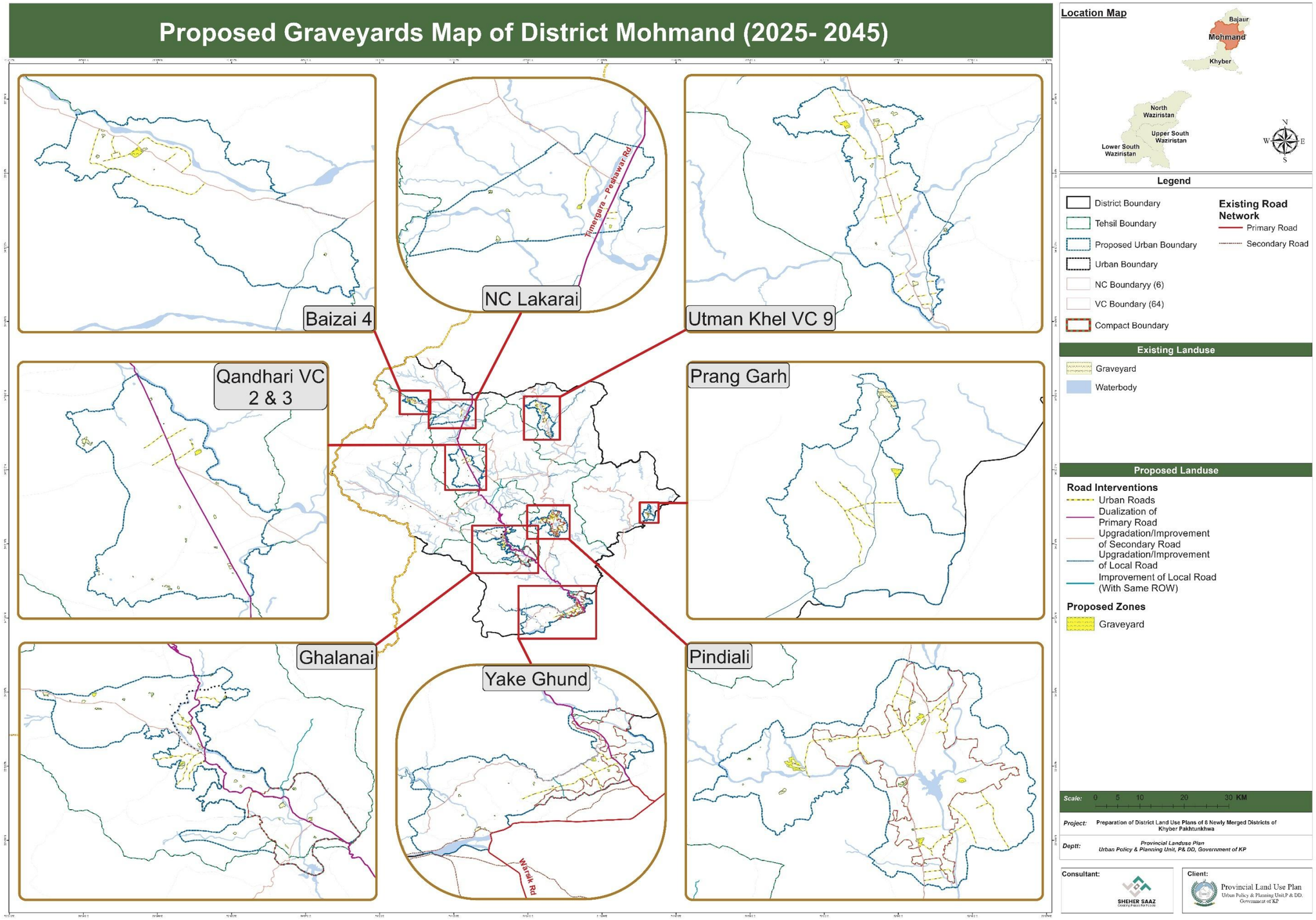
Overall, the proposed land-use framework for graveyards in District Mohmand promotes a balanced, inclusive, and heritage-conscious approach expanding capacity for future needs while protecting the cultural and historical legacy embedded within these sacred spaces.

Table 74: Existing and Proposed Graveyard

Urban centre/Settlements	*Existing Graveyard (Acres)*	*Requirement as per NRM*	*Proposed Graveyard (Acres)*	*Total Graveyard (2025-2045) (Acres)*
Urban Centre				
Ghalanai	79.44	43.85	22.13	101.56
Potential Urban Centre				
Yake Ghund	7.20	47.97	11.43	18.63
Pindiali	20.01	47.71	25.46	45.47
Utman Khel Vc-2&9	27.84	37.89	12.31	40.15
Qandahari Vc-3&2	33.98	18.87	7.21	41.19
Potential Settlement				
Baizai -4	2.58	6.56	4.80	7.38
Lakarai	9.57	6.29	5.87	15.44
Prang Ghar	8.08	10.50	2.91	10.99

Source: Developed by Consultant

Map 44: Proposed Graveyard Map - District Mohmand



Guidelines for the Proposed Graveyards

According to the Khyber Pakhtunkhwa Urban Policy 2022–30, the responsibility of defining Land Use, Building Control, and Zoning Regulations lies with the Khyber Pakhtunkhwa Land Use and Building Control Authority. Under the Khyber Pakhtunkhwa Land Use and Building Control Act, 2021, the Authority specifies the concepts of permitted and permissible land uses. Permissible land uses may be granted approval by the District Planning and Design Committee, subject to the payment of the prescribed fee. However, detailed planning standards and development guidelines are yet to be formally established. In this context, the consultant has reviewed both national and international case studies and formulated development guidelines tailored to the study area. These guidelines shall remain applicable until the Building Control Authority officially notifies any Land Use Classification Rules enforceable across Khyber Pakhtunkhwa. The proposed development guidelines for graveyard sites are as follows:

Permitted Uses	Allied Permissible Uses	Prohibited Uses
• Administration buildings • Religious buildings • Mosques • Clinics/dispensaries • Local shopping areas • Retail stores (e.g., flower shops, horticulture, convenience stores) • Petrol pumps, Gas filling stations • Parking facilities	• Residential for graveyard workers/caretakers • Shops • Zoological garden • Botanical garden • Bird sanctuary	• Heavy, large, and extensive industries (noxious, obnoxious) • Hazardous industries • Warehousing, storage godowns of perishables, hazardous, inflammable goods • Sewage treatment plant/disposal work • Water treatment plant • Solid waste dumping yards • Research laboratories treating contagious diseases

6.5 RECREATIONAL ZONES & TOURISM

6.5.1 Tourist Site & Recreational Facilities

6.5.1.1 Renowned Tourism Sites

The following are the major tourist sites in Mohmand District.

Table 75: Tourist Sites of Significance in Mohmand

Site Name	Type	Location/Tehsil	Description and Potential
Michni Fort	Historic Fort	Michni, near Warsak Dam (Halimzai Tehsil)	British-era fort built to counter Mohmand tribes; offers panoramic river views. Potential for historical tours and photography; integrate with nearby Warsak Dam visits for a full-day eco-historic package.
Tomb of Haji Torangzai / Ghaziabad	Cultural/Heritage Site	Ghaziabad (Central Mohmand)	Tomb of a local freedom fighter; hosts an annual Urs festival in April with music and gatherings. High cultural potential for pilgrimage tourism and Pashtun heritage experiences.
Ancient Sarai (Caravan Route)	Archaeological Site	Near Yaka Ghund (Yake Ghund Tehsil)	Mughal-period rest house on an ancient trade route linking Indus and Oxus valleys; features burnt brick construction and Islamic coins. Ideal for archaeology enthusiasts; potential for guided heritage walks and restoration as a museum site.
Gandab Valley	Natural Valley	Gandab (near Durand Line)	Narrow, barren valley with a bustling bazaar of 200 shops; runs parallel to a dry nullah. Adventure potential for border trekking and shopping for local crafts; scenic drives from Ghalanai (headquarters).
Mandar Dam	Scenic Dam/Reservoir	Mandar (Safi Tehsil)	Irrigation dam amid rugged terrain; offers fishing (trout, carp) and boating. Potential for day trips with picnics; ties into eco-tourism with nearby river streams for angling and nature hikes.
Chamar Kand	Scenic Spot	Chamar Kand (Upper Mohmand)	Picturesque hillside with mountain views and glens. Emerging spot for hiking and photography; potential for community-based eco-lodges to promote sustainable tourism.
Khewazai	Border Area/Valley	Khewazai (near Durand Line, Prang Ghar Tehsil)	Scenic route to the Afghanistan border via Darra Khanch; features thorny forests and wildlife. Adventure tourism potential for guided border tours (with permits); birdwatching for species like sand grouse.
Ghalanai	Town/Cultural Hub	Ghalanai (Halim Zai Tehsil)	District headquarters with scenic bazaars and Pashtun architecture. Base for tours; potential for cultural festivals, homestays, and exploring local cuisine (e.g., chapli kebabs).

Yake Ghund	Hill/Scenic Area	YYake Ghund (Yake Ghund Tehsil)	Elevated hill with ancient caravan route access; rugged slopes ideal for off-road drives. Potential for adventure sports like paragliding; links to archaeological sites for combined tours.
Ilazai Peak	Mountain Peak	Near Afghanistan border (Prang Ghar Tehsil)	Highest peak in the district (~2,500m); offers challenging climbs and border vistas. Mountaineering potential for experienced trekkers; develop trails with safety measures.

6.5.1.2 Informal Recreational Areas

Informal areas in Mohmand consist of open spaces and community spots used for daily recreation, sports, and gatherings. These are not formally managed but serve local Pashtun tribes for activities like picnics, sports, and cultural events.

- ***Village Open Fields and Commons*:** Across tehsils such as Haleemzai and Safi, flat areas near villages are used for informal cricket, football, and traditional games like kabaddi or wrestling. Historical texts describe these as communal spaces in the rugged terrain, often near settlements for accessibility. For example, in the Gandab Valley region, open areas around Pir Killa village are noted for local use. No specific amenities exist, but they provide free, community-driven recreation.
- ***Riverbanks and Streams:*** Banks along seasonal streams (nullahs) and rivers are popular for informal picnics and fishing. The Swat River banks in Lower Mohmand (Prang Ghar and Ambar tehsils) are highlighted for their natural flow and surrounding scenery, used by locals for relaxation. Historical accounts from the early 20th century note these areas as gathering spots amid the barren slopes.

Figure 7: View of the Swat River in the Mohmand region, showing banks suitable for recreation[13]



Source: Google Images

[13] https://www.pakistantoday.com.pk/2025/02/18/socioeconomic-importance-of-the-river-swat/

- ***Hilltops and Local Viewpoints***: Lower hilltops in the Suleman Mountains offer informal hiking and viewpoints. Survey also describes these as part of the district's diverse terrain, used for short treks and family outings, though no trails are maintained.

Figure 8: Hilltops and Local Viewpoints – District Mohmand



Source: Google Images

6.5.1.3 Natural and Man-Made Recreational Areas

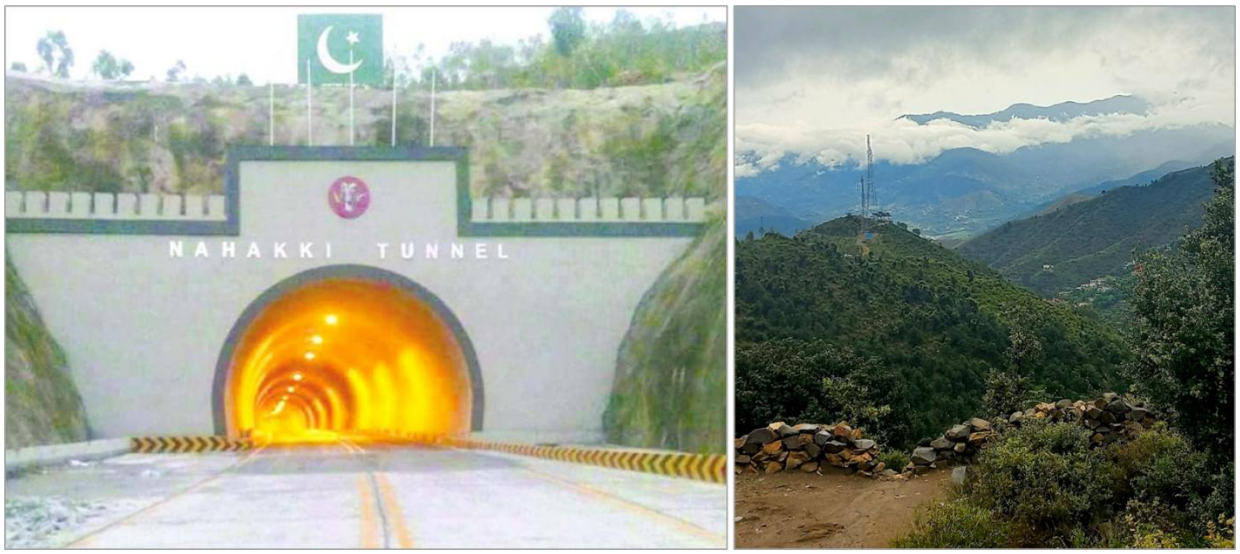
Mohmand's natural features include valleys, rivers, and hills, offering potential for passive recreation like sightseeing and light exploration. The district's geography features barren slopes with sparse vegetation, valleys, and peaks up to 2,716 meters (Ilazai). Tourism is minimal due to the area's history, but recent social media highlights its "rugged beauty."

- ***Swat River Banks (Lower Mohmand):*** The Swat River traverses southern tehsils, providing scenic banks for picnics, fishing, and riverside walks. It's noted for its role in the local ecosystem and as a natural boundary. No developed facilities, but the flowing water and surrounding hills attract locals.

- ***Valleys and Glens***

Nahqi Valley: Located in Upper Mohmand, this valley features dramatic landscapes and the Nahqi Tunnel (also called Nahakki Tunnel), a man-made passage through hills connecting to Bajaur. It's described as a scenic route with potential for exploration, though primarily a transit point.

Figure 9: Nahqi Valley and Tunnel



Source: Google Images

Gandab Valley: A historic valley in the northwest, extending from Pir Killa village. It's characterized by narrow glens and nullah beds, with potential for hiking amid the Hindu Kush foothills. Early 20th-century accounts describe it as a fascinating borderland area with Mohmand tribes.

Soran Valley: Soran Valley is one of the highlighted natural attractions in Mohmand District, known for its scenic beauty amid the rugged Hindu Kush foothills. While specific details on Soran are limited in public sources, it's described as a valley offering potential for eco-tourism with its hilly terrain, potential hiking spots, and proximity to tribal cultural sites. It's listed among top attractions for its untouched landscapes, making it appealing for adventure seekers interested in off-the-beaten-path experiences. Domestic tourists from nearby Khyber Pakhtunkhwa regions visit for day trips, while international appeal could grow with improved access and security, similar to other tribal areas post-merger.

- ***Dams and Reservoir***

Mohmand Dam Reservoir: The under-construction Mohmand Dam on the Swat River, primarily in Prang Ghar/Munda area) (expected completion around 2026-2027) will create a large reservoir extending into Mohmand. Plans include recreational facilities, fisheries, and potential boating/picnic spots, transforming lower tehsils into a major natural attraction.

Figure 10: Mohmand Dam Reservoir



Palai Dam (or Palay Dam): Located primarily in District Charsadda (Tangi Tehsil), along the northern boundary adjoining Mohmand District (formerly Mohmand Agency), the project occupies a strategic position between settled and tribal areas. The dam was completed in 2011, following a construction period from 2009 to 2011, and was developed as a small irrigation dam to support local agriculture.

Its primary function is to store rainwater and river runoff for irrigation purposes, supplying canal water to surrounding agricultural lands, including areas such as Mouza Qilla in Charsadda. In addition to its agricultural role, the reservoir has gradually emerged as a local recreational destination. Nestled among low mountain landscapes, the site offers a calm and scenic environment, making it attractive for picnics, leisure activities, and short visits by local residents who are drawn to its tranquil reservoir views and natural surroundings.

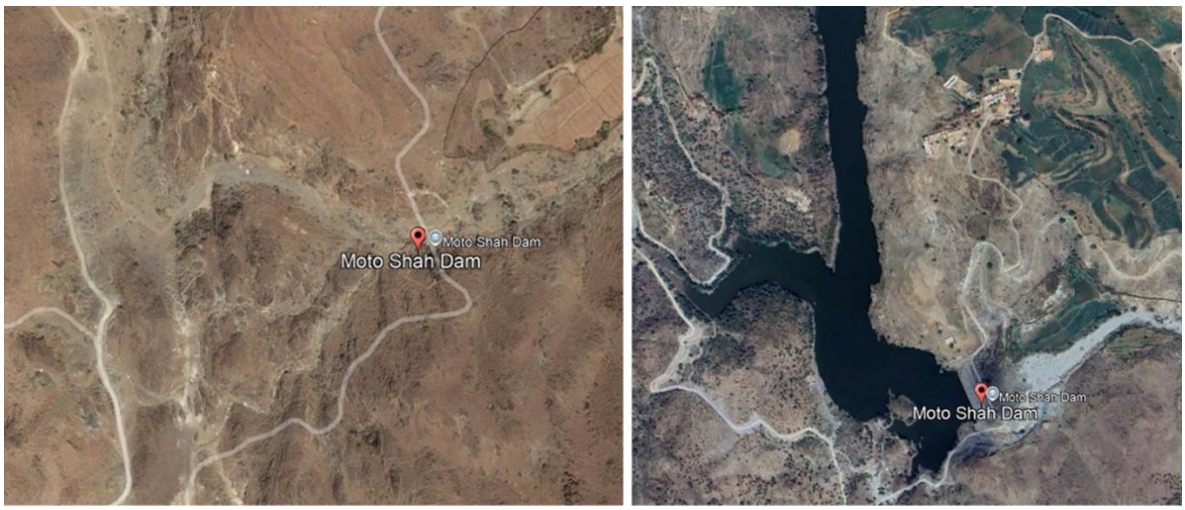
Figure 11: Palai Water Dam



Moto Shah Dam (Pindiali, Mohmand District)[14]: Moto Shah Dam is located in Pindiali Tehsil of Mohmand District (formerly Mohmand Agency) in Khyber Pakhtunkhwa and serves as an important small-scale water resource infrastructure for the area. It is a small earth core rock-fill dam, designed to suit the rugged terrain and hydrological conditions of the region. Construction of the dam began in 2012 and was successfully completed on 30 August 2014, at an estimated cost of PKR 191.60 million.

The dam has a height of about 101 feet and a crest length of approximately 377 feet, enabling it to store water for multiple local uses. Its primary purpose is to support irrigation, water storage, and groundwater recharge, thereby enhancing agricultural productivity and water availability for surrounding communities. Beyond its functional role, Moto Shah Dam also possesses recreational and tourism potential. The reservoir, set against a backdrop of rugged hills and natural landscapes, offers scenic views and is informally used by local residents for picnics and fishing, indicating its emerging role as a community leisure spot.

Figure 12: Motor Shah Water Dam - Pindiali tehsil

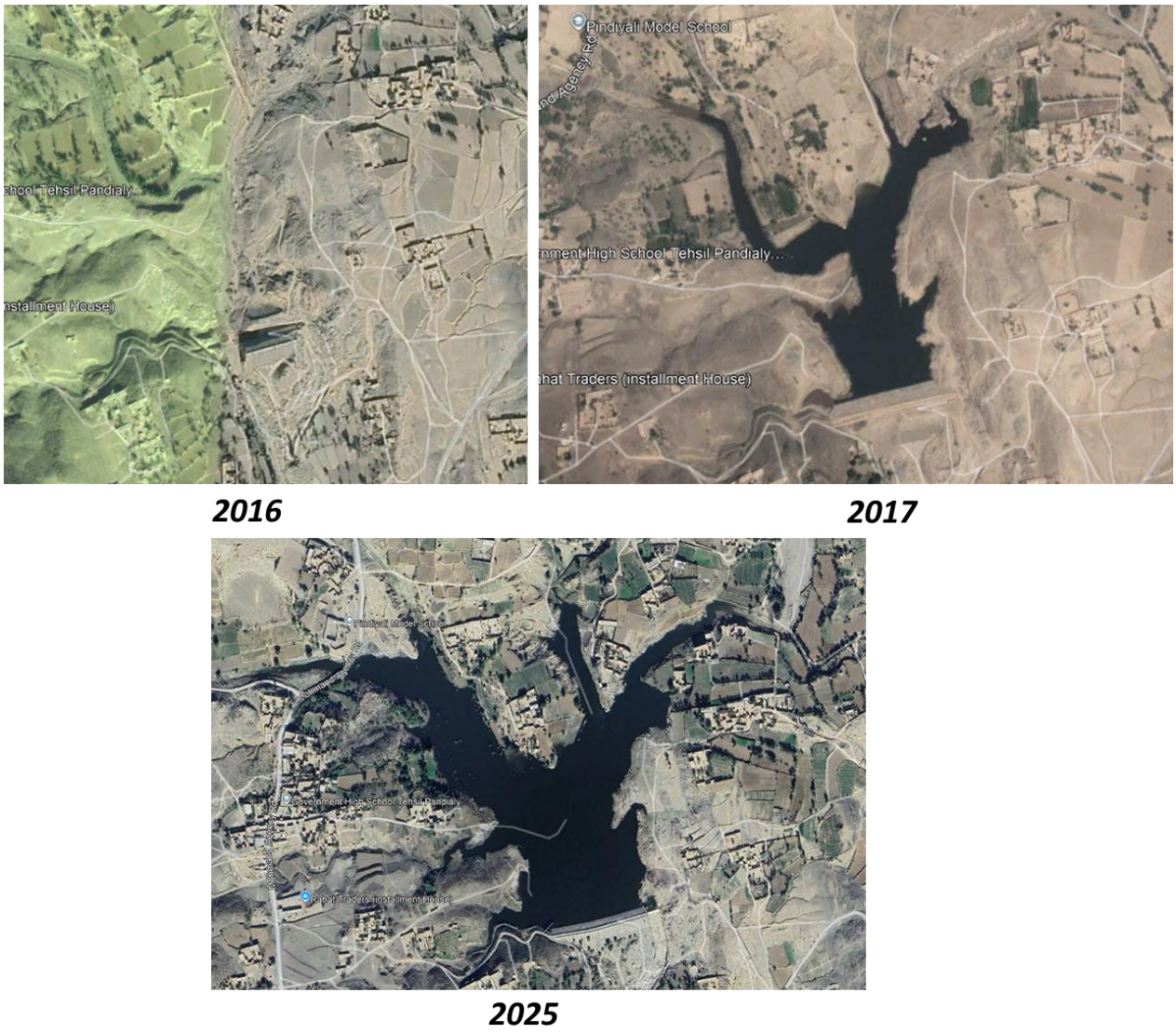


Source: Google Earth

Pindiali Small Dam: The Pindiali (Pandialy) Small Dam is located in Pindiali Tehsil, Mohmand District (formerly Mohmand Agency) and was constructed in 2017 as a small water storage and irrigation facility. The dam was developed to store rainwater, support local irrigation, and enhance groundwater recharge for surrounding agricultural areas. Although small in scale, it holds local importance for water security and is informally used by nearby communities, with limited recreational use such as fishing and short visits, reflecting its functional as well as social value.

[14] Engineering Infrastructures in Frontier Province (Water and Irrigation), 2024 https://www.facebook.com/watch/?v=1020065396223985

Figure 13: Pandialy Small Dam



Source: Google Earth

In addition to their primary purpose of irrigation and water storage, these small dams in Mohmand District, such as Moto Shah Dam and the Pindiali Small Dam, have gradually become informal recreational spots for local communities. Nestled amid scenic landscapes and rugged hills, the reservoirs offer a calm and pleasant environment, attracting residents who visit for picnics, family outings, and relaxation. Locals also engage in fishing and casual leisure activities, making these sites not only functional water infrastructure but also community spaces that contribute to social interaction and outdoor recreation. Over time, these dams have thus developed a dual role, supporting both agricultural needs and informal tourism within the district.

6.5.2 Heritage & Archaeological Sites

Mohmand District, located in the Khyber Pakhtunkhwa province of Pakistan along the western border, is an area of growing archaeological and cultural significance. While previously under-surveyed due to security challenges and limited access, recent efforts by the Khyber

Pakhtunkhwa Department of Archaeology and Museums (KPDOAM) have begun to reveal a richer tapestry of human presence and historical activity across the region.

In the first systematic archaeological survey ever conducted in Mohmand District, the KPDOAM documented **around 53 archaeological sites and more** distributed across multiple tehsils of the district[15]. These include:

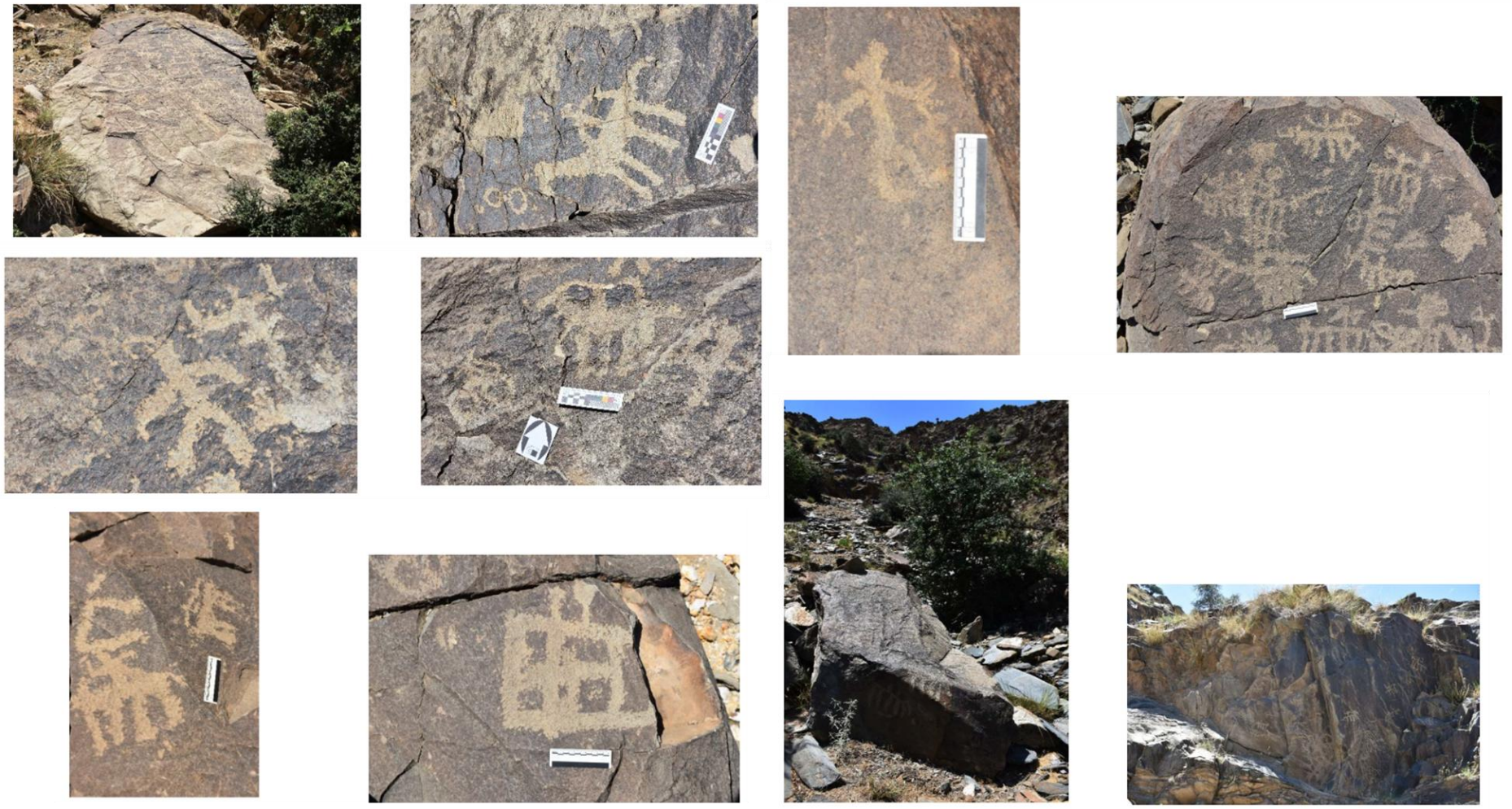
- **Pre-historic caves** indicating ancient human habitation, potentially dating back thousands of years;
- **Rock carvings and petroglyphs** suggesting artistic and symbolic expression by prehistoric communities;
- **Buddhist archaeological remains**, pointing to the region's connectivity with Gandharan and early Buddhist cultures;
- **Hindu Shahi period sites** (7th–11th century CE), including inscriptions and structural remains, showing the area's integration into early medieval polities.

The survey described Mohmand as a crossroads of civilizations, where different cultural traditions interacted from prehistoric artisan groups to later Buddhist and Hindu Shahi influences reflecting the broader historical currents of northern South Asia.

Although many of the specific site details remain unpublished in full academic form, the initial survey has firmly established Mohmand District as a region with significant archaeological potential, previously undocumented in the scientific literature[16].

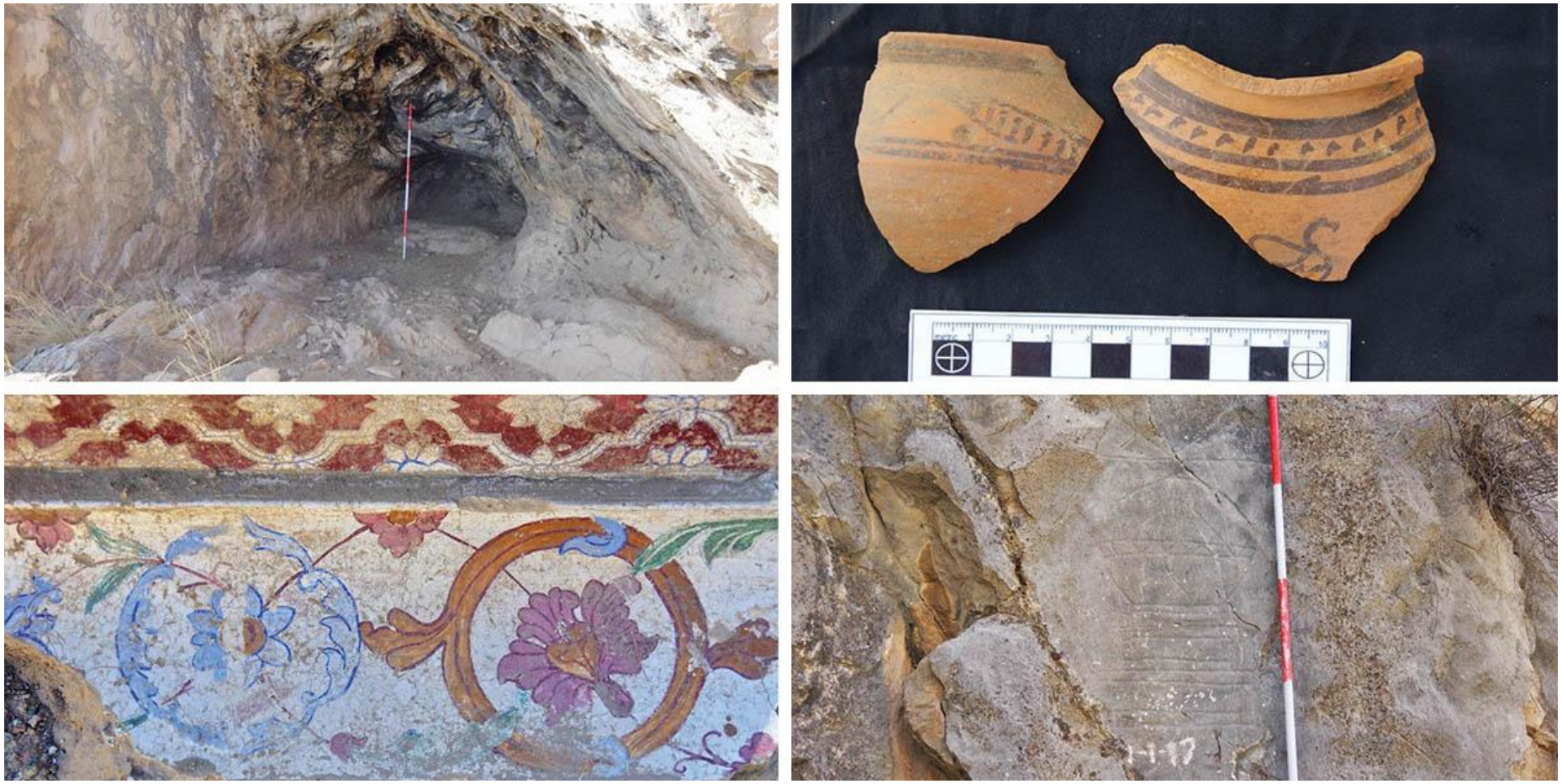
[15] https://www.scribd.com/document/474991521/Review-on-absenteeism
[16] https://dailytimes.com.pk/858468/pre-historic-archaeological-sites-discovered-in-mohmand

Figure 14: Heritage and archaeological sites[17]



[17] https://www.bolnews.com/pakistan/mohmands-ancient-glory

Figure 15: Artifacts and Heritage sites[18]



[18] https://www.bolnews.com/pakistan/mohmands-ancient-glory

6.5.3 Sports Facilities

The existing sports and recreational facilities in District Mohmand are predominantly located in the urban center of Ghalanai. Parks and playgrounds serve as crucial infrastructures for providing both active and passive recreation for the urban population. In Ghalanai, there are five notable parks: Captain Shaheed Rohullah, DC Park, Shagai Cricket Stadium, Quarter Park Civil Colony, and the Football Ground. These parks cover areas of 4.14 acres, 0.44 acres, 2.93 acres, 4 acres, and 42.6 acres, respectively.[19]

However, the condition of these parks and playgrounds is concerning, with most being in a dilapidated state, except for the Civil Colony Park and the DC Park, which are well-maintained and managed by the TMA Ghalanai. The other parks suffer from a lack of management and basic infrastructure, such as water facilities, toilets, footpaths, and aesthetic enhancements like trees and plantings. Moreover, the parks inside the Civil Colony are primarily accessible only to residents of the colony, limiting their use by the broader community.

The urban center of Ghalanai currently lacks an adequate number of parks and open spaces to meet the recreational needs of its growing population. Most of the existing parks are concentrated in the Civil Colony and nearby areas, resulting in a significant deficiency of such spaces in the central and northern parts of the urban center. This scarcity of open spaces can adversely affect the physical and mental health of residents, as well as hinder community cohesion and social interaction.

Currently, the only formal cricket ground in Ghalanai is situated near Chanda Bridge in the central area. In addition to this, there are several informal open spaces that children and young people use for sports like cricket and football. However, these informal spaces are neither officially designated nor adequately equipped for recreational activities, making them insufficient to meet the community's needs.

According to secondary sources, the provincial government has announced plans to construct an Rs800 million sports complex in Mohmand as part of the broader efforts to develop sports infrastructure in the newly-merged tribal districts. This development, inaugurated by the sports director for the erstwhile federally administered tribal areas (FATA), Nawaz Khan, at the Captain Roohullah Shaheed Sports Stadium in Ghalanai, reflects the government's commitment to enhancing sports and recreational facilities in the district [20].

Outside the administrative headquarters of Ghalanai, District Mohmand is predominantly rural, encompassing seven tehsils: Haleemzai, Safi, Khwezai (or Baizai), Pandialai (Pindiali), Prang Ghar, Ambar (Utman Khel), and Upper Mohmand (including Yake Ghund/Yake Ghund). The rugged mountainous terrain, scattered villages, and history of conflict have resulted in very limited formal recreational infrastructure. Most areas rely on informal open spaces, school grounds, riverbanks, and natural landscapes for recreation. Traditional activities

[19] Ghalanai Master Plan 2040, Task-C: Draft Master Plan, Master Plan Strategic Scenario Development/Mapping
[20] News, The Express Tribune, 2019, https://tribune.com.pk/story/2094286/k-p-govt-build-rs800m-sports-complex-mohmand

include community gatherings in hujras, local sports like volleyball or wrestling, and hiking in valleys.

Formal parks or dedicated sports stadiums are virtually non-existent in rural tehsils. However, post-2018 merger initiatives focused on rehabilitation, leading to the development of small-scale facilities, primarily school-based playgrounds serving dual purposes as community spaces.

Key Developments: School-Based Play Areas and Community Parks (2018-2019)

In 2018-2019, the Mohmand district administration, under then-Deputy Commissioner Wasif Saeed, established 10 play areas in government girls' schools across rural tehsils. These were designed for student use during school hours and as open community parks for women and children in the evenings addressing cultural needs for safe, segregated spaces in conservative tribal areas.

Figure 16: Redevelopment of School Based Play areas in District Mohmand



The facilities include swings, slides, basic playground equipment, and boundary walls for privacy and safety. They benefited thousands of residents in populated rural areas.

Distribution:

- Upper Mohmand (Haleemzai and Safi tehsils): 3 parks
- Lower Mohmand (Prang Ghar, Ambar, Pindiali, Yake Ghund/Yake Ghund): 5 parks
- Baizai Subdivision (Baizai/Khwezai tehsils): 2 parks

Specific locations are:

- Government Girls Middle School, Zaeem Qandahari (Safi Tehsil)
- Government Girls High School, Malik Umat Khan Koz Ghandhab (Haleemzai Tehsil)
- Government Girls High School, Sara Shah (Prang Ghar Tehsil)
- Government Girls Middle School, Kota Thrap (Ambar Tehsil)
- Government Girls High School, Elam Kore (Pindiali Tehsil)
- Government Girls Middle School/GHS, Sherano Kalli/Yake Ghund
- Government Girls Middle School, Malik Mazullah (Khwezai Tehsil)
- Government Middle School, Bahi Daag (Baizai Tehsil)

These remain the primary formal recreational sites in rural Mohmand as of recent records. Maintenance is community- or school-managed, with occasional government support[21].

6.5.4 Major Constraint in Tourism

Developing tourism in Mohmand District, despite its rich potential with sites like Michni Fort, Gandab Valley, and the Mohmand Dam, faces several significant constraints. Below is a table summarizing the major constraints and corresponding recommendations, tailored to the district's unique context, including its rugged terrain, cultural dynamics, and ongoing commercial and energy development plans (e.g., Ghalanai's 736.65-acre commercial hub and 185.48-acre recreational facilities in Halimzai Tehsil). These constraints are informed by the district's historical challenges as a former FATA region and its current stabilization efforts.

Constraint	Description
Security Concerns	Ongoing militancy risks and proximity to the Afghanistan border (e.g., Durand Line near Khawazai, Ilazai Peak) deter tourists, especially to remote tehsils like Prang Ghar (64.3 km from Ghalanai). Past conflicts have created a perception of instability.
Poor Infrastructure	Limited road connectivity, especially to peripheral tehsils like Prang Ghar and Utman Khel (50.6 km from Ghalanai), and lack of paved routes hinder access to sites like Mandar Dam and YYake Ghund. Basic amenities (hotels, restrooms) are scarce.
Low Awareness	Limited national and international awareness of Mohmand's attractions (e.g., Tomb of Haji Torangzai, Ancient Sarai) restricts visitor interest. The district is overshadowed by more established KP destinations like Swat.
Cultural Sensitivities	Tribal Pashtun culture and conservative norms in tehsils like Prang Ghar and Utman Khel may resist external visitors or modern tourism practices, risking community pushback.
Limited Facilities	Lack of tourist infrastructure (e.g., hotels, guides, signage) at sites like Ilazai Peak and Mandar Dam limits visitor experience. Recreational allocations (e.g., 41.92 acres in Yake Ghund, 6.55 acres in Prang Ghar) are underdeveloped.
Environmental Risks	Rugged terrain and fragile ecosystems (e.g., Swat River areas, thorny forests in Khawazai) risk degradation from unplanned tourism. Construction near Mohmand Dam could disrupt scenic appeal.

6.5.5 Proposed Recreational Zones

To enhance community well-being, promote social interaction, and strengthen the tourism potential of Mohmand District, a comprehensive network of recreational facilities is proposed

[21] https://www.dawn.com/news/1426250

across all tehsils. The plan envisions the creation of inclusive, accessible, and environmentally responsive recreational spaces that cater to varying population sizes, geographic settings, and local economies.

1. **Central Park Development – Ghalanai as the Recreational Hub**

At the core of the proposal lies the creation of a **Central Multi-Purpose Park in Ghalanai**, serving as the district's flagship recreational facility.

- The park will include **playgrounds, sports fields, walking tracks, cultural activity spaces, and open lawns** designed for both residents and tourists.
- Its central location within **Tehsil Halimzai** will make it easily accessible, supporting community gatherings and cultural events.
- The park will also complement nearby **tourism attractions** such as Michni Fort and Mohmand Dam, enhancing the district's overall recreational and tourism appeal.

This Central Park is envisioned as a vibrant public space promoting social interaction, physical activity, and cultural expression, while serving as a model for sustainable urban park design in the district.

Figure 17: Concept Desing for Central Parks



Source: https://www.behance.net/mayaelsayed

2. **Community Parks – Accessible Green Spaces for Every Tehsil**

To ensure equitable access to recreation across all localities, a series of **Community Parks** are proposed throughout the district.

- These smaller parks will be **strategically located within residential neighborhoods**, ensuring walkable access for local communities.
- Facilities will include **children's play areas, shaded seating, and jogging tracks**, promoting health and social well-being.
- Special emphasis will be given to **densely populated and underserved areas**, ensuring inclusion and balanced development.

Community parks will provide much-needed breathing spaces within growing settlements, improving environmental quality and fostering social cohesion.

Figure 18: Concept Design for Community Parks with Kids play area



Source: https://novostroycity.ru/journals/novosti-kompanij/sminex-novyj-biznes-klass-sportivnyj-detskij-komfortnyj

3. Large Recreational Zones – Sports, Tourism, and Eco-Leisure

To diversify outdoor activities and attract tourism, **Large Recreational Zones** are planned in strategic locations across the district.

- These zones will host **sports complexes, picnic sites, eco-tourism trails, and open-air event grounds**.
- The zones will promote **eco-friendly tourism**, encourage outdoor recreation while preserving natural landscapes.
- Sites will be chosen based on **topography, accessibility, and tourism potential**, ensuring long-term sustainability.

Such recreational zones will not only support local participation but also position Mohmand as an emerging destination for eco- and adventure tourism.

4. Riverfront Parks – Utilizing Natural Corridors

Drawing inspiration from successful dam-based recreation models, the proposed Riverfront Parks in Mohmand District aim to transform the natural corridors of the Swat River and its tributaries into vibrant leisure and adventure destinations. These parks will harmoniously blend nature, recreation, and tourism, offering both tranquility and thrill for residents and visitors alike.

Scenic and Recreational Landscape

- Pedestrian promenades and riverside walkways for scenic exploration.
- Landscaped sitting terraces and shaded picnic lawns for family gatherings.
- Observation decks offering panoramic views of the river and surrounding hills.

Water-Based Activities

To replicate the recreational success of leading dam-based tourist sites, the parks will include:

- Boating (short and long trips)
- Kayaking and wake tubing
- Cliff diving (small and large boats)
- Jet skiing and parasailing
- Wakeboarding, scuba diving, and water skiing

These water sports will be safely managed through trained personnel, ensuring enjoyable and secure experiences for visitors.

Land-Based Adventure Zones

- In addition to water recreation, designated areas will host:
- Archery and air shooting ranges
- Rock climbing and caving zones
- Camping sites and repelling stations for outdoor exploration

Such facilities will attract tourists and encourage local participation in physical and adventure-based activities.

Visitor Amenities

To ensure comfort and accessibility, the Riverfront Parks will provide:

- Refreshment kiosks and food courts
- Eco-friendly parking spaces
- Rest areas and viewing pavilions
- Guided tour points and information centers

Special focus will be given to Pindiali Tehsil (Palai Water Dam), where the natural topography, lush greenery, and proximity to the river make it an ideal site for eco-tourism development. The Riverfront Parks proposed in Recreational zone will serve as both community leisure spaces and tourism anchors, promoting local employment opportunities and sustainable tourism practices.

By combining scenic beauty with recreational vibrancy, the Riverfront Parks / recreational Zone will not only enhance the district's visual and environmental quality but also position Mohmand as an emerging destination for water sports, adventure tourism, and nature-based recreation.

Figure 19: Activities for Riverfront Park (concept)



Source: Google Images (inspired from Khanpur Dam)

The table presents a phased and spatially balanced distribution of parks and recreational facilities across urban centres, potential urban centres, and emerging settlements in District Mohmand. The Urban Centre of Ghalanai, with a combined provision of 84.14 acres, is

positioned as the district's primary recreational node, reinforcing its role as the administrative, commercial, and service hub. The provision of a Central Park and additional urban parks supports higher population density, city-level recreational demand, and the district's growing urban character.

Among the potential urban centres, Pindiali receives a substantial allocation (76.41 acres), including a dedicated recreational zone, reflecting its strategic location and future urban expansion potential. Utman Khel (VC-2 & 9) is allocated 68.06 acres of new recreational and green spaces despite having no existing parks, addressing a critical service gap and improving environmental quality. Yake Ghund, with a total of 54.14 acres, focuses on neighborhood-level parks to support its transition toward an urban centre, while Qandahari (VC-3 & 2) expands its recreational provision to 28.33 acres to meet local community needs.

Within potential settlements, targeted recreational investments are proposed to ensure equitable access to open spaces. Baizai-4 is allocated 39.91 acres, including a tourism-oriented zone, supporting local economic activity and leisure functions. Lakarai increases its recreational area to 34.19 acres, aligning with its emerging settlement role, while Prang Ghar, currently lacking formal facilities, is provided 16.24 acres of parks and green spaces to address basic recreational requirements.

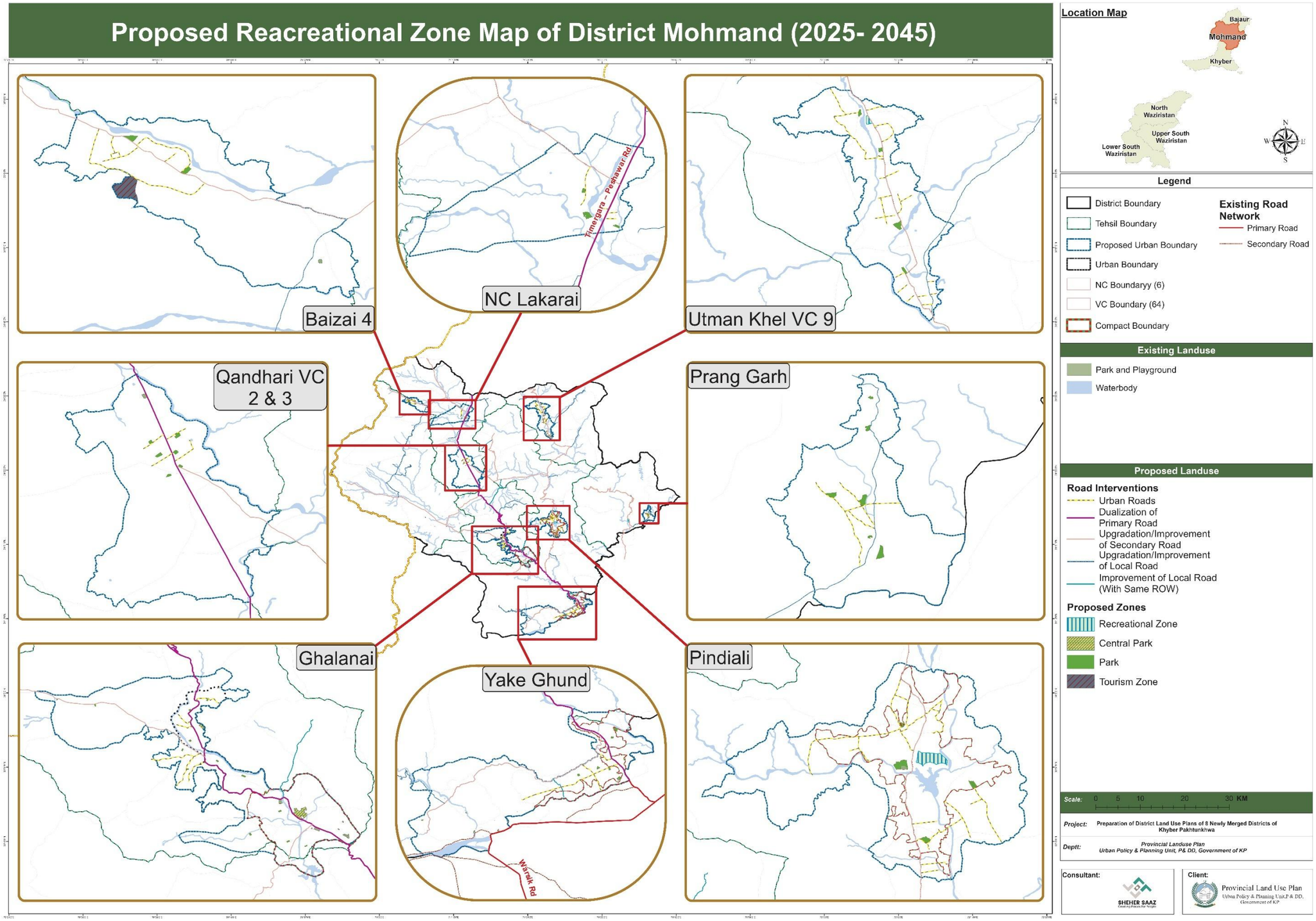
Table 76: Type of Recreational Activity- District Mohmand

Existing Parks/Recreational Facilities		***Proposed Recreational Facilities***	***Total Area (acres)***	***Sum of Existing and Proposed Recreational Facilities***
Urban Centre				
Park and Playground	19.62	Proposed Central Park	45.21	84.14
		Proposed Park	19.31	
Potential Urban Centre				
Yake Ghund				
Park and Playground	18.97	Proposed Park	35.17	54.14
Pindiali				
Park and Playground	4.16	Proposed Park	26.65	76.41
		Proposed Recreational Zone	45.60	
Utman Khel Vc-2&9				
-		Proposed Park	26.49	68.06
		Proposed Recreational Zone	9.32	
		Green Space	32.25	
Qandahari Vc-3&2				
Park and Playground	4.73	Proposed Park	23.59	28.33
Potential Settlement				
Baizai -4				
Park and Playground	0.99	Tourism Zone	29.10	39.91
		Proposed Park	6.53	
		Green Space	3.29	

Lakarai				
Park and Playground	3.51	Proposed Park	20.88	34.19
		Green Space	9.80	
Prang Ghar				
-		Proposed Park	9.10	16.24
		Green Space	7.14	

Source: Devised by consultants

Map 45: Proposed Recreational facilities/zone in District Mohmand



6.6 ENERGY & POWER

6.6.1 Review of National/ provincial policy regarding energy and power.

6.6.1.1 Khyber Pakhtunkhwa Hydel Development Fund Ordinance 2001

Established a dedicated fund for hydropower development in KP. Financed mainly through provincial profits from federal hydel projects, with additional federal, provincial, or external contributions. At least 10% of project profits are reinvested into the Fund.

- Minimum project cost: PKR 500 million (smaller projects only through joint ventures).
- Managed by a Board with authority over project approval and fund investment.
- Proposals initiated by the Irrigation & Power Department, reviewed by PDWP, and approved by the Board.
- Financial controls include annual audits by the Auditor General and strict withdrawal protocols.

6.6.1.2 National Electricity Plan (NEP) 2023–2027

A strategic roadmap to reform Pakistan's power sector with six objectives: diversification, resilience, self-sufficiency, affordability, financial viability, and sustainability.

- **Diversification:** Integrated energy planning, renewables, cross-border trade.
- **Resilience & Access:** Transmission expansion, robust distribution, electrification of remote areas.
- **Self-Sufficiency:** Promote local resources and technologies.
- **Affordability & Viability:** Rationalized subsidies, cost-reflective tariffs, improved recovery.
- **Sustainability:** Decarbonization, efficiency, institutional strengthening, digitalization. Includes clear performance indicators, monitoring, and social protection measures to ensure inclusive energy access.

6.6.1.3 National Electricity Policy 2021

Provides a comprehensive framework for reliable, affordable, and sustainable electricity.

- **Goals:** Affordable access, energy security (via diversified local resources), and sustainability.
- **Guiding principles:** Efficiency, transparency, competition, financial viability, indigenization, and environmental responsibility.
- **Focus areas:** Generation, transmission, distribution, market development, tariffs, subsidies, energy efficiency, integrated planning, and governance. Stresses competitive capacity expansion, grid strengthening, loss reduction, cost-

reflective tariffs, and renewable energy promotion. Includes monitoring and coordinated federal–provincial implementation.

6.6.1.4 Policy for Development of Renewable Energy (2006)

Launched to mainstream renewables (small hydro, wind, solar) into Pakistan's energy mix and attract private investment.

- **Short-term:** Incentives, simplified regulations, guaranteed power purchase, net metering, and wheeling.
- **Medium/Long-term:** Market consolidation, competitive frameworks, and sector self-sufficiency.
- Key incentives: Deregulation for small-scale projects, predictable tariffs, risk allocation to power purchasers, and carbon credit facilitation.
- Institutions: AEDB (one-window for RE), NEPRA (regulation), PPIB (private sector facilitation).

Aims to reduce fossil fuel dependence, enhance energy security, create jobs, and promote sustainability.

6.6.2 Identification of Proposed Projects:

The Mohmand district in Pakistan utilizes both renewable and non-renewable energy sources. Renewable sources include solar, wind, and potentially hydropower from small streams and rivers. Non-renewable sources primarily consist of natural gas (though availability and infrastructure may be limited in some areas) and potentially coal (though its use is less common). Additionally, biomass (like wood) is a significant energy source for cooking and heating, especially in rural areas.

The energy and power sector's Annual Development Plan (ADP) 2024–25 outlines several initiatives that will be implemented.

Table 77: ADP 2024-2025, Energy and Power Project of Mohmand District

ADP S.#.	Code, Name of the Scheme, (Status) with forum and date of last approval	Total Cost	Total Allocation	Exp. Upto June 24
322	191403 - 180492-Pilot Project for "Installation of 13 no's of solar mini grids in merged areas" SUB COMPONENT "Solar Electrification of 300 Masjid/Worship places for Non-Muslims in Merged Districts (erstwhile FATA) Khyber Pakhtunkhwa". [MA].	777.89	127.848	650.042
323	191961 - 170364 Installation of Micro Hydel Power Units in Tribal Districts. [MA]	99.961	14.361	85.6
333	195211 - Providing New/bi-furcation / Bajaur, Mohmand and Khyber (AIP)	845.366	98.494	746.872

335	210369 - Rehabilitation of existing network and electrification of un-electrified villages Merged Areas	1500	172	360
337	Up-Gradation of 66KV Lakari Grid Station to 132KV Level along with Associated Transmission Line from 132KV Northern Mohmand & Khar Bajour Grid Station	1,739.588	33.000	

Source: ADP 2024-2025

The Annual Development Plan (ADP) 2025–26 for the energy and power sector outlines several initiatives that will be implemented.

Table 78: ADP 2025-2026, Energy and Power Project of Mohmand District

ADP S.#.	Code, Name of the Scheme, (Status) with forum and date of last approval	Total Cost	Total Allocation	Exp. Up to June 25
335	240050 - Up-Gradation of 66KV Lakari Grid Station to 132KV Level along with Associated Transmission Line from 132KV Northern Mohmand & Khar Bajour Grid Station	30	30	0
338	251065 - Electrification of Un-electrified Villages in Mohmand District	50	50	0

Source: ADP 2024-2025

6.6.3 Available Energy Resources

Below is a summary table of available and potential energy sources, based on current projects, geographical features, and provincial assessments.

Table 79: Available Energy Resources in Mohmand District

Energy Source	Availability/Status	Key Details and Potential
Hydropower	Primary and most developed source; under-construction major project.	Mohmand Dam Hydropower Project (800 MW capacity, expected commissioning by 2025–2026) on the Swat River, generating ~2,862 GWh annually. Part of KP's ~30,000 MW hydro potential, with Mohmand contributing significantly to flood control and irrigation for 16,737 acres. Smaller micro/mini-hydro sites possible on local streams.
Solar	High potential; underdeveloped but feasible for off-grid	Average 8.5–9.5 hours of daily sunlight in KP; Mohmand's sunny, high-altitude climate suits rooftop PV and small-scale plants. Provincial initiatives like KP

	and distributed generation.	Solarization of Houses (130,000 units) and PEDO projects could extend here. National target: 780 MW installed solar by 2024, with plans for 13,000+ MW by 2030.
Biomass/Biogas	Moderate potential from agricultural waste; limited utilization.	District has ~9% cultivated land (vegetables, fruits) producing residues for biogas or waste-to-energy. KP's overall biomass potential ~5,000–10,000 MW nationally, with small plants possible. Only ~249 MW bagasse-based nationally.
Wind	Low to negligible potential; not locally viable.	Mohmand's inland, mountainous location lacks consistent winds (unlike Sindh's 50,000 MW coastal corridor). KP wind potential minimal; national installed ~1,838 MW from southern sites.
Fossil Fuels (Thermal/Grid)	Available via national grid; not local generation.	Relies on imported/centralized thermal (59% of Pakistan's mix), supplied through PESCO grid. No local coal/gas reserves; minerals like chromite/manganese not energy focused.
Other (e.g., Nuclear/Geothermal)	No available.	No nuclear plants (national ~3,620 MW elsewhere); geothermal/wave/tidal irrelevant to Mohmand's geography.

Mohmand's energy strategy emphasizes renewables, with hydropower as the anchor via the Mohmand Dam, supporting KP's goal of 60% renewable mix by 2030. Solar and biomass offer decentralized solutions for remote areas, while grid enhancements ensure reliability. Development is backed by PEDO and federal policies, but challenges like terrain, funding, and security persist.

6.6.4 Dam Site Analysis & Methodology

6.6.4.1 Dam Site Suitability Analysis

Systematic identification of suitable dam sites is critical for effective water resource management and district infrastructure planning, directly impacting hydroelectric generation, irrigation supply, flood control, and regional development. Dam construction represents substantial capital investment with permanent hydrological and landscape alterations, making appropriate site selection essential for maximizing benefits while minimizing environmental, social, and economic costs. Poor site selection results in structural instability, excessive costs, ecological damage, involuntary resettlement, and suboptimal storage

capacity, whereas well-selected sites offer enhanced foundation stability, favorable reservoir geometry, adequate water availability, and minimal land use conflicts. Traditional field-based selection methods were time-intensive with limited spatial coverage, often missing suitable sites in remote areas.

Contemporary geospatial technologies enable systematic district-wide evaluation through integration of satellite imagery, digital elevation models, hydrological datasets, and land cover information within GIS frameworks. This methodology employs Multi-Criteria Decision Analysis (MCDA) using the Analytic Hierarchy Process (AHP), which decomposes complex spatial problems into hierarchical criteria, establishes relative importance weights, and integrates quantitative and qualitative parameters in transparent, reproducible processes. The analysis utilizes Google Earth Engine (GEE) for cloud-based processing of terrain derivatives, hydrological parameters, and vegetation indices across regional extents. This desktop suitability analysis serves as preliminary screening to identify priority areas warranting detailed field investigation, focusing limited resources on promising candidate sites while systematically excluding fundamentally constrained areas.

6.6.4.2 Data Collection

The analysis integrates multiple satellite-derived and modeled datasets providing complementary information on topography, hydrology, land cover, and vegetation conditions. All datasets were acquired through Google Earth Engine's public data catalog, ensuring standardized processing and reproducibility. The Shuttle Radar Topography Mission (SRTM) Global 1 arc-second Digital Elevation Model provides seamless 30-meter coverage with ±16 meters vertical accuracy, serving as the foundation for terrain analysis. Secondary derivatives including slope gradient, aspect, and hillshade were computed using standard algorithms. Hydrological data derives from MERIT Hydro version 1.0.1 at 90-meter resolution, a hydrologically conditioned dataset that corrects vegetation biases, artifacts, and noise while enforcing hydrological consistency. The flow accumulation layer represents upstream drainage area in square kilometers, enabling identification of perennial streams and main channels essential for assessing water availability.

Land surface characterization utilized Sentinel-2 multispectral imagery from the Copernicus program, with two polar-orbiting satellites providing 5-day global coverage at 10–20-meter resolution across 13 spectral bands. A cloud-filtered annual composite for 2024 was generated by computing median values across scenes with less than 20% cloud cover, minimizing atmospheric effects and seasonal variability. Land cover classification employed ESA WorldCover 2021, a global 10-meter product based on combined Sentinel-1 radar and Sentinel-2 optical data classified into 11 primary classes using machine learning algorithms. Watershed delineation utilized HydroSHEDS Level 7 sub-basins developed by World Wildlife Fund, providing standardized catchment boundaries validated against observed stream networks. Quality assurance procedures validated geometric consistency, coordinate system alignment (WGS84 / UTM Zone 43N), temporal consistency, and attribute accuracy across all datasets.

Table 80: Geospatial Data Sources and Specifications

Dataset	Resolution	Temporal Coverage	Source	Primary Parameters	Application
SRTM DEM	30 m	February 2000	USGS/SRTMGL1_003	Elevation (m above sea level)	Terrain analysis, elevation/slope suitability
MERIT Hydro	90 m	Multi-DEM derived	MERIT/Hydro/v1_0_1	Flow accumulation (km²), flow direction	Stream extraction, drainage area, hydrological suitability
Sentinel-2 SR	10-20 m	January-December 2024	COPERNICUS/S2_SR_HARMONIZED	13 spectral bands (visible-SWIR)	NDVI calculation, land surface characterization
ESA WorldCover	10 m	2021	ESA/WorldCover/v200	11 land cover classes	Land use suitability, constraint mapping
HydroSHEDS Basins	Vector (Level 7)	SRTM-derived	WWF/HydroSHEDS/v1/Basins/hybas_7	Sub-basin boundaries, drainage areas	Watershed delineation, catchment analysis

6.6.4.3 Analysis

The suitability assessment integrates six criteria through structured multi-criteria analysis comprising standardization, weighting, overlay, and classification stages. Each criterion was independently evaluated and standardized to a common 1-5 scale where higher values indicate more favorable conditions, enabling integration of heterogeneous data types within a unified framework. Standardization employed threshold-based reclassification rules derived from civil engineering guidelines, hydrological requirements, and environmental considerations.

Elevation suitability reflects the balance between storage potential and construction feasibility, with maximum suitability (score 5) assigned to 1000-1500 meters where conditions optimize reservoir volume while maintaining reasonable construction access. Slope suitability inversely relates gradient to foundation stability and excavation requirements, with gentle slopes below 5 degrees rated highest (score 5) and slopes exceeding 35 degrees rated lowest (score 1) due to unstable foundations. Slope θ in degrees was computed from elevation z as:

$$\theta = \arctan\left(\sqrt{\left(\frac{\partial z}{\partial x}\right)^2 + \left(\frac{\partial z}{\partial y}\right)^2}\right) \times \frac{180}{\pi}$$

Flow accumulation suitability quantifies water availability based on upstream drainage area A_d, with areas exceeding 5000 km² rated highly suitable (score 5) and areas below 500 km² considered insufficient (score 1) for significant storage. Land use suitability preferentially sites dam in areas with minimal human occupation and ecological value, with barren land and water bodies receiving maximum scores (5) and urban areas receiving minimum scores (1) reflecting prohibitive resettlement costs. Vegetation density assessed through NDVI provides complementary information on land use intensity. NDVI was calculated from Sentinel-2 near-infrared (Band 8) and red (Band 4) reflectance as:

$$\text{NDVI} = \frac{\rho_{NIR} - \rho_{Red}}{\rho_{NIR} + \rho_{Red}} = \frac{B8 - B4}{B8 + B4}$$

where ρ denotes surface reflectance. NDVI values range from -1 (water, bare soil) to +1 (dense vegetation), with suitability inversely proportional such that barren areas (NDVI < -0.1) receive maximum scores (5) and densely vegetated areas (NDVI > 0.6) receive minimum scores (1). Stream proximity suitability reflects construction access requirements, with Euclidean distance d to nearest stream computed using fast distance transform. Locations within 500 meters receive maximum scores (5), declining to minimum scores (1) beyond 5000 meters. Criterion weights were established through AHP methodology reflecting relative importance for dam site selection.

Slope received the highest weight $w_{slope} = 0.25$ (25%) for structural safety primacy. Flow accumulation received $w_{flow} = 0.20$ (20%) recognizing water availability as necessary. Elevation, land cover, and stream proximity each received $w_{elev} = w_{lulc} = w_{prox} = 0.15$ (15%) balancing storage, environmental impacts, and access. NDVI received $w_{NDVI} = 0.10$ (10%) as supplementary to land cover. These weights satisfy normalization:

$$\sum_{i=1}^{6} w_i = w_{elev} + w_{slope} + w_{flow} + w_{lulc} + w_{NDVI} + w_{prox} = 1.0$$

The composite suitability index was computed through weighted linear combination, multiplying each standardized criterion value by its weight and summing products. For any location (x, y), let $S_i(x, y)$ represent standardized suitability (1-5) for criterion i, and w_i the normalized weight.

Overall suitability $S_{total}(x, y)$ is:

$$S_{total}(x, y) = \sum_{i=1}^{n} w_i \cdot S_i(x, y)$$

where $n = 6$. Expanding with specific criteria:

$$S_{total} = w_{elev} \cdot S_{elev} + w_{slope} \cdot S_{slope} + w_{flow} \cdot S_{flow} + w_{lulc} \cdot S_{lulc} + w_{NDVI} \cdot S_{NDVI} + w_{prox} \cdot S_{prox}$$

Substituting established weights:

$$S_{total} = 0.15S_{elev} + 0.25S_{slope} + 0.20S_{flow} + 0.15S_{lulc} + 0.10S_{NDVI} + 0.15S_{prox}$$

This generates a continuous surface with theoretical values from 1.0 to 5.0, though actual ranges reflect spatial variation in how locations satisfy multiple criteria. The continuous index was classified into five discrete categories using natural breaks optimization maximizing between-class variance: Class 1 (Not Suitable, $S_{total} < 1.5$), Class 2 (Less Suitable, $1.5 \leq S_{total} < 2.5$), Class 3 (Moderately Suitable, $2.5 \leq S_{total} < 3.5$), Class 4 (Suitable, $3.5 \leq S_{total} < 4.0$), and Class 5 (Highly Suitable, $S_{total} \geq 4.0$). Priority candidate sites were identified by selecting Classes 4-5 areas within 1000 meters of streams with minimum area 0.5 km². High-suitability cells were vectorized to polygons attributed with identifier, area, drainage, elevation, slope, and suitability score. The resulting Dam Site Suitability Classification Map provides spatially explicit guidance for master planning, enabling systematic prioritization for detailed feasibility investigation while excluding fundamentally constrained locations.

Table 81: Dam Site Suitability Classification System

Class	Score Range	Classification	Color	Description	Recommended Action
1	< 1.5	Not Suitable	Red	Severe constraints: steep slopes (>35°), urban areas, insufficient water	Exclude from consideration
2	1.5 – 2.5	Less Suitable	Orange	Significant limitations: suboptimal elevation, moderate slopes (25-35°), dense vegetation	Low priority; consider only if alternatives absent
3	2.5 – 3.5	Moderately Suitable	Yellow	Acceptable with standard engineering: reasonable topography/hydrology	Secondary priority for detailed assessment
4	3.5 – 4.0	Suitable	Light Green	Good characteristics: favorable slope (5-15°), adequate drainage (>1000 km²), minimal conflicts	High priority for field verification
5	≥ 4.0	Highly Suitable	Dark Green	Optimal conditions: ideal topography, excellent water supply, minimal impacts	Highest priority for feasibility studies

6.6.5 Proposed Locations for Potential Energy Sources

1. Hydropower – Mohmand Dam and Micro-Hydro Sites

- **Primary Location**: Halimzai Tehsil (near Ghalanai, along Swat River)

The Mohmand Dam Hydropower Project (800 MW, ~2,862 GWh annually) is under construction on the Swat River, centrally located in Halimzai, close to Ghalanai's commercial hub (161 acres). This site leverages the river's flow and Ghalanai's administrative centrality (73,704 population by 2045) to distribute power district-wide, supporting the 5.02-acre Grain and Fruit Market. The dam also aids irrigation, benefiting agricultural trade.

2. Solar – Rooftop and Small-Scale Plants

- **Primary Location**: Halimzai Tehsil (Ghalanai) and Pindiali Tehsil

Ghalanai's high sunlight (8.5–9.5 hours daily) and large commercial allocations (161-acres Proposed Commercial Zone) make it ideal for rooftop solar on commercial buildings and a small solar farm (1–5 MW) near the Grain and Fruit Market. Pindiali's 77.5 acres (65.57-acre Linear Commercial, 11.83-acre CBD) and 80180 population justify a solar plant to power its CBD and roadside markets, reducing grid reliance. Both locations benefit from proximity to major roads for installation and maintenance.

3. Grid Enhancements (Thermal/Grid Support)

- **Primary Location**: Northern Mohmand (Lakari Grid Station)

The ongoing upgradation of the 66KV Lakari Grid Station to 132KV, with transmission lines from Northern Mohmand and Khar Bajour (ADP 2024-25, 2025-26, Rs. 1,739.588 million), enhances grid reliability for northern tehsils like Ambar Utman Khel (50.6 km from Ghalanai, 90,858 population). This supports commercial zones in Utman Khel) and integrates with hydropower from Mohmand Dam.

4. Wind and Other Sources

- **Location**: None proposed.

Mohmand's inland, mountainous terrain lacks viable wind speeds (unlike Sindh's coastal corridor). Geothermal, nuclear, or tidal energy is irrelevant due to geography. Focus remains on hydro, solar, and biomass.

6.6.6 Constraints and Recommendations

To ensure effective development of power and energy resources in Mohmand District, a range of constraints must be addressed to align with the proposed locations for hydropower, solar, biomass, and grid enhancements, as well as the district's commercial development plans centered on Ghalanai in Halimzai Tehsil. Below is a table outlining key constraints and corresponding recommendations for sustainable energy development, tailored to Mohmand's rugged terrain, population distribution, and ongoing projects like the Mohmand Dam Hydropower Project and Lakari Grid Station upgrade (ADP 2024-25, 2025-26).

Table 82: Constraints and Recommendations

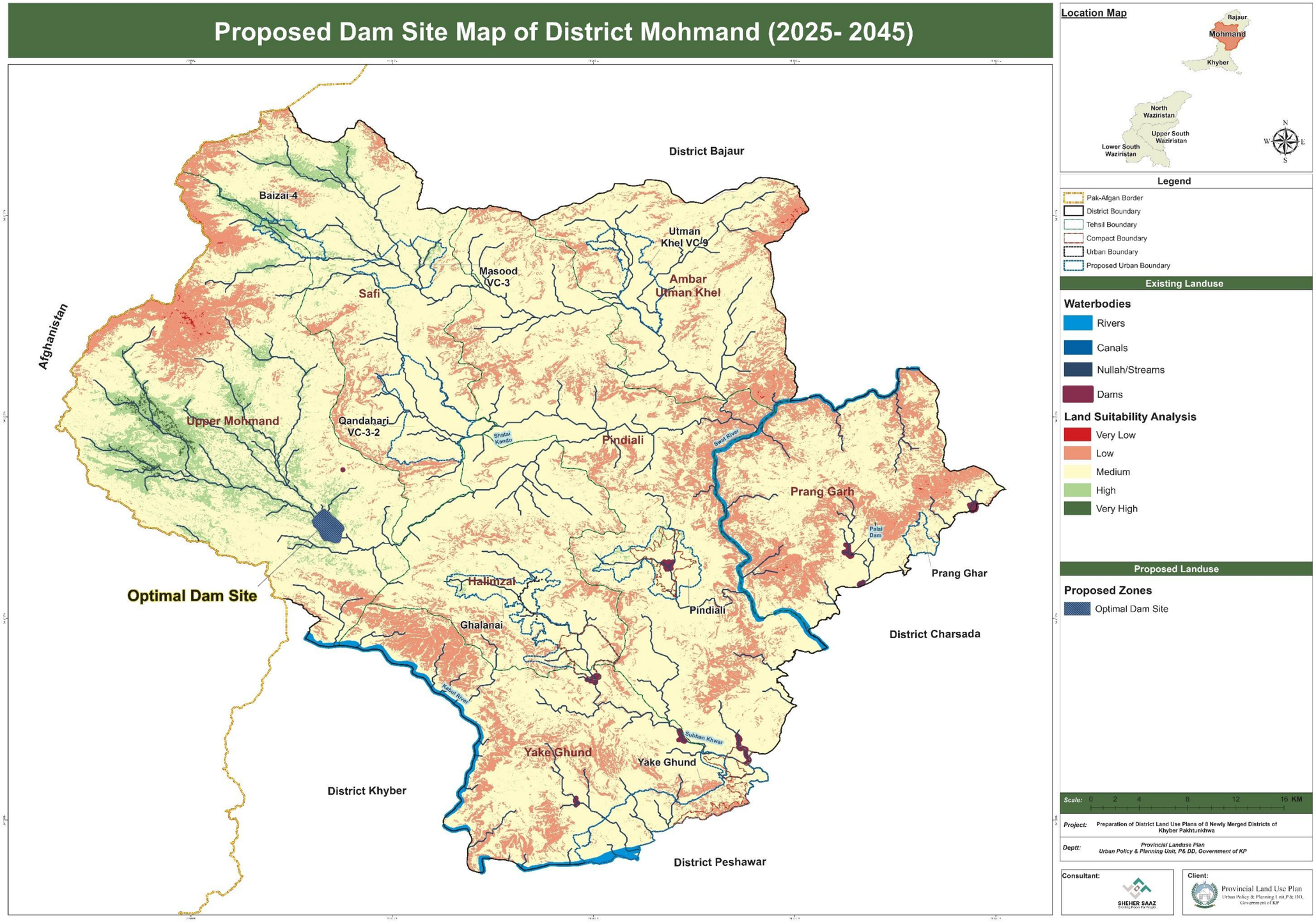
Energy Source	Constraint	Recommendation
Hydropower	**Security Risks**: Ongoing militancy and tribal dynamics in Mohmand, particularly near the Mohmand Dam site in Halimzai, pose risks to construction and operations.	Engage local tribal leaders for community buy-in and security cooperation. Deploy dedicated security units for project sites and coordinate with local administration to ensure safe access.
	Funding Delays: The Mohmand Dam (Rs. 1,739.588 million for grid upgrades in ADP) faces potential funding	Secure consistent funding through international donors (e.g., OPEC, World Bank) and public-private partnerships. Allocate provincial

	shortages due to competing national priorities.	budget increments for micro-hydro projects in Safi and Upper Mohmand.
	Terrain Challenges: Rugged, mountainous terrain complicates access to micro-hydro sites in Safi and Upper Mohmand, increasing costs for infrastructure.	Conduct detailed feasibility studies for micro-hydro sites, prioritizing cost-effective run-of-river systems. Use modular equipment transportable by existing roads to reduce costs.
Solar	**High Initial Costs**: High upfront costs for rooftop solar and small-scale plants in Halimzai and Pindiali deter adoption, especially for rural households.	Leverage KP's solarization initiatives and State Bank of Pakistan's microfinance schemes to subsidize solar panels. Offer low-interest loans for businesses in Ghalanai's 161-acre Commercial Zone and Pindiali's 77.5-acre CBD.
	Limited Technical Expertise: Lack of local expertise in solar installation and maintenance in remote tehsils such as Safi and Yake Ghund.	Partner with PEDO to provide training programs for local technicians. Establish mobile maintenance units based in Ghalanai to service solar installations across the tehsils.
	Land Availability: Limited flat land in Halimzai and Pindiali for larger solar farms due to commercial allocations in Halimzai).	Prioritise rooftop solar on commercial buildings in Ghalanai and Pindiali's CBD. Use marginal, non-arable land near commercial zones for small solar plants (1–5 MW).
Biomass/Biogas	**Waste Collection Systems**: Inadequate infrastructure for collecting agricultural waste in Halimzai (near the 5.02-acre Grain and Fruit Market) and Pindiali limits the biogas potential.	Develop community-based waste-collection systems in collaboration with local cooperatives. Provide incentives for farmers to supply residues to centralised biogas plants in Halimzai.
	Low Awareness: Limited community knowledge about biogas benefits in Utman Khel and Prang Ghar restricts the	Launch awareness campaigns through local councils, highlighting cost savings and sustainability. Pilot small digesters in Utman Khel's

	adoption of small-scale digesters.	18.97-acre CBD area to demonstrate viability.
	Scalability Issues: Small-scale biomass plants in Pindiali and Utman Khel face challenges in scaling due to inconsistent waste supply.	Conduct waste audits to quantify supply from cultivated lands (~9% of Mohmand). Partner with agricultural markets to ensure a steady supply of feedstock for biogas units.
Grid Enhancements (Thermal/Grid Support)	**Grid Reliability**: Frequent outages and reliance on fossil fuel-heavy national grid (59% thermal) affect power supply to Northern Mohmand's Lakari Grid Station.	Integrate Mohmand Dam's 800 MW output into the grid post-2025 to reduce thermal dependence. Accelerate the Lakari Grid Station upgrade (132KV) to improve distribution reliability.
	Remote Access: Poor road connectivity to Prang Ghar (64.3 km) and Utman Khel (50.6 km) hinders grid extension and maintenance.	Prioritize all-weather road upgrades (gravel initially, asphalt long-term) to Prang Ghar and Utman Khel, aligned with commercial zone development (e.g., 17.58 acres in Prang Ghar).
	High Transmission Costs: Extending transmission lines to remote tehsils like Prang Ghar increases costs due to distance and terrain.	Combine grid extensions with off-grid solar/biogas solutions in Prang Ghar to reduce costs. Use modular transformers to optimise transmission efficiency.
General Constraints	**Community Resistance**: Tribal sensitivities and land disputes in Mohmand may delay projects, particularly in peripheral tehsils such as Prang Ghar and Utman Khel.	Engage tribal jirgas early in planning to ensure community benefits (e.g., jobs, access to electricity). Offer land lease agreements with fair compensation for project sites.
	Environmental Impact: Hydropower (Mohmand Dam) and biomass plants pose risks to water quality and land degradation if not managed properly.	Implement environmental impact assessments for all projects. Use eco-friendly designs (e.g., run-of-river hydro, enclosed biogas systems) to minimise ecological disruption.
	Skilled Labor Shortage: Limited local skilled workforce for energy project implementation across tehsils.	Establish vocational training centers in Ghalanai, focusing on renewable energy skills. Partner with

		universities and PEDO for capacity-building programs.

Map 46: Proposed Dam Site Map - District Mohmand



6.7 TRANSPORTATION NETWORK EXISTING AND PROPOSED

6.7.1 Existing

In current times, the reliance of different modes of connectivity including transportation, air, railway and telecommunication systems is crucial for socio-economic growth and sustainability. Housing patterns, land use, and commercial hubs are all influenced by this communication system which facilitates the movement of people and goods between these areas. The following section provides detailed analysis of different communication systems in the Mohmand District.

6.7.1.1 Road Network

The transportation infrastructure in Mohmand District is vital for economic activities, regional connectivity, and socio-economic development. The following section of the report provides comprehensive analysis of different aspects of road network.

6.7.1.2 Regional Connectivity

Mohmand District's regional connectivity serves as a critical foundation for its socio-economic advancement, given its strategic position within the mountainous terrain of Khyber Pakhtunkhwa. The Ghalanai–Michini Road constitutes the district's principal transportation artery, linking the administrative headquarters at Ghalanai with Peshawar, the provincial capital. This corridor is essential for trade, mobility, and administrative integration, acting as the main conduct between local economic activity and regional markets. However, the road remains vulnerable to structural degradation particularly during the monsoon season frequently disrupting access and limiting the district's economic potential.

Within the district, connectivity between tehsils is limited, particularly in Safi and Prang Ghar, where unpaved and poorly maintained roads restrict accessibility. The rugged topography and limited road infrastructure significantly constrain the movement of goods and people, thereby impeding access to basic services such as education, healthcare, and markets. To ensure balanced regional growth, substantial investments are required in the expansion, upgrading, and maintenance of internal road networks, prioritizing resilient and climate-adaptive infrastructure.

Mohmand's proximity to the Afghanistan border presents considerable opportunities for regional trade integration. The Gorsal Border Crossing, although less developed than the Torkham terminal in neighboring Khyber District, holds untapped potential for cross-border commerce. Presently, inadequate customs infrastructure and security challenges restrict its operational capacity. Strategic investments to enhance road connectivity, establish modern customs facilities, and ensure border security could transform Gorsal into a key trade gateway, strengthening economic ties with Afghanistan and beyond.

Furthermore, the Mohmand Dam Project and its associated infrastructure are expected to catalyze major improvements in intra-district connectivity. The construction of new access roads and the rehabilitation of existing ones under the project are anticipated to improve mobility, stimulate economic diversification, and promote tourism within the district. These

interventions will play a vital role in integrating remote communities with regional development corridors.

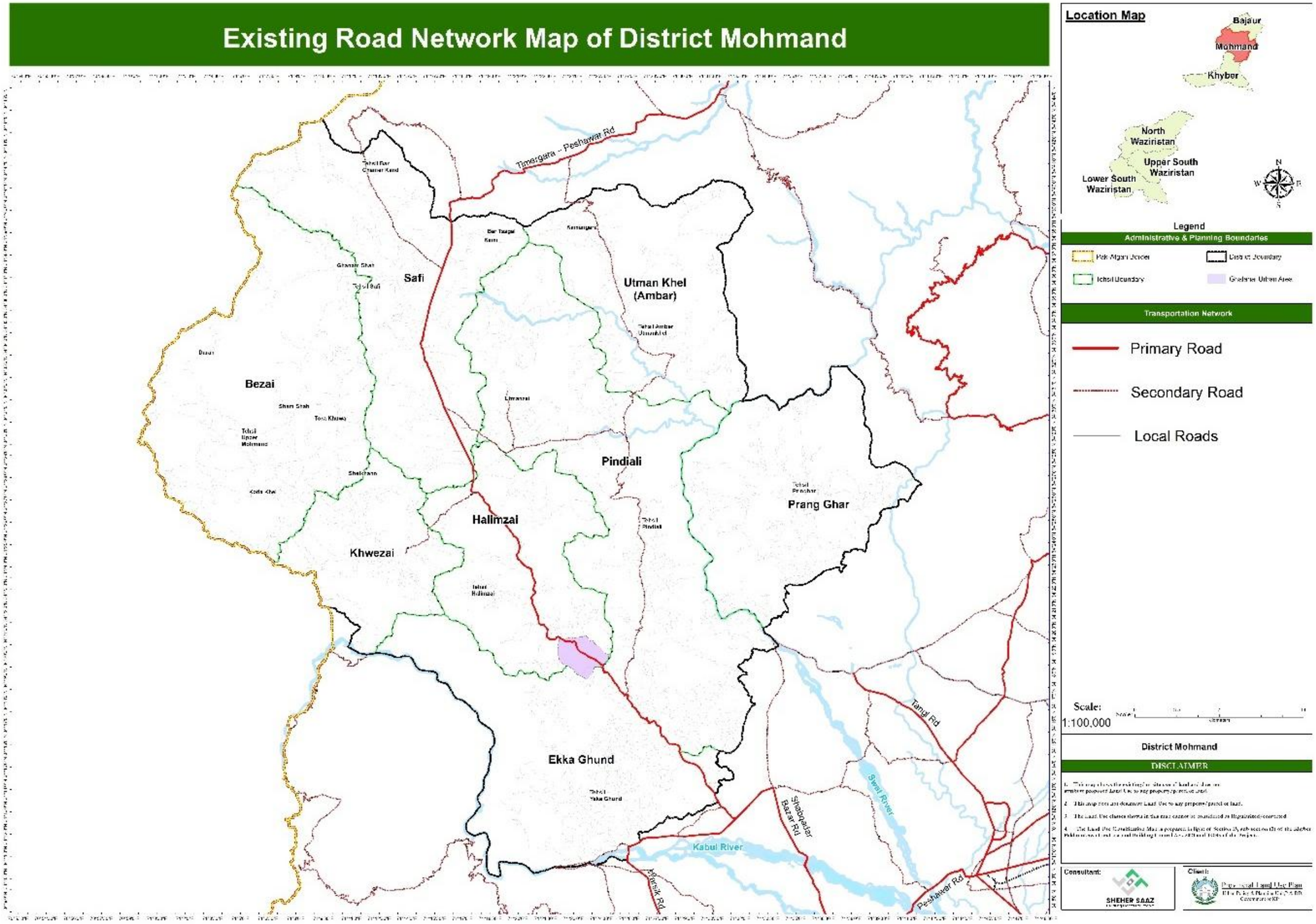
6.7.1.3 Major Transport Corridors

The transport corridors of Mohmand District are pivotal in integrating the district into the broader regional and national mobility framework. The Ghalanai–Michini Road serves as the primary corridor, enabling the movement of goods, services, and passengers between Mohmand and Peshawar. Despite its strategic importance, the road's current design capacity is insufficient to handle rising traffic volumes and climatic stresses. Comprehensive upgrades are necessary to enhance its durability, safety, and operational efficiency.

Secondary and tertiary corridors, particularly those extending toward Safi, Ambar, and Prang Ghar, remain underdeveloped. Most of these routes are either gravel tracks or narrow carriageways prone to erosion, limiting year-round accessibility. Strengthening these internal links is crucial for improving socio-economic equity, enabling rural-to-market linkages, and ensuring that peripheral communities are integrated into the district's development framework.

The corridor leading to the Gorsal Border represents an underutilized strategic asset. If appropriately developed with supporting infrastructure such as logistics hubs, warehousing, and customs facilities it could evolve into a vital component of the regional trade network. In this regard, a coordinated corridor development strategy, aligned with national border trade and connectivity initiatives, is imperative.

Map 47: Existing Road Network Map District Mohmand



6.7.1.4 Existing Roads

Within the Mohmand District itself, several roads and trails connect various towns and villages, ensuring intra-district mobility. While some of these roads are well-paved and maintained, others are more rudimentary, reflecting the challenging terrain of the region. Efforts are ongoing to improve these internal roads to facilitate better access to services and markets for the local population. Improved intra-district connectivity is essential for fostering local economic development and ensuring that the benefits of regional connectivity extend to all parts of the Mohmand District.

Attributes of key roads within the Mohmand district are presented in the following table:

Table 83: District Mohmand Road Inventory

Sr. No.	Road Type	Length (Km)
1	Primary Roads	64.85
2	Secondary Roads	111.76
3	Unpaved Roads	52.93
4	Local Roads	3118.89

The following are the major roads of urban area of Mohmand District.

Sr. No.	Name of the Road	Total Length (km)	Width (ft)
Major Road			
1	Main Road Ghalanai	11.5	26
2	Khapakh Road	3	24
Minor Roads			
3	Total Number of roads = 45	32	12-24
Streets			
4	Total Number of Streets = 63	28.8	12-24
9	Total length of the Roads	76	-

Source: Calculated by Consultant

6.7.1.5 Existing Farm to Market Roads

Farm to market roads in Mohmand District are vital for the local economy, facilitating the movement of agricultural products from rural areas to major markets. These roads improve accessibility and reduce transportation costs for farmers, thereby boosting agricultural productivity and market connectivity. Enhancing these roads is essential for economic development in rural areas.

Key Farm-to-Market Roads

1. **Muhammad Agency Road Ghalanai to Sagi Road**
   - This road serves as a vital link between the agricultural areas around Sagi and the district headquarters in Ghalanai. It is a crucial route for transporting grains, fruits, and vegetables to the central market in Ghalanai.
   - Upgrading the road to an all-weather surface would enhance the efficiency of agricultural transport, reducing losses and travel time.

2. **Muhammad Agency Road Yake Ghund to Ghalanai**
   - Connecting the fertile lands of Yake Ghund with Ghalanai, this road is essential for moving agricultural produce, particularly fruits and vegetables, to the markets near the border areas and Peshawar.
   - Paving and widening the road could increase the capacity for transporting goods, benefiting local farmers and trader.
3. **Shabqadar Road – Prang Ghar to Peshawar**
   - This road links the agricultural zones in Prang Ghar with the markets. It is especially important for the transport of livestock and dairy products.

6.7.1.6 Traffic Surveys

As part of the transportation assessment in Mohmand District, a Manual Classified Count (MCC) Survey was conducted at MCC-1 (Yake Ghund to Mohmand) to determine the traffic flow and assess the Level of Service (LOS) on the roadway. The study analyzed peak-hour traffic conditions in both morning (AM) and afternoon (PM) periods to evaluate roadway efficiency and congestion levels.

Key Findings (MCC-1)

1. **Roadway Capacity & Traffic Volume**
   - The surveyed road segment has a capacity of 2,300 Passenger Car Units per hour (PCU/hr) across two lanes.
   - Observed traffic volumes:
     - AM Peak (9:00 – 10:00 AM): 665 PCUs
     - PM Peak (3:00 – 4:00 PM): 760 PCUs
2. **Volume-to-Capacity (V/C) Ratio & Level of Service (LOS)**
   - AM Peak:
     - V/C Ratio = 0.29
     - LOS = A (Free-flow conditions, minimal delays)
   - PM Peak:
     - V/C Ratio = 0.33
     - LOS = A (Similar free-flow conditions with slightly increased traffic)

Key Findings (MCC-2)

1. **Roadway Capacity & Traffic Volume**
   - The surveyed road segment has a capacity of 2,300 Passenger Car Units per hour (PCU/hr.) across two lanes.
   - Observed traffic volumes:
     - AM Peak (11:00 – 12:00 AM): 813 PCUs
     - PM Peak (3:00 – 4:00 PM): 885 PCUs
2. **Volume-to-Capacity (V/C) Ratio & Level of Service (LOS)**
   - AM Peak:
     - V/C Ratio = 0.35
     - LOS = A (Free-flow conditions, minimal delays)

- PM Peak:
  - V/C Ratio = 0.38
  - LOS = A (Similar free-flow conditions with slightly increased traffic)

Interpretation & Implications

- The road operates at LOS A during both peak hours, indicating excellent traffic conditions with negligible congestion.
- The V/C ratios remain significantly low (below 0.5), suggesting that the roadway has ample capacity to accommodate additional traffic in the future.
- Peak hour variations show slightly higher traffic volumes in the afternoon period, possibly due to return trips from workplaces, markets, or business centers.

This study provides a strong baseline for traffic performance assessment and aids in future transportation planning efforts for Mohmand District.

Table 84: District Mohmand Road LOS

Sr.	Duration	Peak Hour	MCC Location No.	Location		No. of Lanes	Road Capacity (pcu/hr)	Peak Hour Volume V (PCUs)	V/C Ratio	LOS
				From	To		C			
1	AM	9:00-10:00	MCC-1	Yake Ghund	Mohmand	2	2,300	665	0.29	A
2	PM	15:00-16:00		Yake Ghund	Mohmand	2	2,300	760	0.33	A
3	AM	11:00-12:00	MCC-2	Mohmand	Bajaur	2	2300	813	0.35	A
4	PM	14:00-15:00		Mohmand	Bajaur	2	2300	885	0.38	A

Source: Primary Data Collected in the Field

6.7.1.7 Origin Destination Surveys

As part of a comprehensive transport study in Mohmand District, an origin-destination (OD) survey was conducted to assess the movement patterns of travelers. The data collected provides insight into the primary urban centers contributing to travel demand within the district.

Key Findings (CP-1)

1. **Origin Distribution**
   - Most travelers originate from Peshawar (47%), indicating its dominant role as a feeder city for Mohmand District.
   - Mardan (23%) follows, showing a significant secondary contribution to the travel demand.

- Lahore (18%) and Karachi (12%) contribute smaller shares, suggesting long-distance travel but with less frequent movement.

2. **Destination Distribution**
    - Bajaur (64%) emerges as the primary destination, absorbing a significant portion of the travel demand. This suggests strong socio-economic or familial ties between Mohmand and Bajaur.
    - Barokhel (36%) accounts for the remaining flow, highlighting its importance as a secondary hub within the region.

Key Findings (CP-2)

1. **Origin Distribution**
    - Most travelers originate from Temer Gara (34%), indicating its strong connectivity with Bajaur District.
    - Munda Dir Lower (21%) and Mardan (11%) follow, showing their role in regional travel demand.
    - Faisalabad (18%) contributes smaller but notable shares, reflecting long-distance travel patterns.
2. **Destination Distribution**
    - Khar Bajaur (76%) emerges as the primary destination, absorbing a significant portion of travel demand, suggesting strong socio-economic or familial ties.
    - Nawagai (14%) also receives a notable share, highlighting its importance as a secondary hub.
    - Rawalpindi (10%) accounts for the remaining flow, indicating interprovincial connectivity.

Interpretation & Implications

- Peshawar's dominance in origin percentages aligns with its role as a major administrative, economic, and transit hub in Khyber Pakhtunkhwa.
- The high travel flow towards Bajaur suggests strong cross-district connectivity, which may be driven by employment, trade, or social factors.
- The presence of long-distance travel from Karachi and Lahore, albeit at lower percentages, indicates national-level mobility patterns, likely due to seasonal migration, trade, or business purposes.

Recommendations for Transport Planning

- Infrastructure Development: Improving road networks between Peshawar, Mardan, and Bajaur to facilitate smoother transit.
- Public Transport Enhancement: Establishing intercity bus routes to accommodate frequent travelers.
- Traffic Management Strategies: Optimizing key junctions and travel corridors based on the observed OD trends.

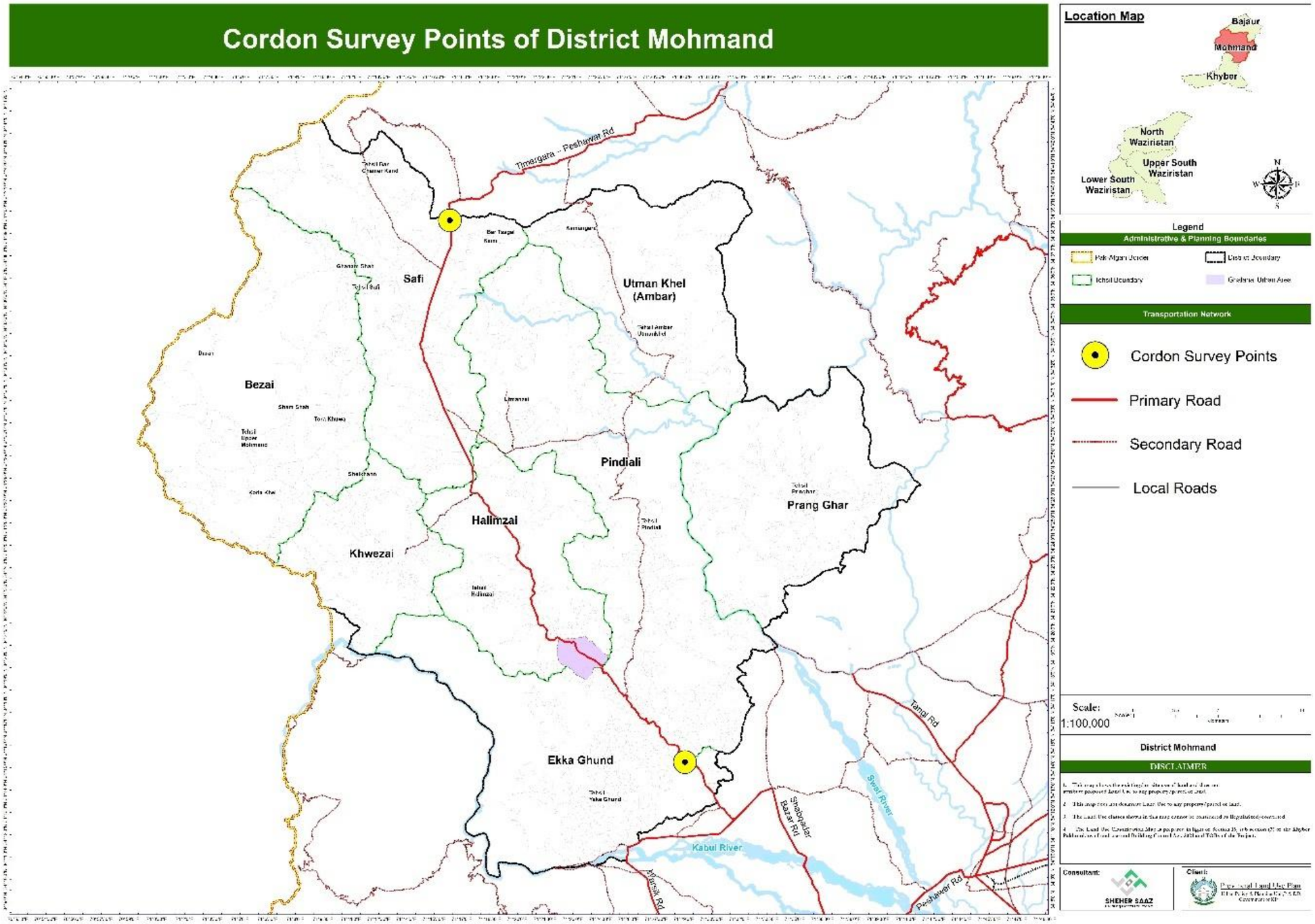
This analysis serves as a foundational dataset for future transport planning and policy decisions in Mohmand District, ensuring efficient mobility solutions for residents and commuters.

Table 85: District Mohmand OD Survey Results

Point ID	Origin	Origin %age	Destination	Destination %age
CP-1	Peshawar	47	Bajaur	64
	Mardan	23		
	Karachi	12	Barokhel	36
	Lahore	18		
CP-2	Temer Gara	34	Khar Bajaur	76
	Munda Dir lower	21		
	Mardan	11		
	Faisalabad	18	Nawagai	14
	Islamabad	16	Rawal Pindi	10

Source: Primary Data Collected in the Field

Map 48: Cordon Survey Points - District Mohmand



6.7.2 Annual Development Plans, Planned and In Progress

The Annual Development Programme (ADP) 2025–2026 for District Mohmand presents a strategic framework for enhancing the district's road infrastructure, regional connectivity, and socio-economic integration within the merged areas. The ongoing and planned projects prioritize the construction, widening, rehabilitation, and blacktopping of key road corridors across Ghalanai, Pandiali, Safi, Prang Ghar, Ambar, and Baizai tehsils. These initiatives encompass both continuing development schemes and new feasibility and design-based interventions, reflecting a balanced approach that addresses current mobility challenges while laying the foundation for future infrastructure growth. Through these targeted investments, the district seeks to facilitate trade, improve access to remote and border settlements, support agricultural and industrial activities, and strengthen its linkages with provincial and national transport networks, thereby contributing to sustained regional development and improved quality of life for local communities.

Table 86: On Going Programme - District Mohmand

ADP code	Project title	Status (ADP)	Length
191794	Construction / Improvement & Rehabilitation of Black Topped Roads in Upper, Lower and Baizai Sub-Division, District Mohmand.	(A) / PDWP (ongoing)	Not specified in ADP.
195303	Improvement & Widening of the existing B/Topped Road from Main Ghallani (Mamad Gut) Road (Ghaiba Chowk) to Gursal Pass (Afghan border), Mohmand — (BC) (AIP).	(A) / PDWP (AIP / ongoing)	40 km (given in ADP title).

Source: ANNUAL DEVELOPMENT PROGRAMME 2025-2026 Province of Khyber Pakhtunkhwa Fiscal Year: July 1, 2025 - June 30, 2026

Table 87: New Projects - District Mohmand

ADP code	Project title	Status (ADP)	Length
251134	Construction of BTR from Main Bedmanai to Yara Khel Baizai — District Mohmand.	(B) / DDWP (new / planned)	Not specified in ADP.
251135	F/S for Construction and Black-Topping of Road from Khakh Bazar to Karer Safi.	(B) / DDWP (new / planned)	Not specified in ADP.
251136	F/S: Improvement, Widening & Rehabilitation of BTR from Main Mamad-gat Road to Chamarkand (Nawapass road).	(B) / PDWP (new / planned)	Not specified in ADP.
251398	Construction / Improvement / Rehabilitation & Widening of BT Roads in District Khyber, Mohmand, Bajaur (Sub-Division Peshawar) multi-district Programme that includes Mohmand.	(B) / PDWP (new / planned)	Not specified in ADP (umbrella / multi-district).

Source: ANNUAL DEVELOPMENT PROGRAMME 2025-2026 Province of Khyber Pakhtunkhwa Fiscal Year: July 1, 2025 - June 30, 2026

6.7.3 Improvement/ upgradation of Roads:

The road network of District Mohmand forms the backbone of its regional and inter-district connectivity, linking Yakeghund, Ghalanai, Pindiali, Safi, Prang Ghar, and Baizai with Peshawar, Bajaur, Khyber, and Charsadda. It also provides strategic linkage to the Mohmand Marble Industrial Zone and emerging cross-border trade points, making it vital for both economic growth and social integration. The district's economy depends heavily on this network for the movement of agricultural goods, minerals, marble, and construction materials, as well as for access to markets, education, and healthcare.

However, the existing road network suffers from limited right-of-way, geometric deficiencies, poor pavement quality, and lack of proper roadside drainage. Many sections are single lane, causing congestion, unsafe overtaking, and high vehicle operating costs. In hilly sections, erosion and landslides further damage pavements, while uncontrolled roadside development and encroachments reduce functional width and traffic flow efficiency.

To address these challenges, the District Land Use Plan (DLUP) proposes a comprehensive program of road widening, geometric improvement, and urban roads upgradation, ensuring long-term capacity, resilience, and safety. The design framework has been aligned with UPPU's Geometric Design Manual and traffic capacity standards, with right-of-way determined through trip generation analysis by using ITE standard manual and projected land-use patterns.

Strategic priority is accorded to corridors that strengthen intra-district mobility and industrial linkages, particularly roads connecting Yakeghund–Ghalanai–Baizai–Safi and Pandiali–Prang Ghar, which are critical for the flow of goods from marble quarries and agricultural farms to external markets. The proposed improvements will facilitate the integration of Mohmand's industrial and rural economy with the regional trade corridors passing through Peshawar and Bajaur.

6.7.3.1 Primary Roads

The Mohmand Agency Primary Road serves as the principal mobility spine across the district, connecting major settlements, economic clusters, and administrative nodes. Within urban limits, the corridor currently operates on a 40 ft Right-of-Way (ROW), which is proposed to be enhanced to 65 ft to accommodate dualization, improve capacity, and support future commercial development along the corridor.

In rural segments, the existing 60 ft ROW is proposed to be expanded to 80 ft, enabling full dualization over a stretch of 64.91 km. This upgrade will significantly improve regional accessibility, reduce travel times, and enhance safety standards in accordance with provincial development priorities.

Table 88: Primary Road Proposals - District Mohmand

Sr. No.	Name	Road Hierarchy	Road Type	Existing Width (ft)	Proposed Width (ft)	Proposal	Length (km)
1	Mohmand Agency Primery Road	Primary Road	Urban	40	65	Dualization	3.80

2	Mohmand Agency Primery Road		Rural	60	80	Dualization	64.91

Source: Developed by Consultant

6.7.3.2 Secondary Roads

The secondary road network in Mohmand District comprises key rural connectors that serve inter-village mobility, access to agricultural zones, and linkages with the primary road spine. Current carriageway widths range from 20 ft to 30 ft, which limit safe two-way flow, restrict freight movement, and create operational bottlenecks during peak agricultural and market activity periods.

The proposed upgrade enhances widths to 40–50 ft, improving geometric standards, safety, and overall service levels. These interventions aim to accommodate future traffic growth, support economic activities, and establish a cohesive hierarchy aligned with districtwide mobility objectives.

Table 89: Secondary Road Proposals - District Mohmand

Sr. No.	Name	Road Hierarchy	Road Type	Existing Width (ft)	Proposed Width (ft)	Proposal	Length (km)
1	Baizai Road	Secondary Road	Rural	30	50	Upgradation/Improvement	35.86
2	Mohmand Agency Road		Rural	30	50	Upgradation/Improvement	61.14
3	Mohmand Agency Link Road		Rural	30	40	Upgradation/Improvement	17.38
4	Laman Utman Khel Road		Rural	20	40	Upgradation/Improvement	40.56
5	Canal Road		Urban	30	40	Upgradation/Improvement	15.86
6	Khewazai Road		Rural	20	40	Upgradation/Improvement	10.43
7	Baizai Mohmand Agency Link Road		Rural	30	40	Upgradation/Improvement	13.54
8	Mohmand Agency Road		Rural	30	40	Upgradation/Improvement	15.80
9	Tarakzai Road		Rural	30	40	Upgradation/Improvement	7.51
10	Dawezai Tamanzai Road		Rural	30	40	Upgradation/Improvement	13.47

Source: Developed by Consultant

6.7.3.3 Local Roads

The local access road system forms the foundational mobility layer in Mohmand District, linking dispersed rural communities, agricultural lands, and small-scale economic nodes to the higher-order arterial and primary networks. Existing widths predominantly fall between 12–30 ft, which restricts turning movements, slows freight access and limits connectivity to social services.

The proposed enhancement program focuses on standardizing local road widths to 30 ft. These improvements aim to strengthen last-mile connectivity, enhance rural accessibility, and ensure safer and more reliable intra-district movement.

Table 90: Local Road Proposals - District Mohmand

Sr. No.	Name	Road Hierarchy	Road Type	Existing ROW (ft)	Proposed ROW (ft)	Proposal	Length (km)
1	Issa Khel Road	Local Road	Rural	30	30	Improvement	10.69
2	Industrial Road		Urban	30	30	Improvement	1.57
3	Kuza Kadi Road		Rural	30	30	Improvement	3.91
4	Bar Kadi Khel Road		Rural	30	30	Improvement	7.01
5	Pranghar Road		Rural	25	30	Upgradation/Improvement	7.24
6	Kamali Halimzai Road		Rural	25	30	Upgradation/Improvement	10.55
7	Amber Utman Khel Road		Rural	20	30	Upgradation/Improvement	15.31
8	Baizai Link Road		Rural	25	30	Upgradation/Improvement	7.55
9	Sham Shah Road		Rural	20	30	Upgradation/Improvement	3.07
10	Tora Khuwa Road		Rural	20	30	Upgradation/Improvement	7.73
11	Saparay Road		Rural	20	30	Upgradation/Improvement	13.10
12	Sagi Road		Rural	25	30	Upgradation/Improvement	4.20
13	Sagi Inzari Road		Rural	25	30	Upgradation/Improvement	5.80
14	Baizai Sham Shah Road		Rural	25	30	Upgradation/Improvement	20.47
15	Burhan Khel Road		Rural	25	30	Upgradation/Improvement	2.55
16	Dawezai Road		Rural	12	30	Upgradation/Improvement	3.15
17	Issa Khel Road		Rural	20	30	Upgradation/Improvement	2.06
18	Darra Kandao Road		Rural	16	30	Upgradation/Improvement	0.48
19	Gulab Bagh Road		Rural	15	30	Upgradation/Improvement	2.84
20	Turangzai Road		Rural	18	30	Upgradation/Improvement	3.90
21	Utman Khel Road		Rural	25	30	Upgradation/Improvement	5.07

22	Kamangara Road		Rural	15	30	Upgradation/Improvement	3.86

Source: Developed by Consultant

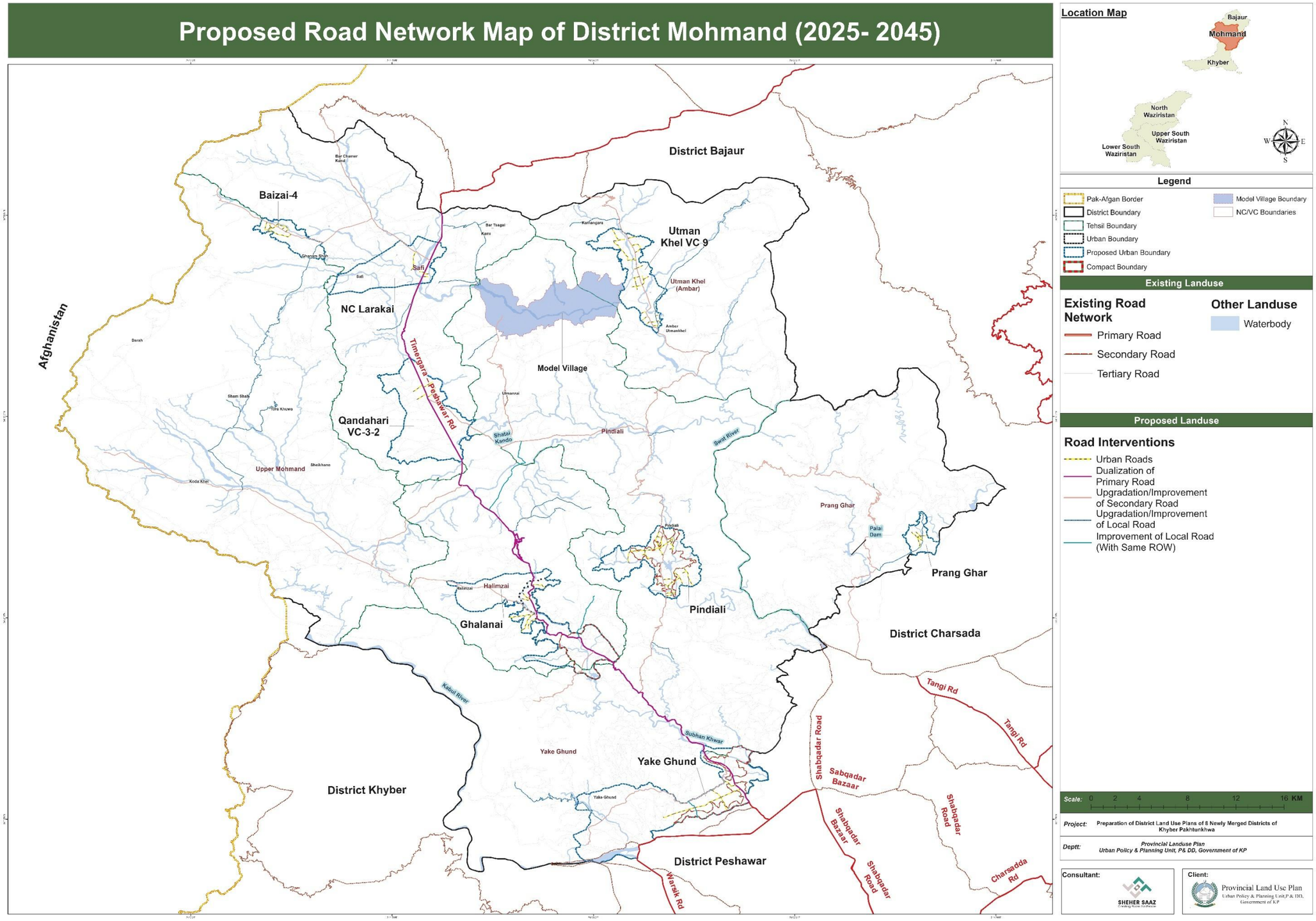
6.7.3.4 Urban Roads

Additionally, urban roads are proposed in all the settlements to support structured internal circulation, reduce congestion in built-up areas and enhance access to emerging industrial and commercial zones. These interventions will collectively ensure smooth freight movement, improved local accessibility and reduced travel time, thus positioning Mohmand as a productive and connected frontier district within the Peshawar Division.

Impact:

The upgradation of roads in District Mohmand will substantially enhance inter- and intra-district travel efficiency, reduce transport and logistics costs, improve access to industrial and agricultural value chains, and strengthen Mohmand's position as a vital production and trade corridor within the Peshawar Division.

Map 49: Proposed Road Network Map – Mohmand District



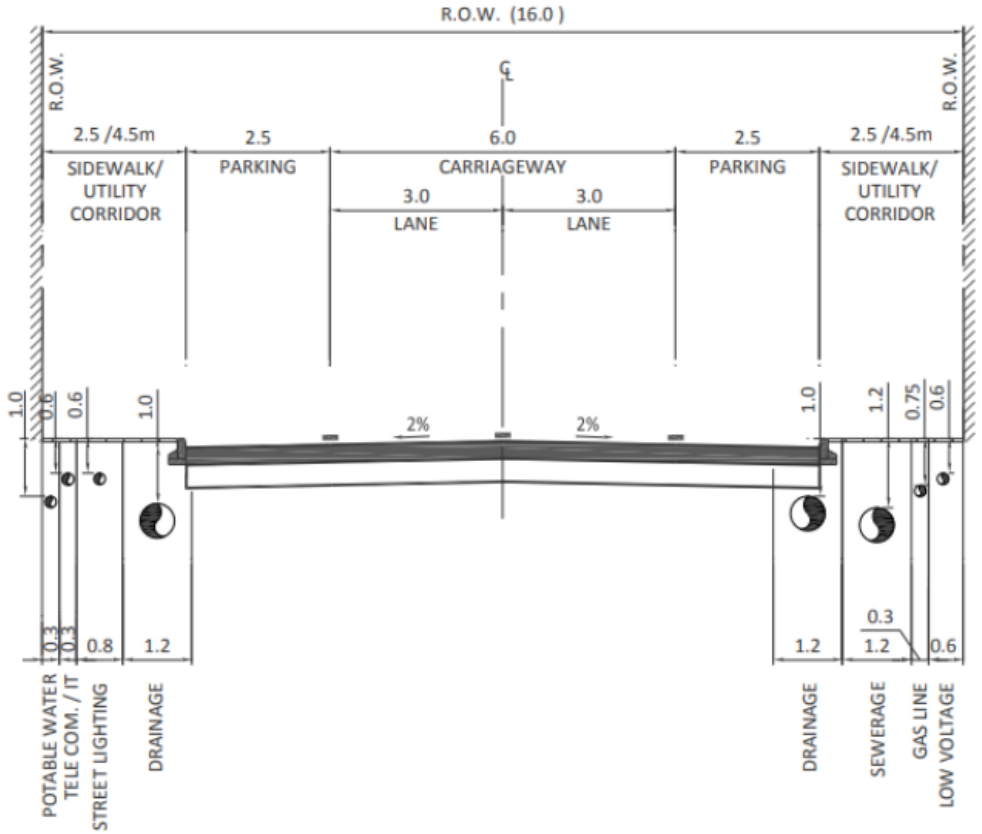


Figure 20: Typical Cross Section for Local and Secondary Roads - Mohmand District
Source: Geometric Design Guidelines (UPPU)

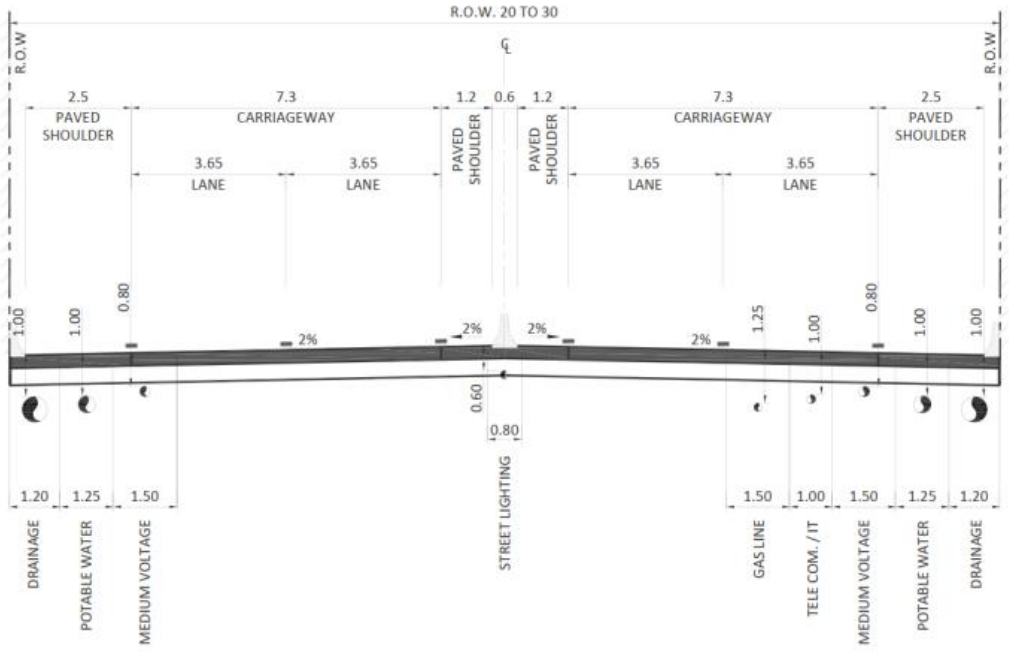


Figure 21: Typical Cross Section for Primary Roads - Mohmand District
Source: Geometric Design Guidelines (UPPU)

6.7.4 Bus Terminal Proposals

The phasing and classification of proposed bus terminals across the NCVC are guided by settlement hierarchy, population concentration, land availability, and anticipated growth in passenger demand. Primary and secondary urban centres such as Ghalanai, Yake Ghund, and Pindiali exhibit higher population densities and stronger mobility needs, warranting early investment in Class-B and Class-C terminals during the 2025–30 and 2025–35 periods. These locations serve as regional service hubs, accommodate significant inter-tehsil movement, and are strategically positioned along existing transport corridors, making them suitable for medium-capacity terminals with organized bays, circulation areas, and passenger support facilities. Tertiary centers like Utman Khel and Qandahari VC-3-2 show moderate demand but play a critical role in connecting surrounding rural pockets. Their Class-C classification ensures infrastructure is scaled to local needs while still providing structured transport services. Development in these areas is placed within the 2025–30 and 2025–35 windows to align with their emerging urbanization trends and to support gradual formalization of transport activity.

Potential settlements such as Baizai-4, Masood VC-3, and Pranghar are characterized by smaller populations, dispersed built form, and lower near-term travel demand, making Class-D terminals an appropriate and efficient solution. These minimal-footprint terminals, scheduled for implementation in 2030–40, offer essential boarding, alighting, and parking facilities without over-investment. Standard land requirements across all terminals follow the Motor Vehicles Ordinance 1965 and Motor Vehicles Rules 1969, ensuring uniform compliance and operational safety. Together, this phased and hierarchical approach ensures that terminal development is demand-responsive, technically sound, and financially prudent across the entire NCVC region.

Table 91: Proposed Bus Terminals in District Mohmand

Sr. No.	Project	Year	Land Required	Concerned Departments
1	Construction of Class-B Bus Terminal in Ghalanai (Primary Urban Centre)	2025–30	As per Motor Vehicles Ordinance 1965 & Motor Vehicles Rules 1969	Transport Department / Provincial & Regional Transport Authority
2	Construction of Class-C Bus Terminal in Yake Ghund (Secondary Urban Centre)	2025–30		
3	Construction of Class-C Bus Terminal in Pindiali (Secondary Urban Centre)	2025–35		
4	Construction of Class-C Bus Terminal in Utman Khel VC-9 (Tertiary Urban Centre)	2025–30		
5	Construction of Class-C Bus Terminal in Qandahari VC-3-2 (Tertiary Urban Centre)	2025–35		
6	Construction of Class-D Bus Terminal in Baizai-4 (Potential Settlement)	2030–40		

7	Construction of Class-D Bus Terminal in Masood VC-3 (Potential Settlement)	2030–40		
8	Construction of Class-D Bus Terminal in Pranghar (Potential Settlement)	2030–40		

Source: Developed by Consultant

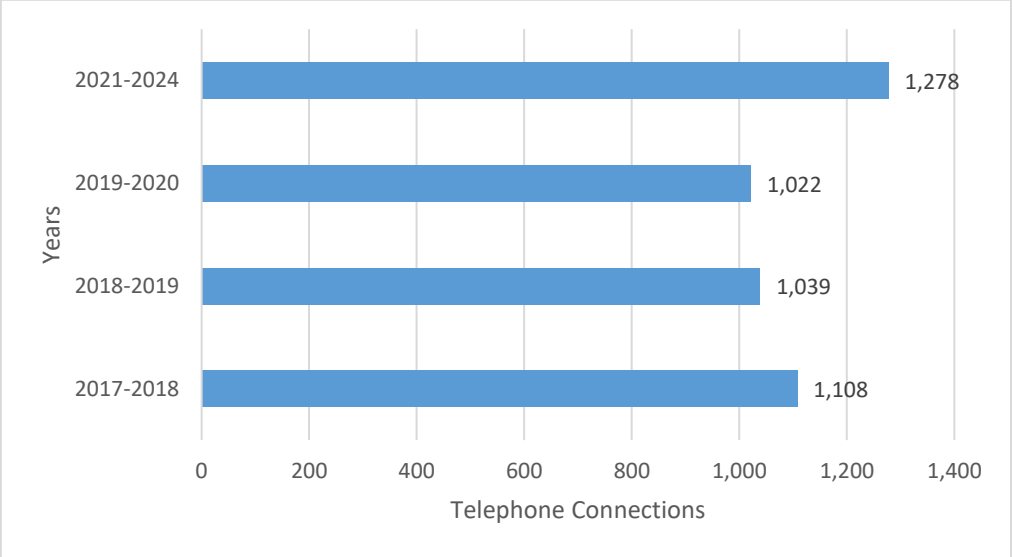
6.7.5 Telecommunication, Postal Services & Telegraphs.

Telecommunication services in Mohmand District are primarily provided by national operators, offering mobile, internet, and postal connectivity. In recent years, network coverage has improved considerably due to provincial and federal infrastructure investments. However, several remote and mountainous areas still experience limited or inconsistent connectivity, restricting access to information, digital services, and modern communication platforms.

6.7.5.1 Level of services and their coverage.

The quality and coverage of telecommunication services across Mohmand District vary considerably by location. According to the Khyber Pakhtunkhwa Development Statistics 2025, telecommunication operations in the district include both exchange services and multiple telephone connections. Currently, there are four (5) telephone exchanges, a number that has remained unchanged since 2024.

Figure 22: Telephone Connections – Mohmand Districts



Source: KP Development Statistics 2025

In terms of telephone connections, fluctuating trends have been observed over the years. In 2017–18, there were 1,108 active connections; this number declined slightly to 1,022 in both 2018–19 and 2019–20 and then uplift to 1278 during the years of 2021-2024. The contraction may be attributed to factors such as shifting consumer demand from fixed line to mobile services, infrastructure limitations, or regional security and maintenance challenges.

Postal services in the district also reflect significant structural change. As shown in the table below, the total number of post offices increase from 9 to 10 from 2021 -2024 but from statistics the number of post offices dropped sharply from 22 in 2017–18 to 6 in 2018–19, with no further changes reported in 2019–20. In 2017–18, the district maintained 2 sub-post offices and 20 branch offices, indicating a widespread network that supported administrative and communication functions. The subsequent reduction could stem from administrative restructuring, conflict-related disruptions, or fiscal rationalization efforts.

Table 92: Number of Post Offices – Mohmand District

Year	Post Offices	Number
2021-22	Total	9
	Head Offices	-
	Sub Post Offices	1
	Branch Offices	8
2022-23	Total	9
	Head Offices	-
	Sub Post Offices	1
	Branch Offices	8
2023-24	Total	10
	Head Offices	-
	Sub Post Offices	1
	Branch Offices	9

Source: KP Development Statistics 2025

Overall, while the postal network demonstrates institutional stability post-2024, the drastic reduction in facilities highlights the need for revitalization of postal and communication services to support administrative efficiency, e-commerce, and rural accessibility.

6.7.5.2 Constraints

Telecommunication infrastructure in Mohmand District faces several constraints that limit accessibility and service reliability:

- Underdeveloped Network Infrastructure: Limited availability of transmission towers and exchanges, particularly in hilly and remote areas.
- Geographical Barriers: Rugged terrain and scattered settlements complicate infrastructure expansion and maintenance.
- Security and Access Limitations: Difficulties in reaching certain areas due to past security conditions hinder operational continuity.
- Economic Constraints: Low population density and limited commercial viability deter private sector investment.
- Outdated Technology: Reliance on legacy systems reduces efficiency and quality of service.

6.7.5.3 Requirement of new postal services in the district and recommendations

Given the current communication landscape and socio-economic development trajectory of District Mohmand, the expansion and modernization of postal services are essential to meet emerging administrative, commercial, and digital communication needs. The existing postal infrastructure comprising a limited number of sub-post and branch offices remains inadequate to cater to the growing population, expanding economic activities, and increasing reliance on e-commerce and logistics.

The district's dispersed settlement pattern, coupled with challenging terrain, has created service gaps in rural and border areas where residents have limited access to reliable postal and courier facilities. Moreover, with the rising use of digital transactions, mobile banking, and online marketplaces, there is a growing demand for digitally enabled postal outlets that can facilitate both traditional mail and modern financial and communication services.

To ensure balanced spatial distribution and equitable access, new postal facilities should be strategically established in underserved tehsils such as Safi, Ambar, Pandiali, and Prang Ghar, where population clusters remain disconnected from existing service points. These facilities should not only provide conventional mail services but also function as multi-service community hubs, offering e-post, courier logistics, and basic financial services such as bill payments and remittances.

Recommendations

- Expansion of Postal Network: Establish new sub-post or branch offices in underserved areas and high-growth areas to improve service accessibility and administrative coverage and upgrade the branch offices to sub post and at least one head office in Ghalanai.
- Digital Integration: Upgrade postal facilities to support electronic money orders, parcel tracking systems, and e-commerce logistics to align with modern communication trends.
- Public–Private Partnerships (PPPs): Encourage collaboration between the Pakistan Post and private courier companies to jointly operate service centers in remote areas.
- Mobile Postal Units: Introduce mobile postal vans to provide periodic services in mountainous hard-to-reach settlements.
- Co-location with Government Offices: Integrate postal counters within tehsil or municipal offices to optimize infrastructure and reduce operational costs.
- Capacity Building: Train postal staff in digital systems, logistics management, and customer service to improve operational efficiency and reliability.
- Infrastructure Upgradation: Modernize existing post offices through digital connectivity, solar power, and improved facilities for customers.

In summary, the establishment of new and digitally equipped postal service points in Mohmand District is crucial for strengthening administrative outreach, promoting local commerce, and integrating the district into the broader digital economy of Khyber Pakhtunkhwa. A modernized postal system would not only enhance communication and financial inclusion but also support the district's long-term development objectives under the Provincial Land Use and Connectivity Framework.

6.8 WATER SUPPLY AND SANITATION NETWORKS

6.8.1 Tehsil Ambar Utman Khel

6.8.1.1 Source(s) of drinking water supply

In Mohmand District, water supply for both irrigation and drinking purposes relies on a variety of sources that cater to the region's diverse geographic and climatic conditions. The Kabul River is a significant water source, particularly for irrigation, providing substantial water that supports agricultural activities in the district. Alongside the Kabul River, local streams and nullahs are crucial, especially during the monsoon season, as they feed into an intricate network of traditional irrigation systems, including karezes and small canals. These surface water sources are vital for maintaining agricultural productivity, particularly in areas where river access is limited. In addition to surface water, groundwater plays a significant role in irrigation. Numerous wells and tube wells, often powered by diesel or electric pumps, tap into the district's underground water reserves, ensuring a consistent water supply for crops, especially during dry spells.

Groundwater also plays an essential role in both irrigation and drinking water supply in Mohmand District. Numerous wells and tube wells, powered by diesel or electric pumps, tap into underground water reserves, ensuring a consistent supply for crops during dry periods. For drinking water, groundwater is extensively utilized through hand pumps, boreholes, and protected wells, especially in rural areas where other water sources might not be readily available. Freshwater springs in the hilly and mountainous regions of the district offer clean and reliable drinking water to local communities.

6.8.1.2 Quality/quantity of drinking water at source and user per WHO/local standards.

Water quality is a crucial aspect of ensuring safe and reliable drinking water for communities. It encompasses various parameters, including microbial safety, chemical composition, and physical characteristics. Microbial contamination, often from pathogens like bacteria, viruses, and protozoa, poses significant health risks and requires effective treatment and monitoring. Chemical contaminants, such as heavy metals, pesticides, and industrial pollutants, can affect water safety and require stringent regulatory measures to control. Additionally, physical characteristics like turbidity and color can impact the aesthetic quality of water and indicate potential contamination.

Following are the parameters and National Standards for Drinking Water Quality (NSDWG) adopted by Pakistan Environmental Protection Agency and WHO:

Table 93: National Standards for Drinking Water Quality (NSDWG)

PROPERTIES /PARAMETE RS	STANDARD VALUES FOR PAKISTAN	WHO STANDARDS
Bacterial		
All water intended for drinking (e.Coli or Thermotolerant Coliform bacteria)	Must not be detectable in any 100 ml sample	Must not be detectable in any 100 ml sample
Treated water entering the distribution system (E.Coli or thermo tolerant coliform and total coliform bacteria)	Must not be detectable in any 100 ml sample	Must not be detectable in any 100 ml sample
Treated water in the distribution system (E.coli or thermo tolerant coliform and total coliform bacteria)	Must not be detectable in any 100 ml sample In case of large supplies, where sufficient samples are examined, must not be present in 95% of the samples taken throughout any 12month period.	Must not be detectable in any 100 ml sample In case of large supplies, where sufficient samples are examined, must not be present in 95% of the samples taken throughout any 12month period.
Physical		
Colour	<15 TCU	<15 TCU
Taste	Non objectionable/Accept able	Non objectionable/Accept able
Odour	Non objectionable/Accept able	Non objectionable/Accept able
Turbidity	< 5 NTU	<5 NTU
Total hardness as CaCO3	< 500 mg/l	---
TDS	< 1000	< 1000
pH	6.5 8.5	6.5 8.5
Chemical		
Essential Inorganic	mg/Litre	mg/Litre
Aluminium (Al) mg/l	<0.2	0.2
Antimony (Sb)	<0.005 (P)	0.02
Arsenic (As)	0.05 (P)	0.01
Barium (Ba)	0.7	0.7
Boron (B)	0.3	0.3

Cadmium (Cd)	0.01	0.003
Chloride (Cl)	<250	250
Chromium (Cr)	<0.05	0.05
Copper (Cu)	2	2
Toxic	mg/Litre	mg/Litre
Fluoride (F)*	<1.5	1.5
Lead (Pb)	<0.05	0.01
Manganese (Mn)	< 0.5	0.5
Mercury (Hg)	<0.001	0.001
Nickel (Ni)	<0.02	0.02
Nitrate (NO3)*	<50	50
Nitrite (NO2)*	<3 (P)	3
Selenium (Se)	0.01 (P)	0.01
Residual chlorine	0.2-0.5 at consumer end 0.5-1.5 at source	--
Zinc (Zn)	5.0	3
Organic		
Pesticides mg/L		PSQCA No. 46392004, Page No. 4 Table No. 3 Serial No. 2058 may be consulted
Phenolic compounds (as Phenols) mg/L		< 0.002
Polynuclear aromatic hydrocarbons (as PAH) g/L		0.01 (By GC/MS method)
Radioactive		
Alpha Emitters bq/L or pCi	0.1	0.1
Beta emitters	1	1

Source: National Standards for Drinking Water Quality (NSDWG), Pakistan Environmental Protection Agency

6.8.1.3 Quantity of Drinking Water at Source as Per WHO/Local Standards

The World Health Organization (WHO) recommends that the amount of water supplied for personal and domestic use should be adequate to meet an individual's needs. These encompass drinking, personal hygiene, washing, food preparation, and other household activities. WHO suggests a daily water allocation of 50 to 100 liters per person to satisfy these basic requirements.

The Public Health Engineering Department also provides guidelines for estimating the water needs when planning water supply infrastructure. This estimate is influenced by growth and directly correlates with the population size. The table below outlines the water demand based on population variations for city planning purposes.

Table 94: Per Capita Consumption of Water as per the PHED Design Criteria

Design Population	Per Capita Consumption Per Day (Inclusive of Unaccounted for Water)
Up to 5,000	10 Gallons
5,001 – 10,000	15 Gallons
10,001 – 20,000	20 Gallons
20,001 – 50,000	30 Gallons
50,001 – 100,000	40 Gallons
100,001 – 200,000	50 Gallons
200,001 – 300,000	55 Gallons
300,001 – 400,000	60 Gallons
400,001 – 500,000	65 Gallons
500,001 – 600,000	70 Gallons
600,001 – 700,000	75 Gallons
700,001 – 800,000	80 Gallons
More than 800,000	85 Gallons

The amount of water needed varies based on several factors. However, it's important to note that Pakistan is facing severe water shortages due to climate change. Therefore, water demand figures may need adjustment based on local terrain, climate conditions, and international climate regulations. Since Mohmand District is categorized by rural settings, the average water requirement is adjusted to 15 gallons per capita per day for all urban settlements except Halimzai. For Halimzai urban area, the demand is taken as 20 gallons per capita per day to meet demand of the district. For rural area, based on their population, the requirement is taken as 10 per capita per day.

6.8.1.4 Existing coverage of the water supply/gaps in demand in Ambar Utman Khel.

This section presents the current and projected water requirements for Ambar Utman Khel Tehsil, based on population growth trends and applicable service level standards. The water

demand has been estimated using a per capita requirement of 15 gallons per capita per day (GPCD) in accordance with PHED rural water supply design benchmarks.

Ambar Utman Khel comprises several Village Councils (VCs), including Bar Targhau, Bataee Alizai, Miamool, Mor Dara, Nazar Mina, Panjkora, Qambar, Sharbatai Koz Kallai, and Tar. The combined rural population is estimated at 83,715 in 2025, projected to rise to 195,864 by 2045, reflecting natural population growth and incremental regional development.

Based on these projections, the average daily rural water demand is expected to increase from 1.26 MGD in 2025 to 2.94 MGD by 2045. The corresponding maximum day demand is projected to rise from 1.88 MGD to 4.41 MGD, while the peak hour demand will increase from 2.83 MGD to 6.61 MGD over the same period.

For urbanizing clusters within the tehsil, the recommended overhead reservoir (OHR) capacity is projected to increase from 0.90 MG in 2025 to 2.20 MG by 2045, based on a 12-hour operational buffer. To meet these supply requirements, the total tube well production capacity will need to increase from 2.80 MGD (3.73 cusecs) in 2025 to 6.60 MGD (8.80 cusecs) by 2045.

6.8.1.4.1 Rural Area Wise Existing and Proposed Water Demand of Ambar Utman Khel

The rural settlements of Ambar Utman Khel Tehsil, comprising Utman Khel VC-1, VC-2, VC-4, VC-5, VC-8 and VC-9, primarily depend on groundwater abstraction through hand pumps, shallow wells, and small community-based water supply systems. Based on the projected rural population of 62,731 in 2025 and an adopted per capita water demand of 15 gallons per capita per day (GPCD), the average daily water requirement is estimated at approximately 0.94 million gallons per day (MGPD). With sustained population growth, the total rural population is projected to reach 139,610 by 2045, increasing the average daily demand to about 2.09 MGPD.

Applying standard design factors for system planning, the maximum-day demand for the tehsil is estimated at approximately 1.41 MGPD in 2025, increasing to about 3.14 MGPD by 2045, while the corresponding peak-hour demand is projected to rise from around 2.12 MGPD in 2025 to approximately 4.71 MGPD in 2045.

Table 95: Rural Area Wise Existing and Proposed Water Demand of Ambar Utman Khel

Year	Rural Population	Water Demand (MGPD)	Maximum Day Demand (MGPD)	Peak Hour Demand (MGPD)
2023	57,908	0.87	1.30	1.95
2025	62,730	0.94	1.41	2.12
2045	139,610	2.09	3.14	4.71

This analysis highlights the critical need for integrated rural water supply planning in Ambar Utman Khel Tehsil to manage increasing demand, mitigate seasonal water shortages, and ensure equitable service delivery across dispersed settlements. Future interventions should prioritize sustainable groundwater management, enhancement of storage capacity, and

gradual upgrading of distribution networks to maintain system reliability and resilience against long-term groundwater depletion pressures.

6.8.1.5 Proposed Water Supply System Ambar Utman Khel

To meet the projected water demand of Ambar Utman Khel (urban and rural areas) up to 2045, a phased and sustainable water supply system is required. The system design is based on per capita consumption of 15 GPCD of rural VCs, accounting for maximum day demand and peak hour demand as per PHED & WASA.

6.8.1.5.1 Proposed Source (New Tube-Well)

Design Basis

Groundwater abstraction is based on the demonstrated safe yield of the Ambar Utman Khel alluvial aquifer, ensuring sustainable utilization and long-term groundwater security for the tehsil's rural and semi-urban settlements.

Unit Well Capacity

Each production well is designed to deliver a continuous yield of 0.75 MGD (1.04 cusecs), considering the local hydrogeological conditions and typical discharge capacities of existing boreholes. Adequate standby provision and scheduled maintenance cycles have been incorporated to ensure system reliability and uninterrupted water supply under variable operational conditions.

Service Objective

The proposed water supply system aims to meet the projected maximum day demand of 3.14 MGD by 2045, with an additional 15 percent redundancy margin to accommodate operational downtime, system losses, and emergency requirements.

Implementation Period	Urban Demand to be Met (MGD)	New Production Wells*	Key Siting/Design Considerations
2025	up to 1.5	2 wells	Develop deeper and more productive aquifer zones and implement groundwater recharge measures such as recharge pits and infiltration trenches to sustain yield and prevent drawdown
2045	up to 3.15	5 wells	Strengthen network reliability through strategic well replacement and augmentation, extending supply to Nazar Mina, Panjkora, and Tar VCs. Ensure hydraulic balance with regional reservoirs and standby redundancy.

This phased plan ensures that Ambar Utman Khel's water supply system evolves sustainably in response to population growth and increasing demand, while maintaining groundwater balance and ensuring equitable access across all Village Councils up to 2045

6.8.1.5.2 Water Storage

Rural Areas (VCs – 15 GPCD)

For dispersed rural settlements in Ambar Utman Khel, smaller Overhead Reservoirs (OHRs) are proposed to ensure reliable and equitable water supply. The design prioritizes sustainable operations through localized balancing storage, minimizing dependence on continuous pumping and ensuring a 12-hour service buffer to accommodate power interruptions and peak-hour fluctuations.

Purpose:

- Ensure consistent and reliable supply for rural communities.
- Provide a 12-hour operational buffer during outages or maintenance.
- Reduce stress on groundwater abstraction systems by regulating pumping cycles

Phased Capacities (based on projected demand):

Year	Maximum Day Demand (MGD)	12-Hour Buffer (MG)	Recommended OHR Capacity (MG)
2023	1.30	0.65	0.6 – 0.8
2025	1.41	0.71	0.75 – 0.8
2045	3.14	1.57	1.6 – 1.8

6.8.1.6 Existing situation of the sanitation/drainage system in Tehsil Ambar utman khel tehsil

Wastewater generation in Ambar Utman Khel Tehsil has been estimated based on 85% of the average daily water demand for predominantly rural settlements. To this base flow, an additional 5% allowance has been incorporated to account for non-domestic usage, including small-scale commercial, institutional, and community facilities.

For hydraulic design, the peak sewage flow has been considered as twice the average daily sewage flow, while stormwater inflow is taken as 50% of the peak sewage flow to account for combined inflows during monsoon events. Additionally, infiltration losses equivalent to 10% of the average sewage flow have been included in line with local hydrogeological and soil infiltration characteristics.

Considering the rural settlement pattern and a per capita water demand of 15 GPCD, the corresponding per capita sewage generation has been derived as approximately 13.5 GPCD, which is typical for rural and semi-urban areas of Khyber Pakhtunkhwa:

Rural Area Wise Existing and Proposed Wastewater Demand – Ambar Utman Khel Tehsil:

The total wastewater generation in Ambar Utman Khel is projected to increase from approximately 0.21 MGD in 2025 to 0.48 MGD by 2045, reflecting rapid growth in both population and water consumption. This necessitates a phased development of the sewerage network, transitioning from decentralized disposal systems to integrated collection, conveyance, and treatment facilities. The introduction of centralized wastewater treatment plants (WWTPs) will be critical to maintaining environmental compliance, safeguarding groundwater quality, and supporting sustainable urban expansion across Ambar and Utman Khel settlements.

Table 96: Urban Area Wise Existing and Proposed Wastewater Demand – Ambar Utman Khel Tehsil

Year	Population	Average Water Demand (MGD)	Wastewater Generation @ 85% + 5% (MGD)	Peak Sewage Flow (MGD)	Stormwater Inflow (MGD)	Total Design Flow (MGD)
2023	57,907	0.87	0.78	2.35	1.17	3.52
2025	62,731	0.94	0.85	2.54	1.27	3.81
2045	139,610	2.09	1.88	5.65	2.83	8.48

Rural Area Wise Existing and Proposed Wastewater Demand – Ambar Utman Khel Tehsil VCs

The rural settlements of Ambar Utman Khel Tehsil, comprising the Utman Khel Village Councils, are projected to experience a steady increase in wastewater generation in line with population growth and rising water consumption. Based on the adopted planning assumption that wastewater generation equals 85% of average water demand plus 5% allowance for losses, the total rural wastewater generation is estimated to increase from approximately 0.85 MGD in 2025 to about 1.88 MGD by 2045.

Correspondingly, the peak sewage flow in rural areas is projected to rise from around 2.54 MGD in 2025 to approximately 5.65 MGD by 2045, while stormwater and infiltration inflows are expected to increase from 1.27 MGD to 2.83 MGD over the same period. This results in a total rural wastewater design flow increasing from about 3.81 MGD in 2025 to approximately 8.48 MGD by 2045, highlighting the growing hydraulic load on sanitation systems.

Given the dispersed settlement pattern, uneven terrain, and low-density household clusters across the rural VCs of Ambar Utman Khel, the development of a conventional gravity-based sewerage network is neither technically feasible nor economically viable. Such systems require substantial capital investment, sustained flow velocities, and skilled operation and maintenance, which are not practical in rural contexts.

Accordingly, a decentralized sanitation strategy is recommended for rural areas. Household-level septic tanks with soakage (leach) pits, supplemented by small community-based

treatment units where densities increase, offer a cost-effective, low-maintenance, and environmentally sustainable solution. This approach is compatible with local soil conditions and minimizes risks to groundwater quality while providing an adaptable framework to accommodate future population growth within the rural settlements of Ambar Utman Khel Tehsil.

Treatment Process

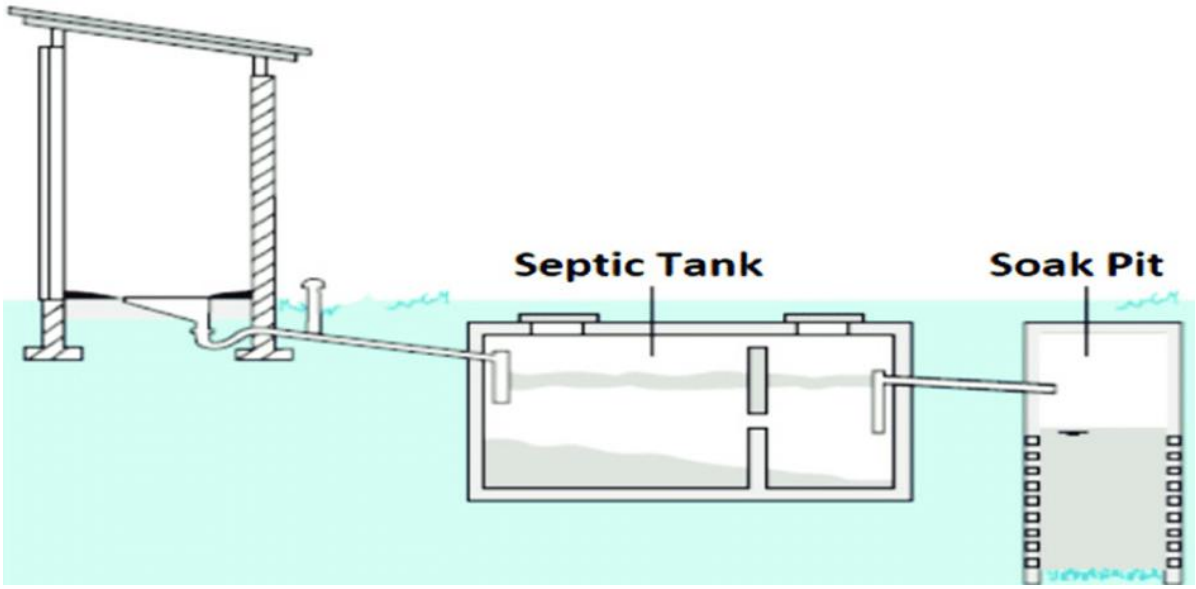
Wastewater from each dwelling enters a sealed septic tank, where solids settle to form sludge and lighter materials form a scum layer.

The clarified effluent passes to a soakage pit, where it percolates through the surrounding soil for further natural filtration and pathogen reduction.

Typical performance of a well-maintained system:

- Suspended Solids (TSS): 80–90 % removal
- Biochemical Oxygen Demand (BOD): 60–80 % reduction
- Pathogens: 80–90 % reduction
- Nutrients (N & P): 60–80 % reduction

This treatment level is adequate for protecting Barang's shallow aquifers and preventing nuisance conditions when tanks are properly sited and desludging.



Wastewater quality & Treatment Barang

The disposal of untreated wastewater into open drains, streams, and agricultural fields is a major cause of environmental degradation in Barang, contaminating both surface and

groundwater resources. To address this challenge, a phased wastewater treatment strategy is proposed.

A centralized Wastewater Treatment Plant (WWTP) will be established near the Barang central plain, serving the urban NCs, while smaller decentralized treatment units (waste stabilization ponds or aerated lagoons) will be developed near rural clusters for VCs.

The WWTP design will follow international and national best practices, with process design based on average sewage flow and pollution loads, and hydraulic design based on peak flows. Treatment will target compliance with NEQS discharge limits (BOD < 80 mg/L, COD < 150 mg/L, TSS < 200 mg/L).

6.8.1.7 Design of Soakage pit & Septic tank

The capacity of soakage pits has been determined based on the daily effluent generation and required retention time, considering local soil permeability and infiltration characteristics

Retention days for pit = 2 days

Void ratio = 0.35.

Worked results & recommended pit diameters

Calculated required gross pit volumes and approximate circular pit diameters for two practical depths (1.5 m and 2.0 m):

Household	Gross pit vol (m^3)	Gross vol (L)	Diameter for depth = 1.5 m (m)	Diameter for depth = 2.0 m (m)
4 p	0.993 m^3	993 L	0.92 m	0.80 m
6 p	1.489 m^3	1,489 L	1.12 m	0.97 m
8 p	1.986 m^3	1,986 L	1.30 m	1.12 m
10 p	2.482 m^3	2,482 L	1.45 m	1.26 m

Practical recommendation: use a cylindrical pit Dia 1.0–1.5 m and depth 1.5–2.0 m depending on household size/percolation — e.g.

4–6 persons - Ø 1.0 m, depth 1.5–2.0 m

8–10 persons - Ø 1.2–1.5 m, depth 1.5–2.0 m

6.8.1.7.1 Construction & installation

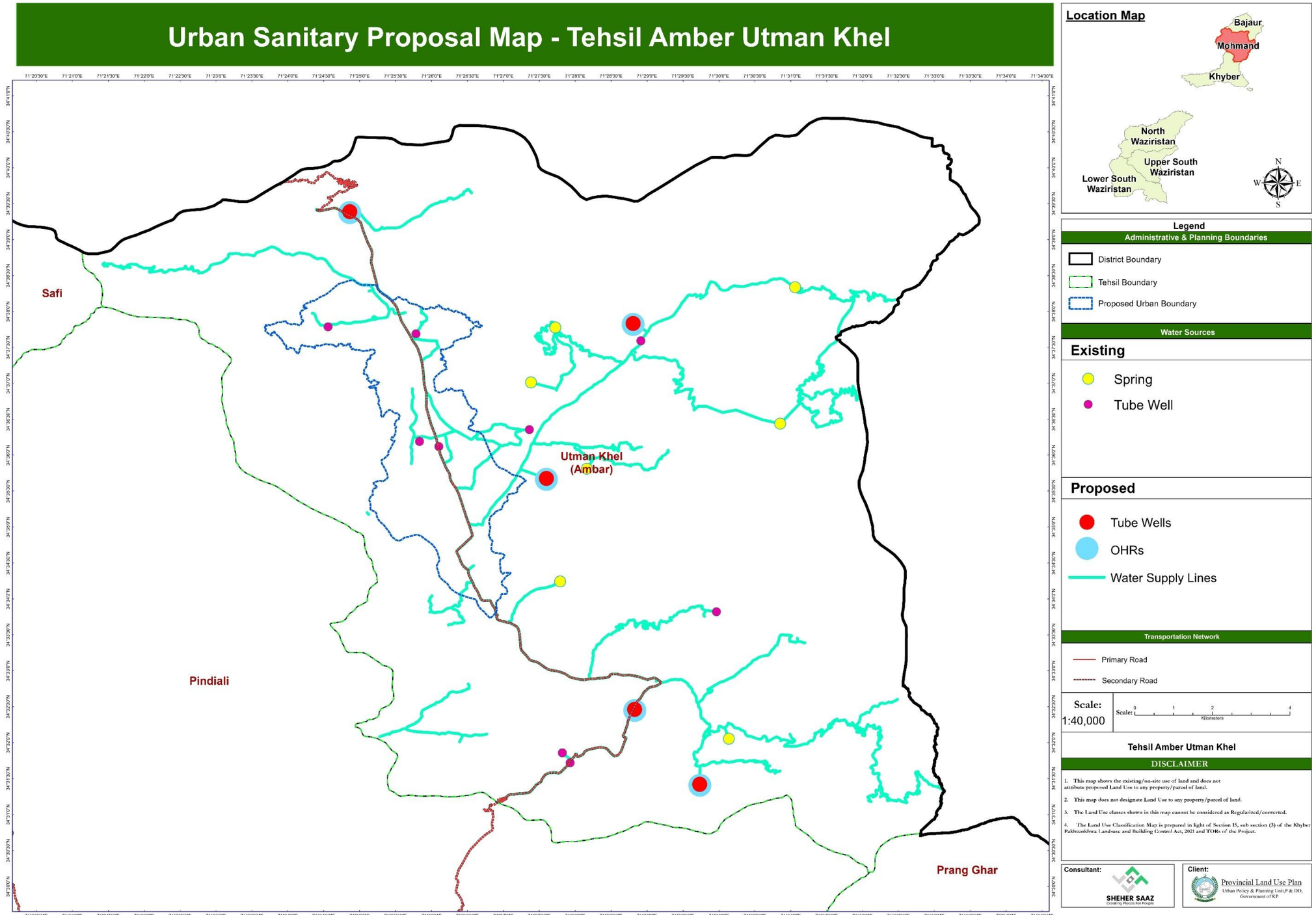
Each household within Ambar Utman Khel Tehsil shall be equipped with an independent on-site sanitation system, comprising a two-chamber reinforced concrete septic tank followed by a soakage pit for subsurface effluent disposal. The septic tank will be designed with inlet and outlet baffles, manhole access covers for periodic cleaning, and adequate structural reinforcement and waterproofing to ensure long-term durability and watertight performance. The inlet invert level shall be placed approximately 150 mm below the outlet invert to

maintain a self-cleansing flow regime and promote effective sedimentation of suspended solids.

Effluent from the outlet chamber shall be directed to a distribution box or soakage pit fitted with a mosquito-proof vent to prevent vector breeding. Regular deluding every 3 to 5 years will be carried out depending on household occupancy and sludge accumulation rates, ensuring optimal treatment efficiency and minimizing odor or overflow risks.

The soakage pit shall be constructed using graded coarse aggregate (void ratio ≈ 0.35), enclosed with a non-woven geotextile filter lining to prevent silt ingress and sustain long-term infiltration capacity. It will be located at a minimum horizontal distance of 10 meters from any potable water source, ideally within a 15–30-meter buffer zone and positioned downslope of wells or tube wells to prevent contamination of groundwater. The pit bottom will maintain a minimum vertical clearance of 1.0 meter above the seasonal high groundwater table to ensure safe percolation.

Map 50: Proposed Urban Sanitary Map - Tehsil Utman Khel



6.8.2 Tehsil Pindiali

6.8.2.1 Existing coverage of the water supply/gaps in demand in Pindiali Tehsil

The rural settlements of Pindiali Tehsil primarily depend on groundwater abstraction through hand pumps, dug wells, and small-scale community-operated water supply schemes. These systems are mostly solar powered, with limited electrically operated setups in the more densely populated villages. On average, these schemes operate for 6–8 hours daily, with individual well discharges ranging between 2,500–5,000 gallons per hour (GPH). While most systems are functional, several experiences reduced yields during dry months due to declining groundwater tables and limited maintenance, which affects service reliability.

At present, about 30–35% of households in Pindiali have access to piped water supply, while the remaining population relies on individual or communal hand pumps and shallow wells. The limited service coverage and aging infrastructure underscore the need for rehabilitation and capacity expansion to meet future rural water requirements.

Based on the projected rural population and a per capita demand of 15 gallons per capita per day (GPCD), the average daily water demand in Pindiali Tehsil is estimated at 1.73 million gallons per day (MGPD) in 2025, rising steadily to 3.72 MGPD by 2045. The corresponding maximum day demand increases from 2.60 MGPD to 5.57 MGPD, while the peak hour demand grows from 3.89 MGPD in 2025 to 8.36 MGPD by 2045. These projections highlight the increasing stress on local groundwater resources and the urgent need for sustainable water management strategies, including the development of new production wells, water storage reservoirs, and community-level supply networks.

The existing wastewater disposal practices in rural Pindiali are largely on-site and unregulated. Most households utilize single or twin-chamber septic tanks with soakage pits, which often lack proper design and maintenance. As a result, groundwater contamination and surface ponding are common during the wet season.

Drainage infrastructure across Pindiali's villages remains rudimentary, typically consisting of unlined or damaged open drains that discharge into natural depressions or agricultural fields. These drains often overflow during rainfall due to poor gradients, silting, and solid waste accumulation, leading to localized flooding and unhygienic conditions.

6.8.2.1.1 Rural Area Wise Existing and Proposed Water Demand of Pindiali Tehsil

This section presents the existing and projected rural water requirements for Pindiali Tehsil, derived from population growth trends and standard rural service level criteria. Water demand has been estimated using a per capita requirement of 15 gallons per capita per day (GPCD), in line with PHED and WASA rural water supply design standards.

The rural settlements of Pindiali Tehsil accommodate an estimated 105,414 persons in 2023, which increased to 112,832 persons in 2025 and is projected to reach 222,716 persons by

2045, reflecting sustained natural population growth and gradual expansion of rural habitation clusters.

Based on these projections, the average daily rural water demand is estimated at 1.58 MGPD in 2023, increasing to 1.69 MGPD in 2025 and further rising to 3.34 MGPD by 2045. Correspondingly, the maximum day demand is projected to increase from 2.37 MGPD in 2023 to 2.54 MGPD in 2025, reaching 5.01 MGPD by 2045. The peak hour demand is expected to rise from 3.56 MGPD in 2023 to 3.81 MGPD in 2025, and significantly to 7.52 MGPD by 2045, indicating a substantial increase in short-duration hydraulic loading on rural water supply systems.

At present, rural water supply in Pindiali Tehsil primarily depends on groundwater abstraction through hand pumps, dug wells, and small community-operated pumping schemes. These systems are constrained by declining groundwater yields, limited storage, short pumping hours, and restricted distribution coverage, resulting in intermittent supply and underserved rural pockets. To meet future rural water demand, there is a critical need to augment groundwater production, enhance storage capacity, and expand distribution networks, along with improved system management to ensure reliable and equitable water supply across the rural areas of Pindiali Tehsil throughout the planning horizon.

Table 97: Rural Area Wise Existing and Proposed Water Demand of Pindiali Tehsil

Year	Urban Population	Water Demand (MGPD)	Maximum Day Demand (MGPD)	Peak Hour Demand (MGPD)
2023	105,414	1.58	2.37	3.56
2025	112,832	1.69	2.54	3.81
2045	222,716	3.34	5.01	7.52

6.8.2.2 Proposed Water Supply System Pindiali Tehsil

To meet the projected water demand of Pindiali Tehsil (covering rural settlements) up to the year 2045, a phased and sustainable water supply system is proposed. The design framework is based on a per capita consumption of 15 gallons per capita per day (GPCD) for rural areas, consistent with PHED and WASA design standards. The proposed design accounts for maximum day and peak hour demand factors to ensure system reliability, operational efficiency, and resilience against future population growth and service expansion across the tehsil.

Proposed Source (New Tube-Well)

Design Basis

Groundwater abstraction is planned from the Pindiali alluvial aquifer, which has demonstrated sustainable yield potential for long-term use. The proposed system emphasizes groundwater-

based abstraction through strategically located deep tube wells, supplemented by spring-fed sources or boreholes where favorable hydrogeological conditions exist.

To enhance energy efficiency and minimize operational costs, solar-powered pumping systems are proposed, particularly for remote and dispersed rural settlements.

Unit Well Capacity:

Each proposed production well will be designed to yield 1.00 cusec (≈ 0.65 MGD) of discharge on a continuous basis. This higher unit capacity significantly reduces the total number of wells required while maintaining redundancy and operational flexibility. Each well will be equipped with a dedicated chlorination system, flow meter, and standby generator or solar backup to ensure continuous functionality during outages or peak demand conditions.

Service Objective:

The system is designed to meet a projected average daily water demand of 5.01 MGD by 2045, including a 15% redundancy margin for system downtime and emergencies. This configuration ensures that the rural population across Pindiali Tehsil receives a reliable, sustainable, and safe water supply throughout the planning horizon.

Stage	Implementation Period	Urban Demand to be Met (MGD)	New Production Wells*	Key Siting/Design Considerations
Immediate	2025 – 2030	up to 2.37	5 wells (1 cusec each)	Prioritize high-density villages around Pindiali Bazaar and nearby settlements. Wells to be located on elevated sites to enable gravity-fed distribution; solar pumping for energy efficiency. Extend network coverage to scattered rural settlements. Integrate new wells into trunk mains feeding OHRs; ensure standby connections between adjacent schemes.
Long-Term	2041 – 2045	up to 5.01	8 wells (1 cusec each)	Expand system to peripheral hamlets. Replace aging wells and coordinate with additional OHR construction to meet peak hour demands (5.01 MGD).

6.8.2.2.1 Rural Areas (VCs – 15 GPCD)

For rural settlements in Pindiali Tehsil, smaller localized OHRs are proposed to ensure reliable and equitable service delivery. Each reservoir provides a 12-hour service buffer, reducing dependence on continuous pumping and mitigating the effects of power interruptions.

Purpose:

- Ensure consistent and reliable supply for rural communities.
- Provide a 12-hour operational buffer during outages or maintenance.
- Reduce stress on groundwater abstraction systems by regulating pumping cycles

Phased Capacities (based on projected demand):

Year	Maximum Day Demand (MGD)	12-Hour Buffer (MG)	Recommended OHR Capacity (MG)
2023	1.19	0.59	0.6
2030	1.27	0.63	0.75
2045	2.51	1.25	1.5

6.8.2.3 Existing situation of the sanitation/drainage system in Pindiali Tehsil (Katcha, Pucca, open and covered etc.).

Wastewater generation in the rural areas of Pindiali Tehsil has been estimated on the basis of 85% of the average daily rural water demand, with an additional 5% allowance to account for non-domestic rural uses such as mosques, schools, small shops, and basic service activities. These assumptions are consistent with standard rural sanitation planning practices.

Based on the assessed rural population, the average daily rural water demand of 1.58 MGD in 2023 results in an estimated wastewater generation of 1.42 MGD. With population growth, wastewater generation increases to 1.52 MGD in 2025 and is projected to rise significantly to 3.01 MGD by 2045, in line with the corresponding increase in rural water consumption.

Year	Population	Average Water Demand (MGD)	Wastewater Generation @ 85% + 5% (MGD)	Peak Sewage Flow (MGD)	Stormwater Inflow (MGD)	Total Design Flow (MGD)
2023	105,414.00	1.58	1.42	4.27	2.13	6.40
2025	112,832.00	1.69	1.52	4.57	2.28	6.85
2045	222,716.00	3.34	3.01	9.02	4.51	13.53

For hydraulic design, the peak sewage flow in rural areas has been adopted as three times the average sewage flow, reflecting diurnal variation and intermittent discharge patterns typical of rural settlements. Accordingly, the peak rural sewage flow is estimated at 4.27 MGD in 2023, increasing to 4.57 MGD in 2025 and reaching 9.02 MGD by 2045. To account for incidental stormwater ingress and surface runoff during monsoon periods, an allowance equal to 50% of the peak sewage flow has been considered, resulting in stormwater inflows of 2.13 MGD in 2023, 2.28 MGD in 2025, and 4.51 MGD in 2045.

Based on these parameters, the total rural wastewater design flow for Pindiali Tehsil is estimated at 6.40 MGD in 2023, increasing to 6.85 MGD in 2025, and further rising to 13.53 MGD by 2045. These figures represent the design basis for planning rural sanitation infrastructure across the tehsil.

On a per capita basis, and using a rural water supply norm of 15 GPCD, the derived rural sewage generation rate corresponds to approximately 12.8 GPCD, reflecting combined domestic wastewater and minor non-domestic contributions. These per capita values provide a consistent basis for the design of household-level sanitation systems, decentralized treatment units, and any future rural sewerage facilities envisaged for the dispersed settlements of Pindiali Tehsil.

Rural Area Wise Existing and Proposed Wastewater Demand – Pindiali Tehsil VCs

In the rural villages of Pindiali Tehsil, where household clusters are scattered and the terrain is uneven, a conventional gravity sewer network is neither economically nor technically feasible. Full-scale pipe sewers demand high capital investment, continuous flow velocities, and regular skilled maintenance requirements that are impractical in sparsely populated settlements.

Instead, decentralized on-site sanitation is recommended. A combination of household septic tanks with soakage pits (leach pit) provides a low-cost, low-maintenance, and environmentally sound solution. This approach is well-suited to Barang's permeable sandy–gravel soils, which facilitate infiltration, and to the region's limited water availability.

Treatment Process

Wastewater from each dwelling enters a sealed septic tank, where solids settle to form sludge and lighter materials form a scum layer.

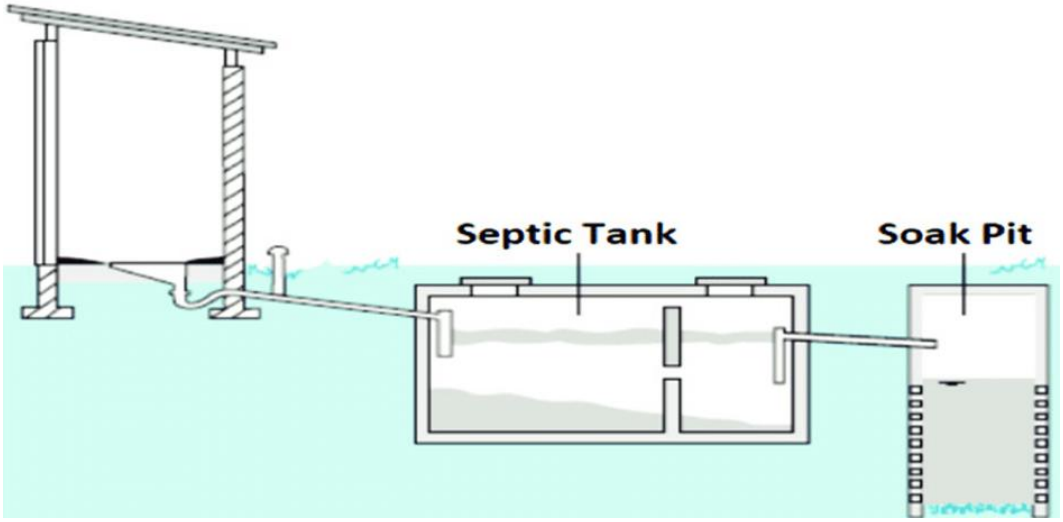
The clarified effluent passes to a soakage pit, where it percolates through the surrounding soil for further natural filtration and pathogen reduction.

Typical performance of a well-maintained system:

- Suspended Solids (TSS): 80–90 % removal
- Biochemical Oxygen Demand (BOD): 60–80 % reduction
- Pathogens: 80–90 % reduction

- Nutrients (N & P): 60–80 % reduction

This treatment level is adequate for protecting Barang's shallow aquifers and preventing nuisance conditions when tanks are properly sited and desludging.



6.8.2.4 Design of Soakage pit & Septic tank

The capacity of soakage pits has been determined based on the daily effluent generation and required retention time, considering local soil permeability and infiltration characteristics

Retention days for pit = 2 days

Void ratio = 0.35.

Worked results & recommended pit diameters

Calculated required gross pit volumes and approximate circular pit diameters for two practical depths (1.5 m and 2.0 m):

Household	Gross pit vol (m^3)	Gross vol (L)	Diameter for depth = 1.5 m (m)	Diameter for depth = 2.0 m (m)
4 p	0.993 m^3	993 L	0.92 m	0.80 m
6 p	1.489 m^3	1,489 L	1.12 m	0.97 m
8 p	1.986 m^3	1,986 L	1.30 m	1.12 m
10 p	2.482 m^3	2,482 L	1.45 m	1.26 m

Practical recommendation: use a cylindrical pit Dia 1.0–1.5 m and depth 1.5–2.0 m depending on household size/percolation — e.g.

4–6 persons - Ø 1.0 m, depth 1.5–2.0 m

8–10 persons - Ø 1.2–1.5 m, depth 1.5–2.0 m

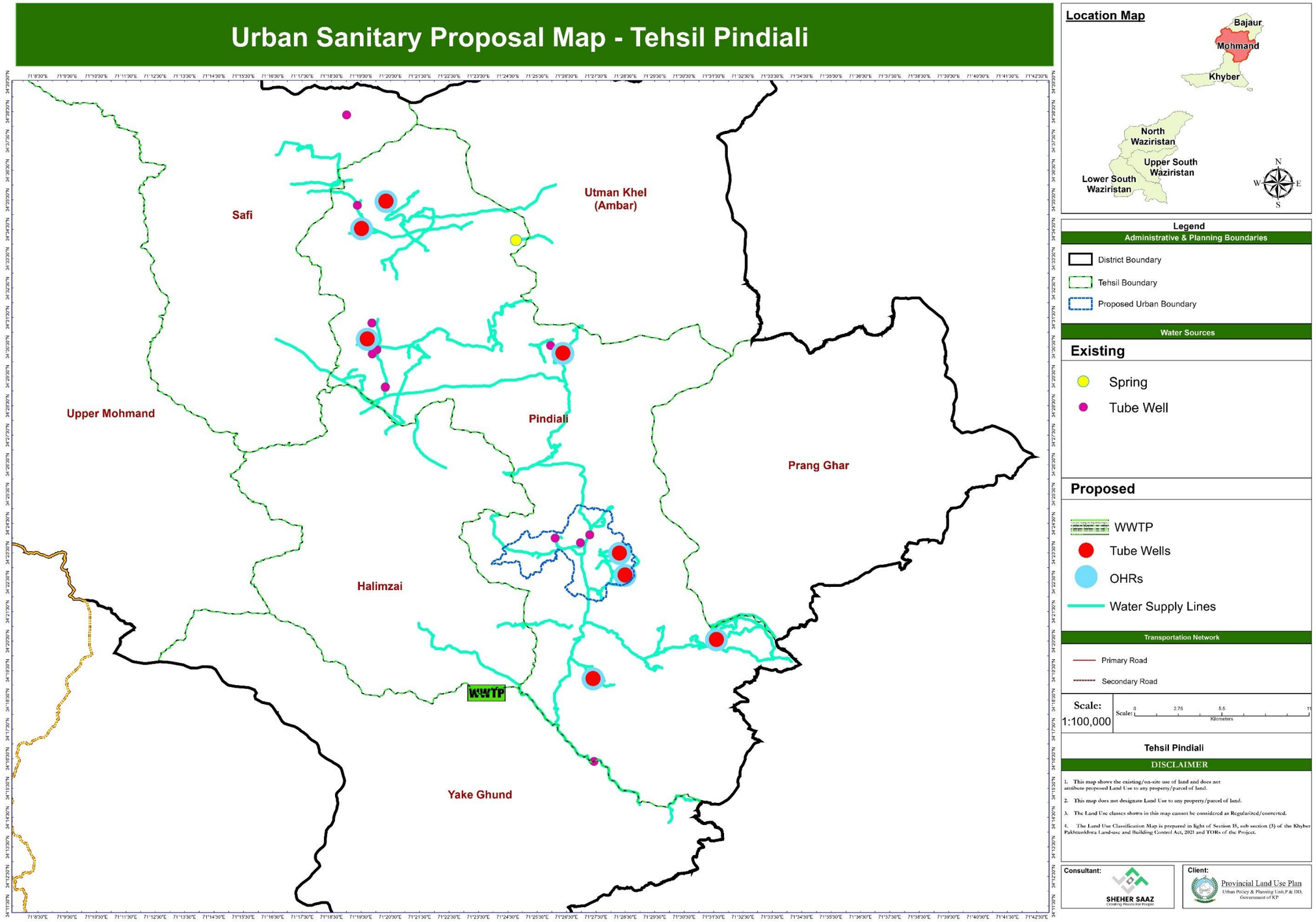
6.8.2.4.1 Construction & installation

Each household within Pindiali Tehsil's rural settlements will be equipped with an independent on-site sanitation system consisting of a two-chamber reinforced concrete septic tank followed by a soakage pit. The septic tank will be constructed with inlet and outlet baffles, manhole access covers for periodic maintenance, and adequate structural cover and waterproofing to ensure durability and watertightness. The inlet invert shall be set approximately 150 mm below the outlet invert to maintain smooth hydraulic flow and effective sedimentation within the tank. Effluent from the outlet chamber will flow into a distribution box or soakage pit, fitted with a mosquito-proof vent to prevent vector breeding. Scheduled desludging every 3 to 5 years shall be carried out based on sludge accumulation and household usage patterns.

The soakage pit will be constructed using graded coarse aggregate (void ratio ≈ 0.35) and enclosed with geotextile lining to prevent silt ingress and maintain percolation efficiency. It shall be located at a minimum horizontal distance of 10 meters from any potable water source, preferably within a 15 to 30 meter separation buffer and positioned downslope of wells or boreholes to minimize groundwater contamination risks. The pit bottom shall maintain at least 1.0 meter vertical clearance above the seasonal high groundwater table to ensure effective infiltration. A reinforced concrete collar and inspection opening will be provided to prevent surface runoff intrusion and facilitate routine inspection.

This on-site sanitation system represents a low-cost, sustainable, and environmentally safe wastewater management solution suitable for Pindiali's scattered rural settlements, where centralized sewerage infrastructure is economically and technically unviable. It ensures hygienic disposal of domestic wastewater while protecting groundwater resources and public health.

Map 51: Proposed Urban Sanitary Map - Tehsil Pindiali



6.8.3 Tehsil Halim Zai

6.8.3.1 Existing coverage of the water supply/gaps in demand in Halim Zai Tehsil

The Halim Zai Tehsil Urban Centre presently depends on a combination of small-scale government and community-operated Water Supply Schemes (WSS), predominantly powered by solar tube wells, with a few systems operating on electricity. These schemes typically function 6–8 hours per day, providing discharges ranging between 2,500–5,000 gallons per hour (GPH). While most of these systems remain operational, a few experiences intermittent disruptions caused by mechanical breakdowns and power supply limitations, resulting in irregular service delivery. Currently, about 35–40% of the urban population is connected to piped water supply networks, whereas the remaining 60–65% rely on private boreholes, hand pumps, and surface water sources.

The existing sewerage and drainage system in Halim Zai Tehsil is largely unplanned, inadequate, and deteriorated. It primarily consists of open surface drains, many of which are undersized, damaged, or frequently clogged with silt and solid waste. Domestic wastewater is often discharged directly into these drains or open plots, leading to stagnant water accumulation and unhygienic conditions. In the absence of a formal underground sewerage network, most households rely on individual septic tanks and soak pits, which have resulted in localized groundwater contamination and environmental degradation.

Although limited stormwater drains exist along selected roads, their performance remains constrained by insufficient capacity, poor maintenance, and blockage due to solid waste, resulting in frequent urban flooding during heavy rainfall. The absence of an integrated and properly designed sewage and drainage system poses significant environmental and public health risk.

6.8.3.1.1 Urban Area Wise Existing and Proposed Water Demand of Halim Zai Tehsil

The urban settlements of Halim Zai Tehsil primarily rely on groundwater abstraction through tube wells, supplemented by hand pumps, shallow wells, and small community-operated water supply systems. These sources remain critical for meeting domestic water requirements, particularly in urban areas where piped water distribution networks are either limited or still under development.

Based on the assessed urban population of 28,058 in 2023, increasing to 29,630 in 2025 and projected to reach 48,332 by 2045, the average daily urban water demand is estimated at 0.98 MGPD in 2023, rising to 1.04 MGPD in 2025, and further increasing to 1.69 MGPD by 2045, in accordance with the figures presented in Table.

Correspondingly, the maximum day demand for urban areas of Halim Zai Tehsil is projected to increase from 1.47 MGPD in 2023 to 1.56 MGPD in 2025, reaching 2.54 MGPD by 2045. The peak hour demand is expected to rise from 2.21 MGPD in 2023 to 2.33 MGPD in 2025, and further to 3.81 MGPD by 2045, reflecting increasing short-duration hydraulic loads on the urban water supply system.

These projections underscore the growing pressure on existing urban groundwater-based water supply infrastructure in Halim Zai Tehsil. To ensure reliable and equitable urban water service delivery over the planning horizon, there is a clear need to augment groundwater production capacity, enhance storage facilities, and expand and rehabilitate urban distribution networks, supported by improved system operation and demand management measures.

Table 98: Urban Area Wise Existing and Proposed Water Demand of Halim Zai Tehsil

Year	Urban Population	Water Demand (MGPD)	Maximum Day Demand (MGPD)	Peak Hour Demand (MGPD)
2023	28058	0.98	1.47	2.21
2025	29630	1.04	1.56	2.33
2045	48332	1.69	2.54	3.81

6.8.3.1.2 Rural Area Wise Existing and Proposed Water Demand of Halim Zai Tehsil

The rural settlements of Halim Zai Tehsil rely predominantly on groundwater abstraction through hand pumps, shallow wells, and small community-operated water supply systems. These decentralized sources remain the primary means of meeting domestic water needs, particularly in dispersed and remote villages where formal piped water infrastructure is limited or absent.

Based on the assessed rural population of 63,227 in 2023, increasing to 66,270 in 2025 and projected to reach 106,031 by 2045, and using an adopted rural water demand standard of 15 gallons per capita per day (GPCD), the average daily rural water demand is estimated at 0.95 MGPD in 2023, rising to 0.99 MGPD in 2025, and further increasing to 1.59 MGPD by 2045, in line with Table.

Table 99: Rural Area Wise Existing and Proposed Water Demand of Halim Zai Tehsil

Year	Urban Population	Water Demand (MGPD)	Maximum Day Demand (MGPD)	Peak Hour Demand (MGPD)
2023	63,227.0	0.95	1.42	2.13
2025	66,270.0	0.99	1.49	2.24
2045	106,031.0	1.59	2.39	3.58

Correspondingly, the maximum day demand for rural areas of Halim Zai Tehsil is projected to increase from 1.42 MGPD in 2023 to 1.49 MGPD in 2025, reaching 2.39 MGPD by 2045. The peak hour demand is expected to rise from 2.13 MGPD in 2023 to 2.24 MGPD in 2025, and further to 3.58 MGPD by 2045, indicating increasing short-duration demand pressures on rural water supply systems.

Given the dispersed settlement pattern and continued reliance on individual and community-based groundwater sources, ensuring reliable, equitable, and safe rural water access remains a significant challenge. Future rural water supply planning for Halim Zai Tehsil should prioritize groundwater conservation and recharge, upgrading of small-scale piped water schemes, and the provision of localized storage, treatment, and distribution facilities. These measures are essential to enhance service continuity, mitigate seasonal shortages, and strengthen resilience against long-term groundwater depletion across all rural settlements of Halim Zai Tehsil.

6.8.3.2 Proposed Water Supply System Halim Zai Tehsil

To cater to the projected water demand of Halim Zai Tehsil encompassing both urban and rural settlements—up to the year 2045, a phased and sustainable water supply system is proposed. The design framework is based on a per capita water consumption of 15 gallons per capita per day (GPCD) for rural areas and 35 GPCD for urban settlements, in line with PHED and WASA design standards.

The proposed system accounts for maximum day and peak hour demand factors, ensuring adequate system capacity, operational flexibility, and service reliability. This approach is intended to support future population growth, urban expansion, and improved service coverage, while maintaining the long-term efficiency and sustainability of the water supply network across all urban and rural areas of Halim Zai Tehsil.

6.8.3.3 Proposed Source (New Tube-Well)

Design Basis

To cater to the projected water demand of Halim Zai Tehsil encompassing both rural and semi-urban settlements—up to the year 2045, a phased and sustainable water supply system is proposed. The design framework is based on a per capita water consumption of 15 gallons per capita per day (GPCD) for rural areas and 35 GPCD for urban settlements, in accordance with PHED and WASA design standards.

The proposed system incorporates maximum day and peak hour demand factors, ensuring sufficient system capacity, operational flexibility, and long-term service reliability. This approach supports anticipated population growth, spatial expansion, and improved service coverage, while maintaining the efficiency and sustainability of the water supply network across Halim Zai Tehsil.

Unit Well Capacity:

Groundwater abstraction will be based on the sustainable yield of the Halim Zai alluvial aquifer, ensuring long-term groundwater balance and protection against over-extraction. The future water supply network will primarily rely on deep tube wells tapping productive aquifer zones, complemented by spring-fed intakes in areas with favorable hydrogeological conditions.

To promote energy efficiency and climate resilience, solar-powered pumping systems will be introduced wherever feasible, minimizing operational costs and reducing dependence on grid electricity.

Unit Well Capacity

Each production well is designed to deliver a continuous discharge of 0.75 MGD (1.16 cusec), reflecting the local aquifer's yield potential and optimal operational efficiency. Adequate provision has been made for standby operation and scheduled maintenance, ensuring reliability and continuity of supply throughout the year.

Service Objective:

The proposed water supply system is designed to meet the maximum day water demand of 2.5 MGD by 2045, with an additional 15% redundancy margin to accommodate operational downtime, maintenance, and emergency supply conditions. This approach ensures a resilient, efficient, and sustainable water supply network capable of meeting Halim Zai Tehsil's future needs.

Stage	Implementation Period	Rural Demand to be Met (MGD)	New Production Wells*	Key Siting / Design Considerations
Immediate	2025 – 2030	up to 1.42	3 wells	Prioritize water-deficient rural clusters . Site wells near existing community schemes and connect them to Overhead Reservoirs (OHRs) for gravity-fed distribution. Adopt solar-powered units where feasible. Expand coverage to peripheral settlements. Integrate wells with new OHRs and small-scale distribution loops; ensure fencing, access, and O&M provisions at all sites.
Long-Term	2041 – 2045	up to 2.5	4 wells	Tap deeper, higher-yield aquifer zones. Implement artificial recharge measures such as infiltration trenches and recharge wells to maintain aquifer sustainability.

6.8.3.3.1 Water Storage

Rural & Urban Areas (VCs – 15 & 35 GPCD)

For rural & Urban settlements in Halim Zai Tehsil, smaller localized OHRs are proposed to ensure reliable and equitable delivery service. Each reservoir provides a 12-hour service buffer, reducing dependence on continuous pumping and mitigating the effects of power interruptions.

Purpose:

- Ensure consistent and reliable supply for rural communities.
- Provide a 12-hour operational buffer during outages or maintenance.
- Reduce stress on groundwater abstraction systems by regulating pumping cycles

Phased Capacities (based on projected demand):

Year	Maximum Day Demand (MGD)	12-Hour Buffer (MG)	Recommended OHR Capacity (MG)
2025	2.90	1.45	1.5-1.6
2035	3.05	1.52	1.6-2.0
2045	4.92	2.46	2.5-3.0

6.8.3.4 Existing situation of the sanitation/drainage system in Halim Zai Tehsil (Katcha, Pucca, open and covered etc.).

Wastewater generation in Halim Zai Tehsil has been estimated at 85% of the average daily water demand for the predominantly rural population, with an additional 5% allowance for non-domestic usage such as small-scale commercial, institutional, and service-sector activities typical of rural environments.

For hydraulic design purposes, the peak sewage flow is considered twice the average daily sewage flow, while stormwater inflow is assumed to be 50% of the peak sewage flow to account for incidental runoff and surface drainage entering the system during monsoon events. Infiltration losses are taken as 10% of the average sewage flow, consistent with the local soil permeability and groundwater conditions.

Based on a per capita water demand of 15 gallons per capita per day (GPCD), the corresponding per capita sewage generation rate is estimated at 7.5 GPCD, representing typical domestic wastewater production in rural settlements.

As Halim Zai Tehsil comprises entirely rural settlements without a centralized sewerage network, wastewater management will continue to depend on on-site sanitation systems, primarily two-chamber reinforced concrete septic tanks followed by soakage pits. These systems are recommended for all households and communal institutions to ensure safe, sustainable, and environmentally compliant wastewater disposal while safeguarding groundwater quality and improving overall sanitation conditions across the tehsil:

Urban Area Wise Existing and Proposed Wastewater Demand – Mamund Tehsil VCs:

The total wastewater generation in Halim Zai Tehsil is projected to increase from 3.66 MGD in 2025 to 5.58 MGD by 2045, emphasizing the importance of strengthening on-site sanitation infrastructure, introducing decentralized wastewater treatment systems, and promoting groundwater protection measures through improved design and maintenance of household-level sanitation facilities.

Table 100:Rural Area Wise Existing and Proposed Wastewater Demand – Halim Zai Tehsil

Year	Urban Population	Average Water Demand (MGD)	Wastewater Generation @ (85% + 5%) (MGD)	Peak Sewage Flow (MGD)	Stormwater Inflow (50% of Peak) (MGD)	Total Design Flow (MGD)
2025	28,058.00	0.42	0.38	1.14	0.57	1.70
2035	29,630.00	0.44	0.40	1.20	0.60	1.80
2045	48,332.00	0.72	0.65	1.96	0.98	2.94

Rural Area Wise Existing and Proposed Wastewater Demand Halim Zai Tehsil VCs

In the rural villages of Halim Zai Tehsil, where household clusters are scattered and the terrain is uneven, a conventional gravity sewer network is neither economically nor technically feasible. Full-scale pipe sewers demand high capital investment, continuous flow velocities, and regular skilled maintenance requirements that are impractical in sparsely populated settlements.

Instead, decentralized on-site sanitation is recommended. A combination of household septic tanks with soakage pits (leach pits) provides a low-cost, low-maintenance, and environmentally sound solution. This approach is well-suited to Barang's permeable sandy–gravel soils, which facilitate infiltration, and to the region's limited water availability.

Treatment Process

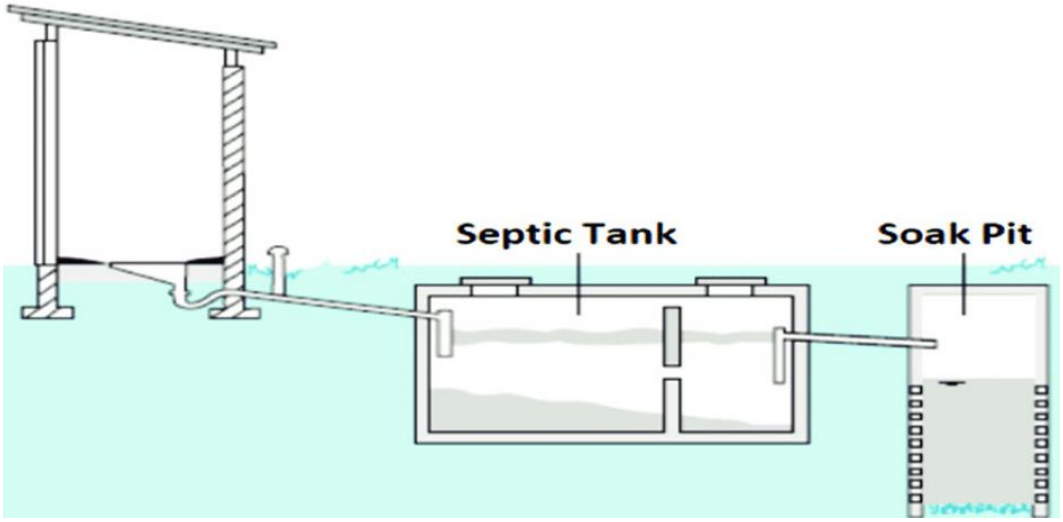
Wastewater from each dwelling enters a sealed septic tank, where solids settle to form sludge and lighter materials form a scum layer.

The clarified effluent passes to a soakage pit, where it percolates through the surrounding soil for further natural filtration and pathogen reduction.

Typical performance of a well-maintained system:

- Suspended Solids (TSS): 80–90 % removal
- Biochemical Oxygen Demand (BOD): 60–80 % reduction
- Pathogens: 80–90 % reduction
- Nutrients (N & P): 60–80 % reduction

This treatment level is adequate for protecting Barang's shallow aquifers and preventing nuisance conditions when tanks are properly sited and desludging.



Wastewater quality & Treatment Halim Zai Tehsil

The disposal of untreated wastewater into open drains, streams, and agricultural fields is a major cause of environmental degradation in Mamund Tehsil, contaminating both surface and groundwater resources. To address this challenge, a phased wastewater treatment strategy is proposed.

A centralized Wastewater Treatment Plant (WWTP) will be established near the Barang central plain, serving the urban NCs, while smaller decentralized treatment units (waste stabilization ponds or aerated lagoons) will be developed near rural clusters for VCs.

The WWTP design will follow international and national best practices, with process design based on average sewage flow and pollution loads, and hydraulic design based on peak flows. Treatment will target compliance with NEQS discharge limits (BOD < 80 mg/L, COD < 150 mg/L, TSS < 200 mg/L).

6.8.3.5 Design of Soakage pit & Septic tank

The capacity of soakage pits has been determined based on the daily effluent generation and required retention time, considering local soil permeability and infiltration characteristics

Retention days for pit = 2 days

Void ratio = 0.35.

Recommended pit diameters

Calculated required gross pit volumes and approximate circular pit diameters for two practical depths (1.5 m and 2.0 m):

Household	Gross pit vol (m^3)	Gross vol (L)	Diameter for depth = 1.5 m (m)	Diameter for depth = 2.0 m (m)
4 p	0.993 m^3	993 L	0.92 m	0.80 m
6 p	1.489 m^3	1,489 L	1.12 m	0.97 m
8 p	1.986 m^3	1,986 L	1.30 m	1.12 m
10 p	2.482 m^3	2,482 L	1.45 m	1.26 m

Practical recommendation: use a cylindrical pit Dia 1.0–1.5 m and depth 1.5–2.0 m depending on household size/percolation — e.g.

4–6 persons = Ø 1.0 m, depth 1.5–2.0 m

8–10 persons = Ø 1.2–1.5 m, depth 1.5–2.0 m

6.8.3.5.1 Construction & installation

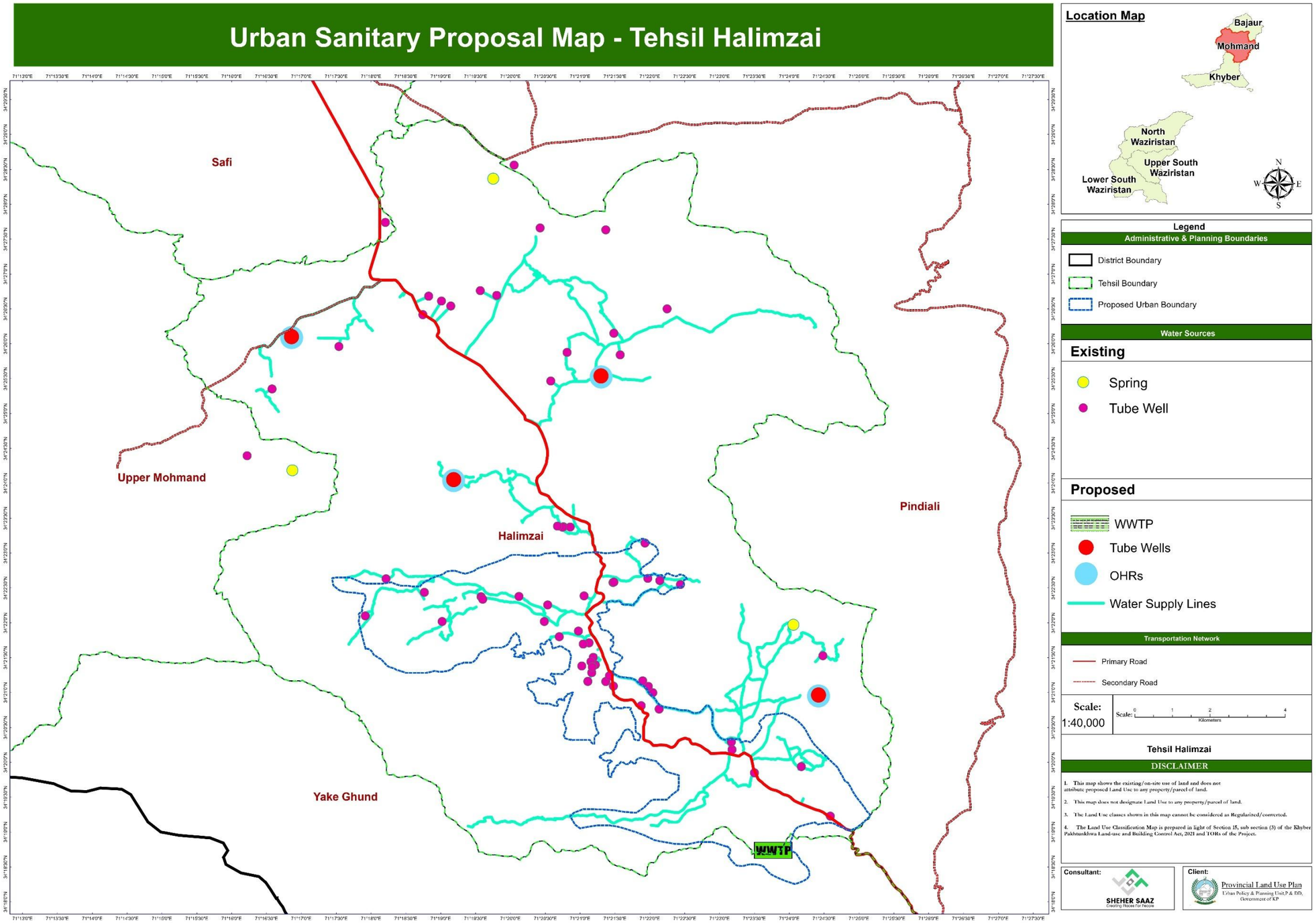
Each household within Halim Zai Tehsil rural settlements will be equipped with an independent on-site sanitation system consisting of a two-chamber reinforced concrete septic tank followed by a soakage pit. The septic tank will be designed with inlet and outlet baffles, manhole covers for periodic desludging and inspection, and adequate structural reinforcement and waterproofing to ensure durability and watertight performance. The inlet invert level shall be maintained approximately 150 mm below the outlet invert to promote uniform flow and effective sedimentation of solids.

Effluent from the outlet chamber will be directed to a distribution box or soakage pit, provided with a mosquito-proof vent to prevent vector breeding. Desludging operations shall be carried out every 3 to 5 years, depending on sludge accumulation and household water usage patterns.

The soakage pit will be filled with graded coarse aggregate (void ratio ≈ 0.35) and lined with geotextile fabric to minimize siltation and ensure long-term infiltration efficiency. The pit shall be located at least 10 meters away from any drinking water source, with a preferred separation of 15 to 30 meters and placed downslope of wells or boreholes to prevent groundwater contamination. A minimum vertical clearance of 1.0 meter shall be maintained between the pit bottom and the seasonal high groundwater table. Each pit will include a reinforced concrete collar and an inspection cover to prevent surface water ingress and facilitate maintenance.

This decentralized on-site sanitation system offers a safe, cost-effective, and environmentally sustainable wastewater management solution tailored to the rural context of Mamund Tehsil, where the absence of a centralized sewerage network and the scattered settlement pattern make individual household systems the most practical and hygienic option.

Map 52: Proposed Urban Sanitary Map - Tehsil Halimzai



6.8.4 Tehsil Safi

6.8.4.1 Existing coverage of the water supply/gaps in demand in Safi Tehsil.

This section presents the current and projected water requirements for Safi Tehsil, based on population growth trends and applicable service level standards. Water demand has been estimated using per capita requirements consistent with PHED rural water supply design benchmarks for developing tehsils.

Safi Tehsil comprises several major Village Councils (VCs) and Neighborhood Councils (NCs), including Gurbaz, Masood, Qandahari, Sagi, Chamarkand, Sheikh Baba, Lakarai, and other dispersed rural settlements. The total population across these settlements is estimated at 110,087 in 2025, projected to rise to 161,785 by 2045, reflecting natural population growth and gradual settlement expansion.

Average daily demand (ADD) is expected to increase from 1.70 MGD in 2025 to 2.42 MGD by 2045. Maximum demand (MDD) is projected to rise from 2.53 MGD to 3.63 MGD. Peak hour demand (PHD) will increase from 3.79 MGD to 5.44 MGD over the same period.

For the tehsil's main population clusters and semi-urban centers, the recommended Overhead Reservoir (OHR) capacity should increase from 1.10 MG in 2025 to 1.65 MG by 2045, based on a 12-hour operational storage criterion to ensure adequate supply during high-demand periods.

To meet these requirements, the total tube well production capacity will need to be enhanced from approximately 2.50 MGD (3.35 cusecs) in 2025 to 4.85 MGD (6.50 cusecs) by 2045, ensuring sustained water availability and equitable distribution across all settlements within Safi Tehsil.

6.8.4.1.1 Urban Area Wise Existing and Proposed Water Demand of Safi Tehsil

The urban settlements of Safi Tehsil primarily rely on groundwater-based municipal supplies, supported by tube wells and small distribution networks. Based on projected urban populations and an average per capita demand of 35 gallons per capita per day (GPCD), the average daily water requirement for these urban centers is estimated at 0.90 MGPD in 2025, increasing to 1.30 MGPD by 2045.

Corresponding maximum-day demand is expected to rise from 1.36 MGPD in 2025 to 1.96 MGPD in 2045, while peak-hour demand will increase from 2.04 MGPD to 2.93 MGPD over the same period.

Year-wise projections indicate steady population growth in the main urban settlements—from a combined population of 29,798 in 2025 to 42,289 by 2045—resulting in proportional increases across all water demand categories. These rising requirements underscore the need to strengthen groundwater abstraction capacity, augment storage systems, and upgrade existing distribution networks to ensure reliable and continuous water supply for Safi Tehsil's expanding urban communities.

Year	Urban Population	Water Demand (MGPD)	Maximum Day Demand (MGPD)	Peak Hour Demand (MGPD)
2023	11265	0.39	0.59	0.89
2025	11666	0.41	0.61	0.92
2045	16555	0.58	0.87	1.30

6.8.4.1.2 Rural Area Wise Existing and Proposed Water Demand of Safi Tehsil

The rural settlements of Safi Tehsil primarily rely on groundwater abstraction through hand pumps, shallow wells, and small-scale community-operated water supply systems. Based on the projected rural population and an average per capita demand of 15 gallons per capita per day (GPCD), the average daily water requirement is estimated at 1.48 MGPD in 2025, increasing steadily to 2.18 MGPD by 2045.

Correspondingly, the maximum-day demand is projected to rise from 2.22 MGPD in 2025 to 3.27 MGPD in 2045, while peak-hour demand will increase from 3.34 MGPD to 4.90 MGPD over the same period.

Year-wise projections indicate a gradual increase in rural population—from 98,822 in 2025 to 145,230 by 2045—resulting in proportional growth in water supply requirements. The rising demand highlights the necessity of expanding groundwater abstraction capacity and improving system efficiency.

Year	Rural Population	Water Demand (MGPD)	Maximum Day Demand (MGPD)	Peak Hour Demand (MGPD)
2025	98,822	1.48	2.22	3.34
2040	102,342	1.54	2.30	3.45
2045	145,230	2.18	3.27	4.90

To complement the rural water supply, tube well production capacity is projected to increase from 2.50 MGD (3.35 cusecs) in 2025 to 4.85 MGD (6.50 cusecs) by 2045. Similarly, the recommended overhead reservoir (OHR) capacity for a 12-hour operational buffer will expand from 1.10 MG in 2025 to 1.65 MG by 2045, ensuring continuous and reliable service delivery.

This analysis underscores the need for integrated rural water supply planning to address seasonal shortages, ensure equitable service delivery, and enhance resilience against potential groundwater depletion. Strengthening well-field management, storage capacity, and distribution networks will be crucial to meeting future water demand across Safi Tehsil's rural settlements.

6.8.4.2 Proposed Water Supply System Safi Tehsil

To meet the projected water demand of Safi Tehsil (covering both rural and semi-urban settlements) up to the year 2045, a phased and sustainable groundwater-based water supply system is proposed. The design framework is based on a per capita consumption of 15 gallons per capita per day (GPCD) for rural areas, incorporating maximum day demand (MDD) and peak hour demand (PHD) factors in accordance with PHED and WASA design standards.

6.8.4.2.1 Proposed Source (New Tube-Well)

Design Basis

Groundwater abstraction is proposed from the alluvial aquifer underlying Safi Tehsil, which has demonstrated sufficient yield potential to sustain long-term withdrawal within safe recharge limits. The system is designed to ensure sustainable utilization and equitable water access across the tehsil's dispersed settlements.

Unit Well Capacity:

Each tube well is designed to yield 0.75 MGD (1.04 cusecs) on a continuous basis, considering the local hydrogeological characteristics and typical borehole performance in the region. The design includes standby wells and scheduled maintenance provisions to maintain continuous water supply and operational efficiency during maintenance or system downtime.

Service Objective:

The proposed water supply system aims to meet the projected maximum day demand of 3.63 MGD by 2045, with an additional 15% redundancy margin to accommodate potential system losses, operational constraints, and emergency requirements.

Stage	Implementation Period	Urban Demand to be Met (MGD)	New Production Wells*	Key Siting/Design Considerations
Immediate	2025 – 2030	up to 2.22	3 wells	Address existing water shortages in high-demand VCs such. Wells to be located near populated clusters and existing hand pump networks for effective system integration.
Long-Term	2041 – 2045	up to 3.27	5 wells	Strengthen system reliability through well augmentation and replacement. Extend coverage to peripheral settlements such as Sagi, Shahkot, and Ghalanai, ensuring

				redundancy and continuous service.

Each well is designed for a discharge of 0.75 MGD, with one standby well in each phase for maintenance and emergency backup.

This phased implementation plan ensures that the Safi Tehsil water supply system expands sustainably in line with population growth and water demand through 2045. The approach emphasizes aquifer sustainability, equitable distribution, and operational resilience, ensuring long-term water security and improved service reliability across all Village Councils.

6.8.4.2.2 Water Storage

Rural & Urban & (VCs – 15 & 35 GPCD)

For dispersed rural settlements in Safi Tehsil, smaller Overhead Reservoirs (OHRs) are proposed to ensure reliable and equitable water supply. The design prioritizes sustainable operations through localized balancing storage, minimizing dependence on continuous pumping and ensuring a 12-hour service buffer to accommodate power interruptions and peak-hour fluctuations.

Purpose:

- Ensure consistent and reliable supply for rural communities.
- Provide a 12-hour operational buffer during outages or maintenance.
- Reduce stress on groundwater abstraction systems by regulating pumping cycles

Phased Capacities (based on projected demand):

Year	Maximum Day Demand (MGD)	12-Hour Buffer (MG)	Recommended OHR Capacity (MG)
2023	2.22	1.11	1.2
2025	2.30	1.15	1.2
2045	3.27	1.63	1.7

Location and Configuration:

This phased implementation plan ensures that the Safi Tehsil water supply system expands sustainably in line with population growth and water demand through 2045. The approach emphasizes aquifer sustainability, equitable distribution, and operational resilience, ensuring long-term water security and improved service reliability across all Village Councils.

6.8.4.3 Existing situation of the sanitation/drainage system in Safi Tehsil (Katcha, Pucca, open and covered etc.).

Wastewater generation in Safi Tehsil has been estimated at 85% of the average daily water demand, with an additional 5% allowance to account for non-domestic usage such as small-scale commercial, institutional, and community facilities typically found in rural and semi-urban settlements.

For hydraulic design purposes, the peak sewage flow is assumed to be twice the average daily sewage flow, while stormwater inflow is considered as 50% of the peak sewage flow to represent combined inflows during monsoon periods. Furthermore, infiltration losses equivalent to 10% of the average sewage flow have been included, reflecting local soil permeability and hydrogeological characteristics.

Based on a per capita water demand of 15 GPCD, the corresponding per capita sewage generation is estimated at approximately 13.5 GPCD, consistent with rural wastewater production patterns observed across Khyber Pakhtunkhw:

Urban Area Wise Existing and Proposed Wastewater Demand – Safi Tehsil:

Year	Population	Average Water Demand (MGD)	Wastewater Generation @ 85% + 5% (MGD)	Peak Sewage Flow (MGD)	Stormwater Inflow (MGD)	Total Design Flow (MGD)
2023	11,265.00	0.17	0.15	0.46	0.23	0.68
2025	11,666.00	0.17	0.16	0.47	0.24	0.71
2045	16,555.00	0.25	0.22	0.67	0.34	1.01

Based on the projected urban population and corresponding water demand, wastewater generation in Safi Tehsil's urban settlements is estimated at 0.16 MGD in 2025, increasing to 0.22 MGD by 2045. Peak sewage flows are projected to rise from 0.47 MGD to 0.67 MGD, while stormwater inflows will increase from 0.24 MGD to 0.34 MGD, resulting in total design flows of 0.71 MGD in 2025 and 1.01 MGD by 2045. This reflects a population increase from 11,666 in 2025 to 16,555 in 2045, highlighting the need for improved urban sanitation infrastructure. Initially, wastewater management will rely on on-site systems, such as two-chamber reinforced concrete septic tanks with soakage pits. However, as urban density grows, the development of decentralized sewerage networks and cluster-based wastewater collection, conveyance, and treatment systems, including appropriately sized wastewater treatment plants (WWTPs), will be essential to ensure safe, sustainable, and environmentally compliant sanitation service delivery across Safi Tehsil.

Rural Area Wise Existing and Proposed Wastewater Demand – Safi Tehsil VCs

In the rural villages of Barang Tehsil, where household clusters are scattered and the terrain is uneven, a conventional gravity sewer network is neither economically nor technically feasible. Full-scale pipe sewers demand high capital investment, continuous flow velocities, and regular skilled maintenance requirements that are impractical in sparsely populated settlements.

Instead, decentralized on-site sanitation is recommended. A combination of household septic tanks with soakage pits (leach pits) provides a low-cost, low-maintenance, and environmentally sound solution. This approach is well-suited to Barang's permeable sandy–gravel soils, which facilitate infiltration, and to the region's limited water availability.

Treatment Process

Wastewater from each dwelling enters a sealed septic tank, where solids settle to form sludge and lighter materials form a scum layer.

The clarified effluent passes to a soakage pit, where it percolates through the surrounding soil for further natural filtration and pathogen reduction.

Typical performance of a well-maintained system:

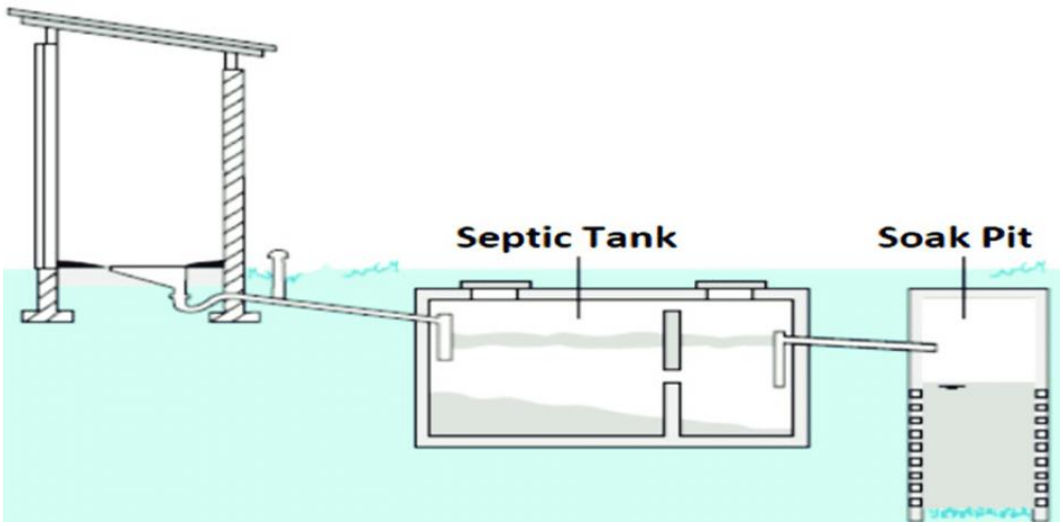
Suspended Solids (TSS): 80–90 % removal

Biochemical Oxygen Demand (BOD): 60–80 % reduction

Pathogens: 80–90 % reduction

Nutrients (N & P): 60–80 % reduction

This treatment level is adequate for protecting Safi Tehsil shallow aquifers and preventing nuisance conditions when tanks are properly sited and desludging.



Wastewater quality & Treatment Safi Tehsil

The disposal of untreated wastewater into open drains, streams, and agricultural fields is a major cause of environmental degradation in Safi Tehsil, contaminating both surface and groundwater resources. To address this challenge, a phased wastewater treatment strategy is proposed.

A centralized Wastewater Treatment Plant (WWTP) will be established near the Barang central plain, serving the urban NCs, while smaller decentralized treatment units (waste stabilization ponds or aerated lagoons) will be developed near rural clusters for VCs.

The WWTP design will follow international and national best practices, with process design based on average sewage flow and pollution loads, and hydraulic design based on peak flows. Treatment will target compliance with NEQS discharge limits (BOD < 80 mg/L, COD < 150 mg/L, TSS < 200 mg/L).

6.8.4.4 Design of Soakage pit & Septic tank

The capacity of soakage pits has been determined based on the daily effluent generation and required retention time, considering local soil permeability and infiltration characteristics

Retention days for pit = 2 days

Void ratio = 0.35.

Worked results & recommended pit diameters

Calculated required gross pit volumes and approximate circular pit diameters for two practical depths (1.5 m and 2.0 m):

Household	Gross pit vol (m^3)	Gross vol (L)	Diameter for depth = 1.5 m (m)	Diameter for depth = 2.0 m (m)
4 p	0.993 m^3	993 L	0.92 m	0.80 m
6 p	1.489 m^3	1,489 L	1.12 m	0.97 m
8 p	1.986 m^3	1,986 L	1.30 m	1.12 m
10 p	2.482 m^3	2,482 L	1.45 m	1.26 m

Practical recommendation: use a cylindrical pit Dia 1.0–1.5 m and depth 1.5–2.0 m depending on household size/percolation — e.g.

4–6 persons - Ø 1.0 m, depth 1.5–2.0 m

8–10 persons - Ø 1.2–1.5 m, depth 1.5–2.0 m

6.8.4.4.1 Construction & installation

Each household within Safi Tehsil shall be provided with an independent on-site sanitation system, consisting of a two-chamber reinforced concrete septic tank followed by a soakage pit for subsurface effluent disposal. The septic tank will be designed with inlet and outlet baffles,

manhole access covers for periodic desludging, and adequate structural reinforcement and waterproofing to ensure long-term durability and watertight performance.

The inlet invert level will be positioned approximately 150 mm below the outlet invert to maintain a self-cleansing hydraulic gradient and promote efficient sedimentation of suspended solids. Effluent from the outlet chamber shall discharge into a distribution box or soakage pit equipped with a mosquito-proof vent to prevent vector breeding and ensure hygienic operation.

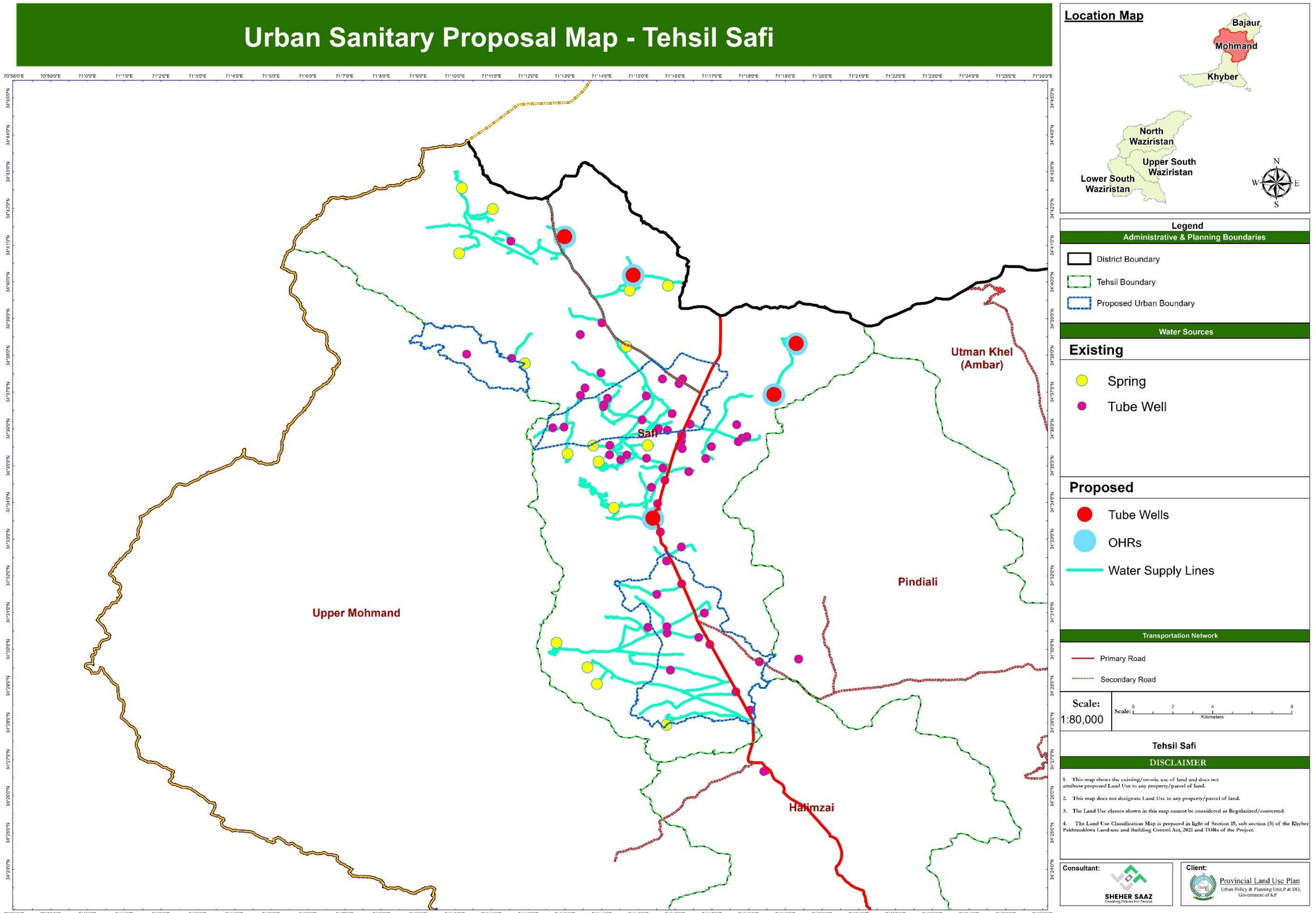
Desludging of septic tanks shall be carried out every 3 to 5 years, depending on household occupancy and sludge accumulation, to maintain optimal treatment performance and prevent odor or overflow issues.

The soakage pit shall be filled with graded coarse aggregate (void ratio ≈ 0.35) and lined with a non-woven geotextile fabric to prevent siltation and sustain infiltration efficiency. The pit will be located at a minimum horizontal distance of 10 meters from any drinking water source, preferably within a 15 to 30 meter buffer zone and positioned downslope of wells or tube wells to avoid groundwater contamination. A minimum vertical clearance of 1.0 meter shall be maintained between the pit bottom and the seasonal high groundwater table to ensure safe percolation.

Each soakage pit will include a reinforced concrete collar and inspection access at the surface to prevent direct stormwater entry and enable periodic maintenance.

This decentralized sanitation system provides a technically sound, low-maintenance, and environmentally sustainable wastewater management solution well-suited to the scattered rural and semi-urban settlement pattern of Safi Tehsil, where centralized sewerage infrastructure is not economically or technically feasible.

Map 53: Proposed Urban Sanitary Map - Tehsil Safi



6.8.5 Tehsil Prang Ghar

6.8.5.1 Existing coverage of the water supply/gaps in demand

The rural settlements of Prang Ghar Tehsil primarily rely on groundwater abstraction through hand pumps, dug wells, and small-scale community-operated water supply schemes. Most of these systems are solar-powered, with limited diesel or electricity-operated units serving the more populated clusters. On average, the existing schemes operate for 6–8 hours per day, with individual well discharges ranging between 2,000–4,000 gallons per hour (GPH) depending on depth and aquifer conditions.

While most water supply schemes remain functional, a number of them experience declining yields during dry months due to groundwater depletion, poor maintenance, and aging pumping infrastructure. Consequently, service reliability fluctuates seasonally, particularly in remote and scattered settlements.

At present, only about 25–30% of households in Prang Ghar Tehsil are connected to piped water systems, while the remaining majority depend on individual or communal hand pumps and shallow wells for their domestic water requirements. The limited-service coverage and system inefficiencies underscore the need for rehabilitation and expansion of existing supply infrastructure to meet current and future rural demand.

These projections indicate the increasing pressure on local groundwater resources and highlight the urgent need for sustainable water management measures, including the development of new production wells, construction of overhead storage reservoirs (OHRs), and improvement of rural distribution networks.

6.8.5.2 Rural Area Wise Existing and Proposed Water Demand of Prang Ghar Tehsil

This section presents the existing and projected urban water demand for Prang Ghar Tehsil, based on population growth trends and PHED/WASA urban service level standards. The demand has been estimated using a per capita water requirement of 35 gallons per capita per day (GPCD), consistent with design benchmarks for small urban settlements.

The total urban population of Prang Ghar Tehsil is projected to increase from 29,433 in 2025 to 41,269 by 2045, driven by natural growth and gradual densification within emerging commercial and residential clusters. Based on these projections, the average daily urban water demand is expected to rise from 0.44 MGPD in 2025 to 0.62 MGPD by 2045. Correspondingly, the maximum-day demand will increase from 0.66 MGPD to 0.93 MGPD, while the peak-hour demand will grow from 0.99 MGPD to 1.39 MGPD over the same period.

Year	Urban Population	Water Demand (MGPD)	Maximum Day Demand (MGPD)	Peak Hour Demand (MGPD)
2023	28,455	0.43	0.64	0.96
2025	29,433	0.44	0.66	0.99

2045	41,269	0.62	0.93	1.39

At present, the water supply systems in Prang Ghar Tehsil's urban areas rely primarily on groundwater abstraction through tube wells. However, limited pumping hours, declining well yields, and inadequate distribution coverage contribute to intermittent supply and service gaps within several neighborhoods. Strengthening the system through new tube wells, solar-powered pumping units, expanded storage facilities, and network rehabilitation will be essential to ensure long-term reliability, improve service continuity, and meet the projected urban water demand by 2045.

6.8.5.3 Proposed Water Supply System Prang Ghar Tehsil

To cater to the projected rural water demand of Prang Ghar Tehsil up to the year 2045, a phased and sustainable groundwater-based water supply system is proposed. The design framework follows PHED and WASA rural water supply standards, incorporating maximum day and peak hour demand factors to ensure system reliability and resilience.

Proposed Source (New Tube-Well)

Design Basis

Groundwater abstraction will be undertaken from the Prang Ghar alluvial aquifer, which exhibits favorable yield potential for long-term extraction. New deep tube wells are proposed at strategic locations to serve population clusters through localized distribution networks. To enhance operational efficiency and reduce running costs, solar-powered pumping units are recommended for all new and rehabilitated water supply schemes.

Unit Well Capacity:

Each production well will be designed for a discharge of 1.00 cusec (≈ 0.65 MGD) under continuous operation. This higher capacity minimizes the number of required wells while maintaining operational flexibility and redundancy. Each tube well will include a chlorination unit, flow meter, and solar/standby generator backup to ensure uninterrupted operation during power outages or maintenance cycles.

Service Objective:

The proposed system is designed to meet the projected maximum day demand of 1.10 MGD by 2045, including a 15% redundancy margin to accommodate seasonal fluctuations, maintenance downtime, and emergency condition.

Stage	Implementation Period	Urban Demand to be Met (MGD)	New Production Wells*	Key Siting/Design Considerations
Immediate	2025 – 2030	up to 0.437	1 wells	Serve central villages near Prang Ghar Bazaar; locate wells on

				elevated sites for gravity-fed distribution; solar pumping for energy efficiency.
Long-Term	2041 – 2045	up to 0.624	2 wells	Expand system to remote clusters; upgrade OHRs and replace aging wells to maintain full service coverage.

6.8.5.3.1 Rural Areas (VCs – 15 GPCD)

For rural settlements in Prang Ghar Tehsil, smaller localized overhead reservoirs (OHRs) are proposed to provide reliable service and maintain supply continuity during power or mechanical interruptions. Each reservoir will provide a 12-hour storage buffer based on maximum day demand.

Purpose:

- Ensure consistent and reliable supply for rural communities.
- Provide a 12-hour operational buffer during outages or maintenance.
- Reduce stress on groundwater abstraction systems by regulating pumping cycles

Phased Capacities (based on projected demand):

Year	Maximum Day Demand (MGD)	12-Hour Buffer (MG)	Recommended OHR Capacity (MG)
2025	0.43	0.25	0.50
2040	0.44	0.25	0.50
2045	0.62	0.35	0.50

6.8.5.4 Existing situation of the sanitation/drainage system in Prang Ghar Tehsil (Katcha, Pucca, open and covered etc.).

Wastewater disposal in Prang Ghar Tehsil is predominantly on-site and unregulated. Most households utilize single or twin-chamber septic tanks with soakage pits, often constructed without proper design or maintenance, leading to groundwater contamination and surface ponding during wet seasons.

Drainage infrastructure across villages is rudimentary, consisting mainly of unlined open drains that discharge into natural depressions or agricultural lands. These drains often overflow

during rainfall due to poor slopes, silting, and solid waste accumulation, resulting in localized flooding and unsanitary conditions.

Rural Area Wise Existing and Projected Wastewater Generation – Prang Ghar Tehsil

Wastewater generation has been calculated as (85% + 5%) of average daily water demand, with peak sewage flow taken as twice the average flow, and stormwater inflow as 50% of peak flow.

Rural Area Wise Existing and Proposed Wastewater Demand – Prang Ghar Tehsil:

Year	Urban Population	Average Water Demand (MGD)	Wastewater Generation @ (85% + 5%) (MGD)	Peak Sewage Flow (MGD)	Stormwater Inflow (50% of Peak) (MGD)	Total Design Flow (MGD)
2023	28,454	0.43	0.38	1.15	0.58	1.73
2025	29,433	0.44	0.40	1.19	0.60	1.79
2045	41,269	0.62	0.56	1.67	0.84	2.51

The total wastewater generation in Prang Ghar Tehsil is projected to rise from 1.73 MGD in 2025 to 2.51 MGD by 2045, highlighting the necessity for improved on-site sanitation systems, lined drainage channels, and future community-level wastewater treatment facilities. These interventions will be vital for protecting groundwater quality, reducing public health risks, and improving environmental hygiene across the tehsil.

Rural Area Wise Existing and Proposed Wastewater Demand – Prang Ghar Tehsil VCs

In the rural villages of Prang Ghar Tehsil, where household clusters are scattered and the terrain is uneven, a conventional gravity sewer network is neither economically nor technically feasible. Full-scale pipe sewers demand high capital investment, continuous flow velocities, and regular skilled maintenance requirements that are impractical in sparsely populated settlements.

Instead, decentralized on-site sanitation is recommended. A combination of household septic tanks with soakage pits (leach pit) provides a low-cost, low-maintenance, and environmentally sound solution. This approach is well-suited to PRANG GHAR TEHSIL's permeable sandy–gravel soils, which facilitate infiltration, and to the region's limited water availability.

Treatment Process

Wastewater from each dwelling enters a sealed septic tank, where solids settle to form sludge and lighter materials form a scum layer.

The clarified effluent passes to a soakage pit, where it percolates through the surrounding soil for further natural filtration and pathogen reduction.

Typical performance of a well-maintained system:

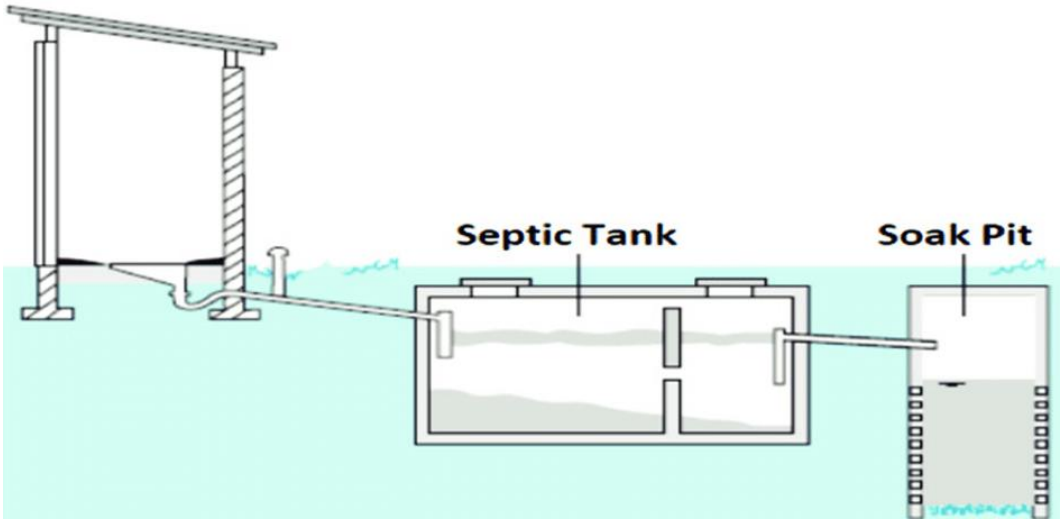
Suspended Solids (TSS): 80–90 % removal

Biochemical Oxygen Demand (BOD): 60–80 % reduction

Pathogens: 80–90 % reduction

Nutrients (N & P): 60–80 % reduction

This treatment level is adequate for protecting PRANG GHAR TEHSIL's shallow aquifers and preventing nuisance conditions when tanks are properly sited and desludging.



6.8.5.5 Design of Soakage pit & Septic tank

The capacity of soakage pits has been determined based on the daily effluent generation and required retention time, considering local soil permeability and infiltration characteristics

Retention days for pit = 2 days

Void ratio = 0.35.

Worked results & recommended pit diameters

Calculated required gross pit volumes and approximate circular pit diameters for two practical depths (1.5 m and 2.0 m):

Household	Gross pit vol (m^3)	Gross vol (L)	Diameter for depth = 1.5 m (m)	Diameter for depth = 2.0 m (m)
4 p	0.993 m^3	993 L	0.92 m	0.80 m
6 p	1.489 m^3	1,489 L	1.12 m	0.97 m
8 p	1.986 m^3	1,986 L	1.30 m	1.12 m
10 p	2.482 m^3	2,482 L	1.45 m	1.26 m

Practical recommendation: use a cylindrical pit Dia 1.0–1.5 m and depth 1.5–2.0 m depending on household size/percolation — e.g.

4–6 persons - Ø 1.0 m, depth 1.5–2.0 m

8–10 persons - Ø 1.2–1.5 m, depth 1.5–2.0 m

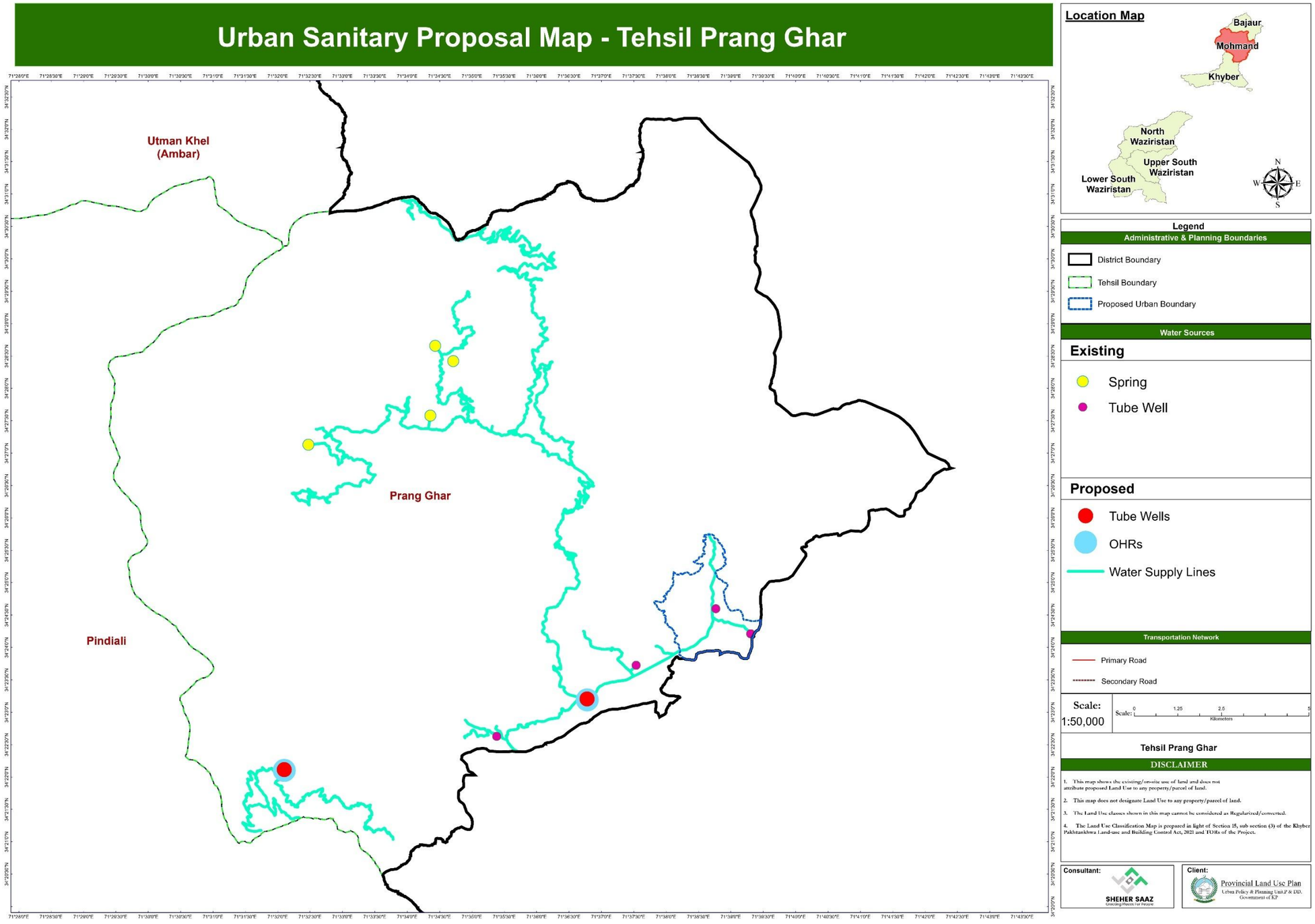
6.8.5.5.1 Construction & installation

Each household within Prang Ghar Tehsil rural settlements will be equipped with an independent on-site sanitation system consisting of a two-chamber reinforced concrete septic tank followed by a soakage pit. The septic tank will be constructed with inlet and outlet baffles, manhole access covers for periodic maintenance, and adequate structural cover and waterproofing to ensure durability and watertightness. The inlet invert shall be set approximately 150 mm below the outlet invert to maintain smooth hydraulic flow and effective sedimentation within the tank. Effluent from the outlet chamber will flow into a distribution box or soakage pit, fitted with a mosquito-proof vent to prevent vector breeding. Scheduled desludging every 3 to 5 years shall be carried out based on sludge accumulation and household usage patterns.

The soakage pit will be constructed using graded coarse aggregate (void ratio ≈ 0.35) and enclosed with geotextile lining to prevent silt ingress and maintain percolation efficiency. It shall be located at a minimum horizontal distance of 10 meters from any potable water source, preferably within a 15 to 30 meter separation buffer and positioned downslope of wells or boreholes to minimize groundwater contamination risks. The pit bottom shall maintain at least 1.0 meter vertical clearance above the seasonal high groundwater table to ensure effective infiltration. A reinforced concrete collar and inspection opening will be provided to prevent surface runoff intrusion and facilitate routine inspection.

This on-site sanitation system represents a low-cost, sustainable, and environmentally safe wastewater management solution suitable for Prang Ghar Tehsil scattered rural settlements, where centralized sewerage infrastructure is economically and technically unviable. It ensures hygienic disposal of domestic wastewater while protecting groundwater resources and public health.

Map 54: Proposed Urban Sanitary Map - Tehsil Prang Ghar



6.8.6 Tehsil Upper Mohmand

6.8.6.1 Existing coverage of the water supply/gaps in demand

The settlements of Upper Mohmand (Baizai) Tehsil primarily depend on small-scale, government-operated and community-managed water supply schemes, utilizing groundwater abstraction through tube wells, hand pumps, and shallow dug wells. Most of these systems are solar-powered, with a few electric-powered units serving central clusters such as Baizai Bazaar and adjoining villages. These schemes generally operate for 6–8 hours daily, with discharges ranging between 2,500–5,000 gallons per hour (GPH).

At present, approximately 35–40% of the tehsil's population is connected to piped water supply systems, while the remaining households rely on individual or communal hand pumps and open wells. Although functional, many systems face operational interruptions due to equipment failure, power shortages, and declining groundwater tables during dry seasons. Consequently, the service remains irregular and inadequate in several peripheral and upland areas.

6.8.6.1.1 Urban Area Wise Existing and Proposed Water Demand of Upper Mohmand

Based on population projections, the urban population of Upper Mohmand (Baizai) Tehsil is expected to increase from 10,015 persons in 2025 to 11,682 persons by 2045, reflecting gradual densification and limited expansion within existing semi-urban clusters. Using an urban per capita water consumption standard of 35 gallons per capita per day (GPCD), the average daily urban water demand is projected to rise from 0.35 MGPD in 2025 to 0.41 MGPD by 2045. Correspondingly, the maximum-day demand is expected to increase from 0.53 MGPD to 0.61 MGPD, while the peak-hour demand will grow from 0.79 MGPD to 0.92 MGPD over the planning horizon. These incremental increases highlight the need for targeted improvements in groundwater abstraction, modest expansion of storage facilities, and gradual upgrading of distribution networks to ensure reliable and adequate urban water supply services in Upper Mohmand (Baizai) Tehsil.

Year	Urban Population	Water Demand (MGPD)	Maximum Day Demand (MGPD)	Peak Hour Demand (MGPD)
2025	10,015	0.35	0.53	0.79
2040	10,156	0.36	0.53	0.80
2045	11,682	0.41	0.61	0.92

6.8.6.1.2 Rural Area Wise Existing and Proposed Water Demand of Upper Mohmand Tehsil (Baizai)

Based on population projections, the rural population of Upper Mohmand (Baizai) Tehsil is expected to increase from 43,243 persons in 2025 to 50,443 persons by 2045, reflecting natural population growth and gradual expansion of dispersed rural settlements. Using a rural

per capita water consumption standard of 15 gallons per capita per day (GPCD), the average daily rural water demand is projected to increase steadily over the planning horizon. Correspondingly, maximum-day and peak-hour demands are also expected to rise in proportion to population growth, placing additional pressure on existing groundwater-based supply systems. These increasing requirements highlight the need for strengthening groundwater abstraction through tube wells and improved hand pump coverage, enhancing storage provisions, and upgrading rural distribution systems to ensure reliable, equitable, and sustainable water supply services across the rural areas of Upper Mohmand (Baizai) Tehsil.

Year	Urban Population	Water Demand (MGPD)	Maximum Day Demand (MGPD)	Peak Hour Demand (MGPD)
2023	54,532	0.82	1.23	1.84
2025	64,979	0.97	1.46	2.19
2045	100,610	1.51	2.26	3.40

The steady and substantial increase in projected water demand underscores the need for systematic expansion, rehabilitation, and modernization of the existing water supply infrastructure. Enhancing groundwater abstraction capacity, constructing new tube wells, integrating solar pumping systems, and improving storage and distribution networks will be essential to ensure safe, equitable, and reliable water supply services across Upper Mohmand (Baizai) Tehsil's growing urban and semi-urban settlements.

6.8.6.2 Proposed Water Supply System Upper Mohmand Tehsil (Baizai)

To address projected water requirements through 2045, a phased and sustainable water supply system is proposed for Upper Mohmand (Baizai) Tehsil. The design framework follows PHED and WASA standards, adopting 15 GPCD for rural areas and 35 GPCD for semi-urban settlements.

The proposed system accounts for maximum day and peak hour factors, ensuring operational flexibility, resilience, and sufficient capacity to meet long-term demand. Key components include sustainable groundwater abstraction, solar-powered pumping, modular storage reservoirs, and gravity-fed distribution networks to ensure equitable water access across all settlements.

6.8.6.2.1 Proposed Source (New Tube-Well)

Design Basis

Groundwater will remain the principal source for the proposed water supply network in Upper Mohmand (Baizai) Tehsil. Productive aquifer zones identified through hydrogeological investigations will be tapped using deep tube wells, ensuring sustainable yield and aquifer protection against over-extraction.

To enhance operational efficiency and reduce energy dependency, solar-powered pumping systems will be installed wherever feasible, particularly in off-grid and remote villages.

Unit Well Capacity:

Each production well will be designed to yield a continuous discharge of 0.75 MGD (≈1.16 cusec), representing optimal performance for local aquifer conditions. Standby arrangements will ensure uninterrupted operation during maintenance or mechanical downtime.

Service Objective:

The proposed system aims to meet a maximum day demand of 1.76 MGD by 2045, including a 15% redundancy margin for maintenance and emergency conditions.

Stage	Implementation Period	Rural Demand to be Met (MGD)	New Production Wells*	Key Siting / Design Considerations
Immediate	2025 – 2030	0.82	2 wells	Prioritize Baizai Bazaar and nearby settlements; site wells at elevated locations for gravity-fed distribution; install solar units.
Long-Term	2041 – 2045	1.51	3 wells	Expand to peripheral settlements; rehabilitate aging wells; ensure hydraulic coordination with OHRs for pressure management.

6.8.6.2.2 Water Storage

Rural Areas (VCs – 15 GPCD)

For rural areas of Upper Mohmand (Baizai) Tehsil, localized Overhead Reservoirs (OHRs) are proposed to provide consistent supply and storage capacity for a 12-hour operational buffer.

Purpose:

- Ensure consistent and reliable supply for rural communities.
- Provide a 12-hour operational buffer during outages or maintenance.
- Reduce stress on groundwater abstraction systems by regulating pumping cycles

Phased Capacities (based on projected demand):

Year	Maximum Day Demand (MGD)	12-Hour Buffer (MG)	Recommended OHR Capacity (MG)
2025	0.97	0.48	0.40 – 0.45

2040	0.99	0.5	0.70 – 0.75
2045	1.13	0.88	0.85 – 0.90

6.8.6.3 Existing situation of the sanitation/drainage system in Upper Mohmand Tehsil (Baizai) (Katcha, Pucca, open and covered etc.).

Wastewater generation in Upper Mohmand (Baizai) Tehsil is estimated at 85% of the average daily water demand, with an additional 5% allowance for non-domestic uses such as small-scale commercial and institutional activities.

For hydraulic design, the peak sewage flow is taken as twice the average daily sewage flow, while stormwater inflow is assumed as 50% of the peak flow to account for combined inflows during monsoon conditions. Infiltration losses are considered at 10% of the average sewage flow, consistent with local soil and groundwater characteristics:

Urban Area Wise Existing and Proposed Wastewater Demand – Upper Mohmand Tehsil (Baizai)VCs:

Year	RURAL Population	Average Water Demand (MGD)	Wastewater Generation @ (85% + 5%) (MGD)	Peak Sewage Flow (MGD)	Stormwater Inflow (50% of Peak) (MGD)	Total Design Flow (MGD)
2023	10,014.92	0.15	0.14	0.41	0.20	0.61
2025	10,156.11	0.15	0.14	0.41	0.21	0.62
2045	11,682.31	0.18	0.16	0.47	0.24	0.71

The total wastewater generation is projected to increase from 0.61 MGD in 2025 to 0.71 MGD by 2045, underscoring the need for structured on-site sanitation and decentralized treatment interventions.

Rural Area Wise Existing and Proposed Wastewater Demand Upper Mohmand (Baizai) Tehsil VCs

In the rural villages of Upper Mohmand Tehsil (Baizai), where household clusters are scattered and the terrain is uneven, a conventional gravity sewer network is neither economically nor technically feasible. Full-scale pipe sewers demand high capital investment, continuous flow velocities, and regular skilled maintenance requirements that are impractical in sparsely populated settlements.

Instead, decentralized on-site sanitation is recommended. A combination of household septic tanks with soakage pits (leach pits) provides a low-cost, low-maintenance, and environmentally sound solution. This approach is well-suited to Barang's permeable sandy–gravel soils, which facilitate infiltration, and to the region's limited water availability.

Treatment Process

Wastewater from each dwelling enters a sealed septic tank, where solids settle to form sludge and lighter materials form a scum layer.

The clarified effluent passes to a soakage pit, where it percolates through the surrounding soil for further natural filtration and pathogen reduction.

Typical performance of a well-maintained system:

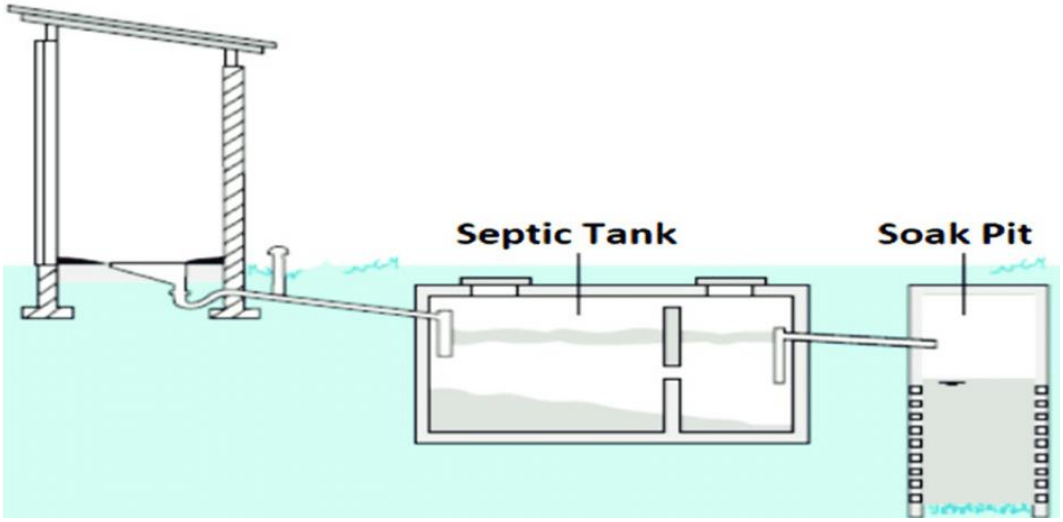
Suspended Solids (TSS): 80–90 % removal

Biochemical Oxygen Demand (BOD): 60–80 % reduction

Pathogens: 80–90 % reduction

Nutrients (N & P): 60–80 % reduction

This treatment level is adequate for protecting Upper Mohmand (Baizai) Tehsil shallow aquifers and preventing nuisance conditions when tanks are properly sited and desludging.



Wastewater quality & Treatment Yake Tehsil

The disposal of untreated wastewater into open drains, streams, and agricultural fields is a major cause of environmental degradation in Upper Mohmand (Baizai) Tehsil, contaminating both surface and groundwater resources. To address this challenge, a phased wastewater treatment strategy is proposed.

A centralized Wastewater Treatment Plant (WWTP) will be established near the Barang central plain, serving the urban NCs, while smaller decentralized treatment units (waste stabilization ponds or aerated lagoons) will be developed near rural clusters for VCs.

The WWTP design will follow international and national best practices, with process design based on average sewage flow and pollution loads, and hydraulic design based on peak flows.

Treatment will target compliance with NEQS discharge limits (BOD < 80 mg/L, COD < 150 mg/L, TSS < 200 mg/L).

6.8.6.4 Design of Soakage pit & Septic tank

The capacity of soakage pits has been determined based on the daily effluent generation and required retention time, considering local soil permeability and infiltration characteristics

Retention days for pit = 2 days

Void ratio = 0.35.

Recommended pit diameters

Calculated required gross pit volumes and approximate circular pit diameters for two practical depths (1.5 m and 2.0 m):

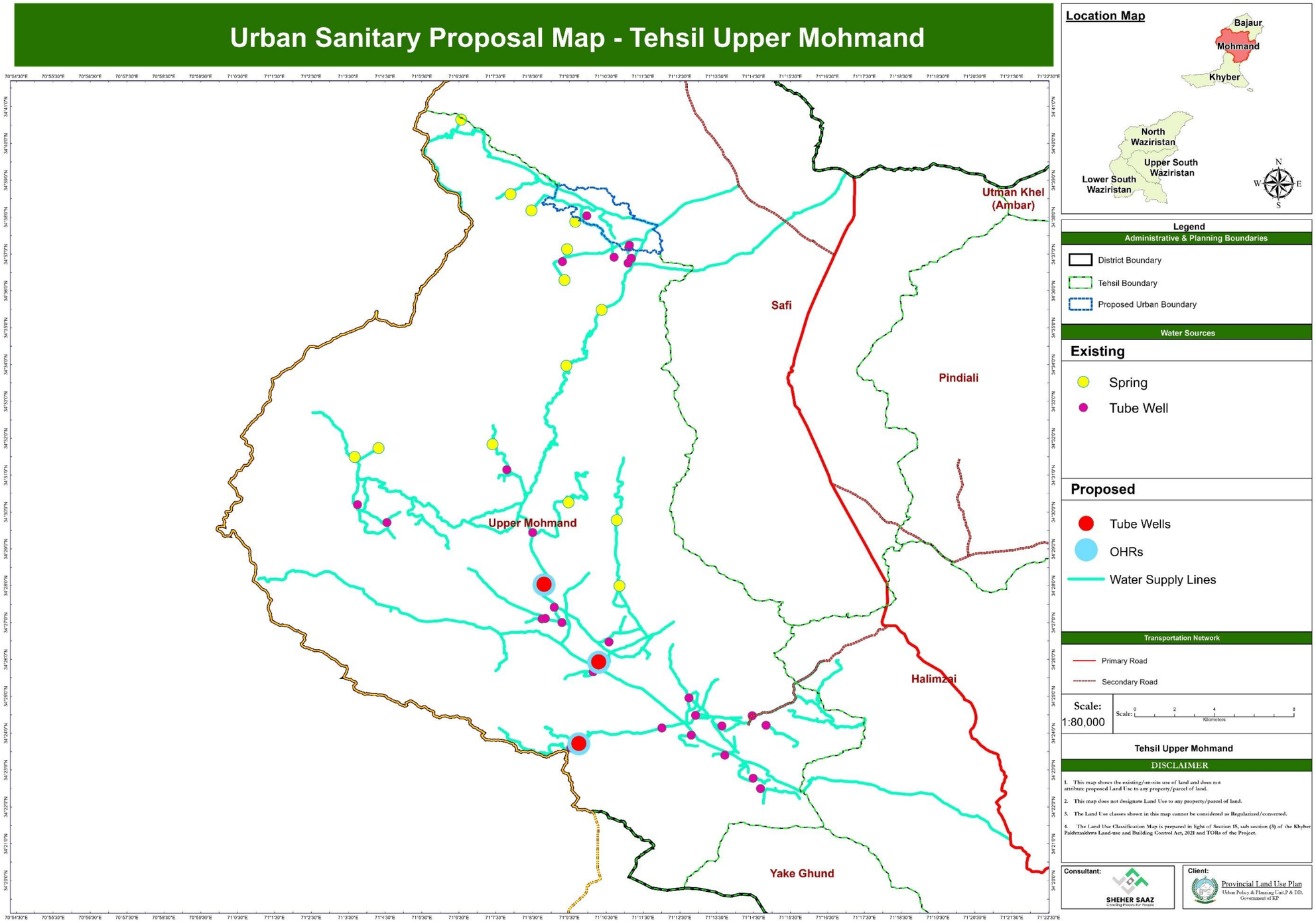
Household	Gross pit vol (m^3)	Gross vol (L)	Diameter for depth = 1.5 m (m)	Diameter for depth = 2.0 m (m)
4 p	0.993 m^3	993 L	0.92 m	0.80 m
6 p	1.489 m^3	1,489 L	1.12 m	0.97 m
8 p	1.986 m^3	1,986 L	1.30 m	1.12 m
10 p	2.482 m^3	2,482 L	1.45 m	1.26 m

Practical recommendation: use a cylindrical pit Dia 1.0–1.5 m and depth 1.5–2.0 m depending on household size/percolation — e.g.

4–6 persons = Ø 1.0 m, depth 1.5–2.0 m

8–10 persons = Ø 1.2–1.5 m, depth 1.5–2.0 m

Map 55: Proposed urban Sanitary Map - Tehsil Upper Mohmand



6.8.7 Tehsil Yake Ghund

6.8.7.1 Existing coverage of the water supply/gaps in demand in Yake Tehsil

The settlements of Yake Tehsil presently rely on a combination of small-scale government-operated and community-managed water supply schemes, primarily based on groundwater abstraction through tube wells, hand pumps, and dug wells. Most of these systems are solar-powered, with limited electrically operated setups serving the more densely populated localities. On average, these schemes operate for 6–8 hours per day, with individual well discharges ranging between 2,500–5,000 gallons per hour (GPH).

Currently, approximately 35–40% of the population in Yake Tehsil is connected to piped water supply systems, while the remaining residents depend on individual or communal hand pumps and open wells. These systems, though functional, often face operational interruptions due to equipment malfunction, falling groundwater levels during the dry season, and insufficient maintenance. Consequently, service delivery remains intermittent and unreliable in several areas.

6.8.7.1.1 Urban Area Wise Existing and Proposed Water Demand of Ekkaghund

Based on projected population growth, the urban population of Yake Tehsil is expected to increase from 10,332 persons in 2025 to 16,268 persons by 2045, reflecting gradual densification and expansion within existing urban clusters. Applying the urban design standard of 35 gallons per capita per day (GPCD), the average daily water demand is projected to rise from 0.36 MGPD in 2025 to 0.57 MGPD by 2045.

Correspondingly, the maximum-day demand is expected to increase from 0.54 MGPD to 0.85 MGPD, while the peak-hour demand will rise from 0.81 MGPD to 1.28 MGPD over the same period. These projections underscore the growing need for expanded and resilient urban water supply infrastructure to support Yake Tehsil's increasing population.

Year	Urban Population	Water Demand (MGPD)	Maximum Day Demand (MGPD)	Peak Hour Demand (MGPD)
2023	9,873	0.35	0.52	0.78
2025	10,332	0.36	0.54	0.81
2045	16,268	0.57	0.85	1.28

To meet future demand, priority interventions should focus on the development of deep tube wells, enhancement of water storage capacity, and expansion of distribution networks to underserved areas. Strengthening source sustainability, improving operational efficiency, and ensuring water quality compliance will be essential for achieving reliable and equitable urban water supply services across Yake Tehsil.

6.8.7.1.2 Urban Area Wise Existing and Proposed Water Demand of Ekkaghund

Based on projected population growth, the urban population of Yake Tehsil is expected to increase from 10,332 persons in 2025 to 16,268 persons by 2045, reflecting gradual densification and expansion within existing urban clusters. Applying the urban design standard of 35 gallons per capita per day (GPCD), the average daily water demand is projected to rise from 0.36 MGPD in 2025 to 0.57 MGPD by 2045.

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6.8.7.1.3 Proposed Water Supply System Yake Tehsil

To address the projected water demand of Yake Tehsil covering both rural and semi-urban settlements up to the year 2045, a phased and sustainable water supply system is proposed. The design is based on 15 GPCD for rural areas and 35 GPCD for semi-urban areas, following PHED and WASA standards.

The system design integrates maximum day and peak hour demand factors, ensuring operational flexibility, resilience, and capacity for future population growth. Key elements of the proposed scheme include sustainable groundwater abstraction, solar-powered pumping, and modular water storage reservoirs for reliable service delivery.

6.8.7.2 Proposed Source (New Tube-Well)

Design Basis

Groundwater abstraction will be the principal source for the proposed water supply network in Yake Tehsil. Wells will tap into productive aquifer zones identified through hydrogeological surveys, ensuring long-term sustainability without over-extraction.

To promote energy efficiency, solar-powered pumping systems are recommended, especially for off-grid and remote settlements, minimizing operational costs and improving service continuity.

Unit Well Capacity:

Each production well will be designed to yield a continuous discharge of 0.75 MGD (≈1.16 cusec). This capacity ensures efficient groundwater extraction, manageable maintenance, and operational redundancy to maintain continuous service during outages.

Service Objective:

The proposed system is designed to meet a maximum day demand of 1.85 MGD by 2045, including a 15% redundancy margin for operational downtime and emergencies. This configuration ensures reliable and sustainable water service across all settlements.

Stage	Implementation Period	Rural Demand to be Met (MGD)	New Production Wells*	Key Siting / Design Considerations
Immediate	2025 – 2030	up to	2 wells	Extend coverage to peripheral clusters; connect wells to new OHRs; ensure standby operation and fencing.
Long-Term	2041 – 2045	up to 1.85	4 wells	Expand network to remote settlements; replace aging wells; ensure OHR coordination for pressure management.

6.8.7.2.1 Water Storage

Urban Areas (VCs – 15 & 35GPCD)

For rural settlements in Yake Tehsil, localized Overhead Reservoirs (OHRs) are proposed to provide consistent supply and operational reliability. Each OHR will provide a 12-hour service buffer, ensuring stable supply during power interruptions or maintenance shutdowns.

Purpose:

- Ensure consistent and reliable supply for rural communities.
- Provide a 12-hour operational buffer during outages or maintenance.
- Reduce stress on groundwater abstraction systems by regulating pumping cycles

Phased Capacities (based on projected demand):

Year	Maximum Day Demand (MGD)	12-Hour Buffer (MG)	Recommended OHR Capacity (MG)
2025	0.60	0.3	0.35

2040	0.61	0.3	0.35
2045	0.70	0.35	0.35

6.8.7.3 Existing situation of the sanitation/drainage system in Yake Tehsil (Katcha, Pucca, open and covered etc.).

Wastewater generation in Yake Tehsil has been estimated at 85% of the average daily water demand, with an additional 5% allowance for non-domestic usage, including small-scale commercial and institutional activities.

For hydraulic design purposes, the peak sewage flow is taken as twice the average daily sewage flow, while stormwater inflow is considered 50% of the peak flow to account for combined inflows during the monsoon season. Additionally, 10% infiltration losses have been incorporated to reflect local soil and hydrogeological conditions.

Based on the design per capita water demand of 15 GPCD, the corresponding per capita sewage generation is approximately 7.5 GPCD, typical for rural and semi-urban settlement:

Urban Area Wise Existing and Proposed Wastewater Demand – Yake TehsilVCs:

Year	RURAL Population	Average Water Demand (MGD)	Wastewater Generation @ (85% + 5%) (MGD)	Peak Sewage Flow (MGD)	Stormwater Inflow (50% of Peak) (MGD)	Total Design Flow (MGD)
2025	53,258.54	0.80	0.72	2.16	1.08	3.24
2040	54,009.40	0.81	0.73	2.19	1.09	3.28
2045	62,125.60	0.93	0.84	2.52	1.26	3.77

Based on rural population projections, wastewater generation in Yake Tehsil's rural settlements is expected to increase gradually in line with population growth and water consumption trends. With a rural population of 53,258.54 in 2025, rising to 62,125.60 by 2045, and corresponding average water demand increasing from 0.80 MGD to 0.93 MGD, wastewater generation (calculated at 85% plus 5% allowance) is projected to rise from 0.72 MGD in 2025 to 0.84 MGD by 2045.

Peak sewage flows are expected to increase from 2.16 MGD to 2.52 MGD, while stormwater inflows, assumed at 50% of peak sewage flow, will rise from 1.08 MGD to 1.26 MGD over the planning horizon. Consequently, the total design flow for rural wastewater systems is projected to increase from 3.24 MGD in 2025 to 3.77 MGD by 2045.

These projections highlight the need for a phased and integrated rural sanitation strategy, focusing on improved on-site sanitation systems, development of decentralized wastewater treatment solutions, protection of groundwater resources, and enhancement of rural drainage infrastructure. Implementing these measures will be critical to ensuring

environmentally safe, resilient, and sustainable wastewater management across the rural areas of Yake Tehsil.

Rural Area Wise Existing and Proposed Wastewater Demand Yake Tehsil VCs

In the rural villages of Yake Tehsil, where household clusters are scattered and the terrain is uneven, a conventional gravity sewer network is neither economically nor technically feasible. Full-scale pipe sewers demand high capital investment, continuous flow velocities, and regular skilled maintenance requirements that are impractical in sparsely populated settlements.

Instead, decentralized on-site sanitation is recommended. A combination of household septic tanks with soakage pits (leach pits) provides a low-cost, low-maintenance, and environmentally sound solution. This approach is well-suited to Barang's permeable sandy–gravel soils, which facilitate infiltration, and to the region's limited water availability.

Treatment Process

Wastewater from each dwelling enters a sealed septic tank, where solids settle to form sludge and lighter materials form a scum layer.

The clarified effluent passes to a soakage pit, where it percolates through the surrounding soil for further natural filtration and pathogen reduction.

Typical performance of a well-maintained system:

- Suspended Solids (TSS): 80–90 % removal
- Biochemical Oxygen Demand (BOD): 60–80 % reduction
- Pathogens: 80–90 % reduction
- Nutrients (N & P): 60–80 % reduction

This treatment level is adequate for protecting Barang's shallow aquifers and preventing nuisance conditions when tanks are properly sited and desludging.

Wastewater quality & Treatment Yake Tehsil

The disposal of untreated wastewater into open drains, streams, and agricultural fields is a major cause of environmental degradation in Yake Tehsil, contaminating both surface and groundwater resources. To address this challenge, a phased wastewater treatment strategy is proposed.

A centralized Wastewater Treatment Plant (WWTP) will be established near the Barang central plain, serving the urban NCs, while smaller decentralized treatment units (waste stabilization ponds or aerated lagoons) will be developed near rural clusters for VCs.

The WWTP design will follow international and national best practices, with process design based on average sewage flow and pollution loads, and hydraulic design based on peak flows. Treatment will target compliance with NEQS discharge limits (BOD < 80 mg/L, COD < 150 mg/L, TSS < 200 mg/L).

6.8.7.4 Design of Soakage pit & Septic tank

The capacity of soakage pits has been determined based on the daily effluent generation and required retention time, considering local soil permeability and infiltration characteristics

Retention days for pit = 2 days

Void ratio = 0.35.

Recommended pit diameters

Calculated required gross pit volumes and approximate circular pit diameters for two practical depths (1.5 m and 2.0 m):

Household	Gross pit vol (m^3)	Gross vol (L)	Diameter for depth = 1.5 m (m)	Diameter for depth = 2.0 m (m)
4 p	0.993 m^3	993 L	0.92 m	0.80 m
6 p	1.489 m^3	1,489 L	1.12 m	0.97 m
8 p	1.986 m^3	1,986 L	1.30 m	1.12 m
10 p	2.482 m^3	2,482 L	1.45 m	1.26 m

Practical recommendation: use a cylindrical pit Dia 1.0–1.5 m and depth 1.5–2.0 m depending on household size/percolation — e.g.

4–6 persons = Ø 1.0 m, depth 1.5–2.0 m

8–10 persons = Ø 1.2–1.5 m, depth 1.5–2.0 m

6.8.7.4.1 Construction & installation

Each household within Yake Tehsil rural settlements will be equipped with an independent on-site sanitation system consisting of a two-chamber reinforced concrete septic tank followed by a soakage pit. The septic tank will be designed with inlet and outlet baffles, manhole covers for periodic desludging and inspection, and adequate structural reinforcement and waterproofing to ensure durability and watertight performance. The inlet invert level shall be maintained approximately 150 mm below the outlet invert to promote uniform flow and effective sedimentation of solids.

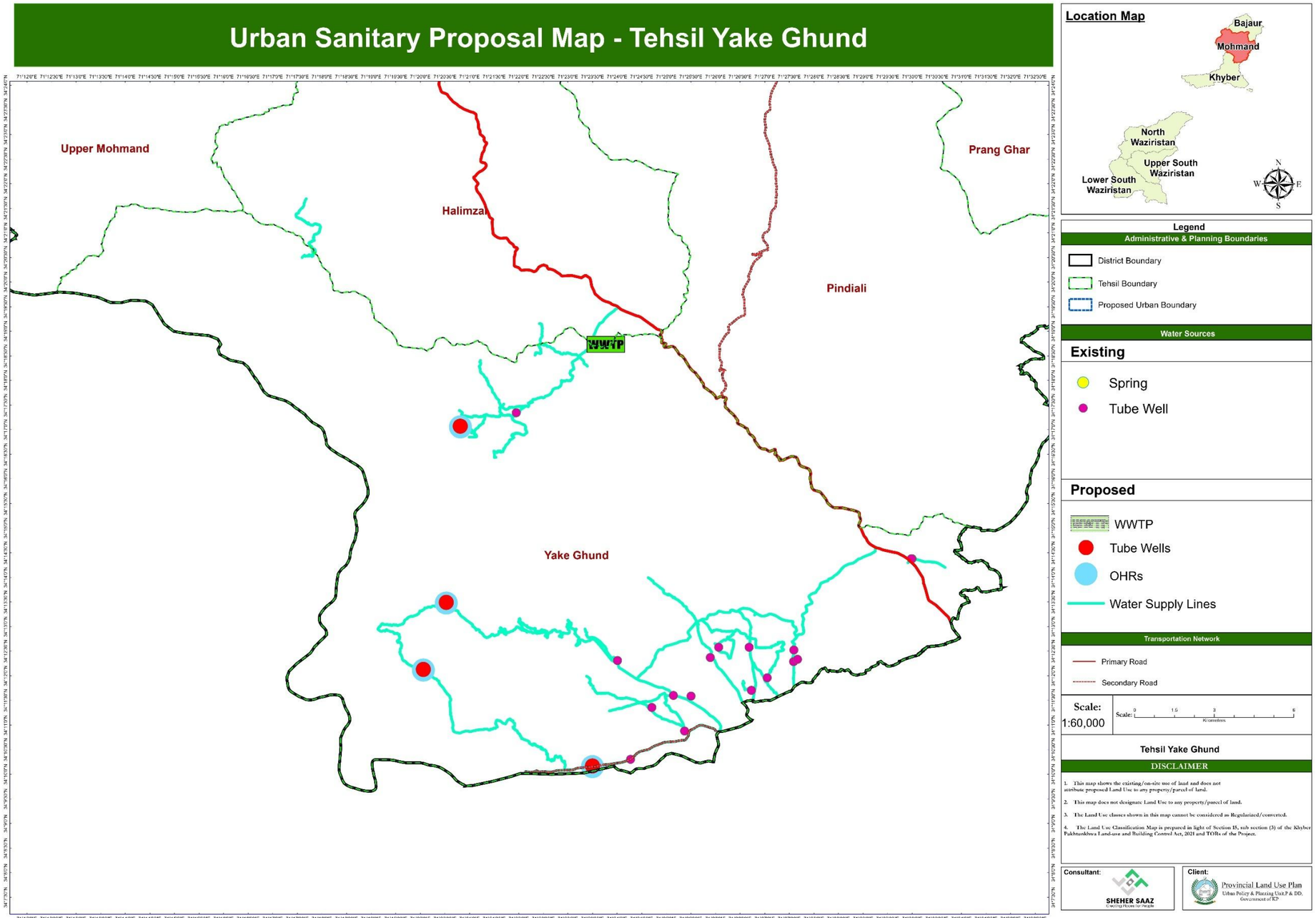
Effluent from the outlet chamber will be directed to a distribution box or soakage pit, provided with a mosquito-proof vent to prevent vector breeding. Desludging operations shall be carried out every 3 to 5 years, depending on sludge accumulation and household water usage patterns.

The soakage pit will be filled with graded coarse aggregate (void ratio ≈ 0.35) and lined with geotextile fabric to minimize siltation and ensure long-term infiltration efficiency. The pit shall be located at least 10 meters away from any drinking water source, with a preferred separation of 15 to 30 meters and placed downslope of wells or boreholes to prevent groundwater contamination. A minimum vertical clearance of 1.0 meter shall be maintained

between the pit bottom and the seasonal high groundwater table. Each pit will include a reinforced concrete collar and an inspection cover to prevent surface water ingress and facilitate maintenance.

This decentralized on-site sanitation system offers a safe, cost-effective, and environmentally sustainable wastewater management solution tailored to the rural context of Yake Tehsil, where the absence of a centralized sewerage network and the scattered settlement pattern make individual household systems the most practical and hygienic option.

Map 56: Proposed Urban Sanitary Map - Tehsil Yake Ghund



6.9 SOLID WASTE MANAGEMENT

6.9.1 Existing Condition of Solid Waste Management

The solid waste management challenges prevail in District Mohmand. Solid waste in Mohmand encompasses various types, including residential, commercial, industrial, and agricultural waste, with major contributors being urban centers and bazaars. Currently, waste management in these areas lacks advanced recycling techniques found in more developed regions. Instead, waste disposal practices predominantly involve dumping in open spaces or designated dumpsites known locally as "Deran," leading to severe environmental repercussions such as soil degradation and potential contamination of groundwater resources.

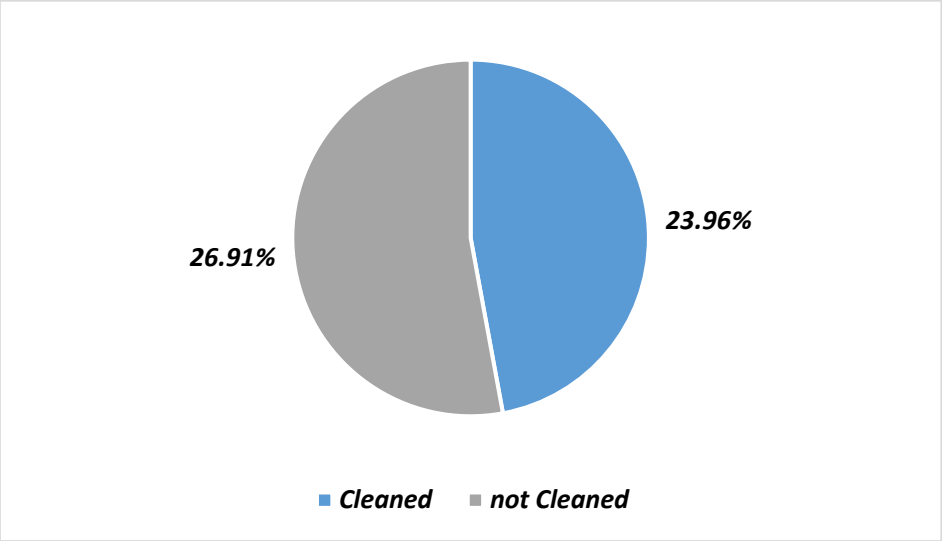
The condition of waste disposal sites in Mohmand reveals noticeable environmental impacts. The absence of a formal waste management system exacerbates these issues, as garbage is often discarded in roadside areas or open spaces in villages, and liquid waste is discharged into unlined drains. The waste in Mohmand contains high levels of organic matter. Plastic waste is consistently high across all monitored sites. Other components such as paper, clothes, and metals are present in varying concentrations. The presence of heavy metals in the waste further exacerbates environmental concerns, affecting soil chemistry and potentially impairing plant growth.

Addressing these issues is crucial for improving waste management practices in Mohmand and mitigating the associated environmental impacts. The survey findings highlight significant gaps in SWM and overall cleanliness across the Mohmand region. As illustrated in Figure below, only 24 percent of the assessed areas were reported as “cleaned,” while 27 percent remained “not cleaned,” and a further 49 percent of data was missing. This distribution underscores systemic challenges in municipal solid waste collection, disposal, and monitoring, with implications for public health, environmental sustainability, and community well-being. The data points to the urgent need for targeted investments in SWM infrastructure, strengthened capacity of municipal authorities, and the promotion of community-led cleanliness initiatives. Addressing these service delivery gaps will not only improve environmental outcomes but also directly enhance the health, productivity, and resilience of urban and peri-urban populations in the Mohmand region.

Table 101: Solid Waste and Cleanliness in Mohmand District, KP

SOLID WASTE AND CLEANLINESS		
Sr. #		Percentage (%)
1	Cleaned	23.96
2	Not Cleaned	26.9
3	Missing	49.13
	Total	**100.00**

Figure 23: Community response for the Solid Waste and Cleanliness situation in Mohmand District

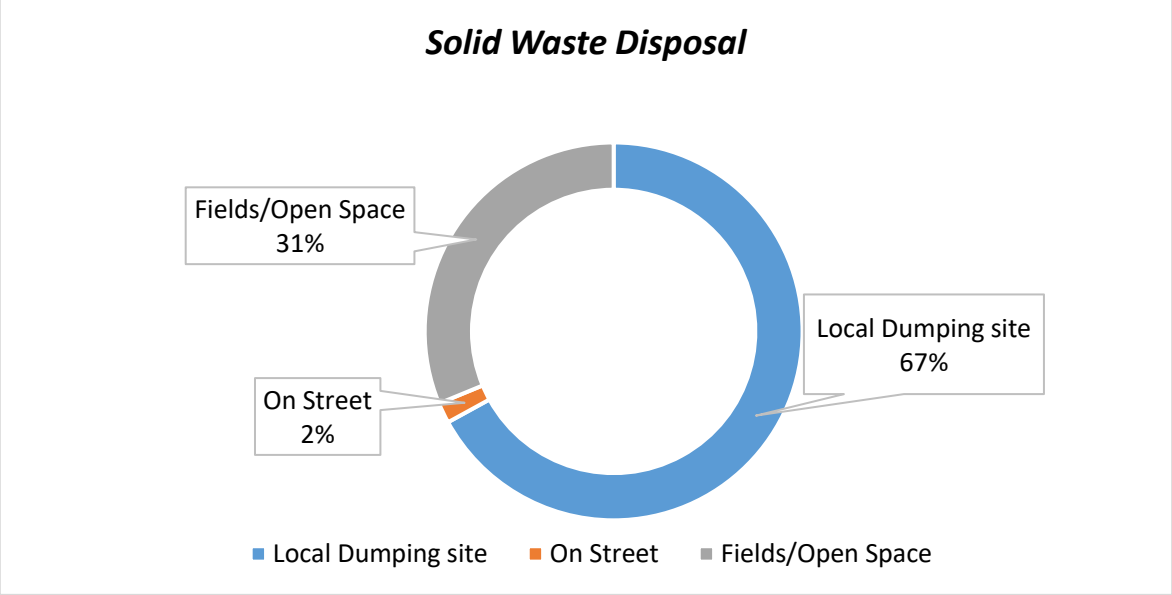


Source: Devised by Consultant

The data reveals a heavy reliance on informal and environmentally harmful disposal practices. A striking 67.0 percent of solid waste is discarded at local dumping sites, highlighting both the absence of effective municipal collection systems and weak enforcement of waste management regulations. Smaller yet notable shares are disposed of in fields and open spaces (31.2 percent) and on streets (1.8 percent), further contributing to environmental degradation, blocked drainage systems, and heightened risks of vector-borne diseases. Formal waste management mechanisms appear almost non-existent: no households were reported to benefit from collection services by the Tehsil Municipal Administration (TMA) or the use of municipal containers. The "other" category, accounting for a marginal proportion, remains concerning due to its direct implications for water pollution and public health.

This pattern underscores an urgent need for systemic reforms. Scaling up municipal solid waste services, introducing community-level segregation and recycling initiatives, and establishing sanitary landfills are critical interventions. Without these measures, the current reliance on local dumping sites and open space disposal will continue to erode environmental quality, increase health risks, and undermine local development objectives in the Mohmand region.

Figure 24: Current Solid Waste Disposal Practices in District Mohmand, KP



Source: Devised by Consultant

6.9.2 Identification of Solid Waste Disposal Sites

In District Mohmand, there are currently no officially designated solid waste disposal sites. Field investigations have identified approximately seven locations within urban areas, primarily in and around Ghalanai, the district's main urban center, where garbage is regularly dumped.

These informal dumping grounds lack the infrastructure and environmental safeguards necessary to manage waste effectively. Waste is disposed of in local dumping sites, fields, open spaces, and on streets, contributing to pollution and creating unsanitary living conditions for the local population. The absence of proper waste disposal facilities, such as collection services by the TMA or municipal containers, poses significant environmental and public health risks, including soil and water contamination.

The reliance on these informal sites underscores the urgent need for a structured and sustainable waste management system in District Mohmand. Without official disposal sites, the district faces escalating environmental challenges that must be addressed through comprehensive planning and resource allocation. Establishing proper waste disposal facilities and enhancing the capacity of the TMA Ghalanai to manage waste effectively are critical interventions.

6.9.3 Current and Projected Solid Waste Generation in the settlement/ district.

In Pakistan, solid waste generation ranges between 0.283 to 0.612 kg/capita/day, with an estimated annual growth rate of 2.4%. Using an average waste generation of 0.45 kg/capita/day, the current and future solid waste generation for District Mohmand has been projected based on updated population estimates.

As of 2023, the district produces approximately 244 tons of solid waste per day, which equals about 89,060 tons per year. With a projected population of 580,462 in 2025, annual solid waste generation is expected to increase to 93,221 tons, and further rise to around 135,828 tons by 2045, corresponding to a population of approximately 845,756.

Table 102: Current and Projected Solid Waste Generation in Mohmand District, KP

Tehsil	Estimated SW 2025			Estimated SW 2045		
	Cluster Population	Estimated Solid Waste Generation (kg/Day)	Estimated Solid Waste Generation (Tons/Day)	Cluster Population 2045	Estimated Solid Waste Generation (kg/Day)	Estimated Solid Waste Generation (Tons/Day)
Halimzai Tehsil	55393.66	21603.5	23.8	88629.5	34565.51	38.02
Pindiali Tehsil	85236.67	33242.3	36.6	168246.8	65616.23	72.17
Paranghar Tehsil	11049.28	4309.2	4.7	15492.6	6042.13	6.64
Safi Tehsil	71625.25	27933.8	30.7	101641.1	39640.01	43.60
Yake Ghund Tehsil	5574.776	2174.2	2.4	8778.0	3423.43	3.76
Upper Mohmand Tehsil	36897.47	14390.0	15.8	42442.2	16552.45	18.20
Amber Tehsil	34189.95	13334.1	14.7	76091.14	29675.54	32.643
Total (Tons/ year)			**46970.3**			**78499.4**

6.9.4 Phase-Wise Development Proposal

This SWMP focuses on all of the Mohmand District, including seven Tehsils. The solid waste generated from different sources, including domestic level (households), Commercial waste, institutional waste (offices, educational institutes), industrial waste, hospital waste, and Construction and Demolition (C&D).

6.9.4.1 Strategic Approach for Solid Waste Management

The proposed Solid Waste Management Plan (SWMP) is designed to provide broad guidelines to suggest measures to manage the growing solid waste in the Mohmand District. This has been determined after assessing the potential and constraints in the existing SWM of the tehsils in Mohmand, particularly the reliance on informal "Deran" sites and the absence of formal collection

services. The proposed action plans aim to identify gaps in existing municipal services and address the needs for incremental population growth. Additionally, the plans include provisions for capacity building for the TMA Ghalanai to ensure effective operation and maintenance of municipal services.

One of the key principles underlying the waste management hierarchy is to ensure that waste is dealt with as high up the hierarchy as possible. Since all waste management options have some impact on the environment, the only way to avoid impact is not to produce waste in the first place, and waste prevention/avoidance reduction is therefore at the top of the hierarchy. Minimization of waste through re-use and recycling, followed by recovery techniques (treatment, composting, and generating energy from waste), follows, while disposal to landfill (the least favorable option) is at the bottom of the hierarchy. For Mohmand, this underscores the critical need to leapfrog from unregulated open dumping to establishing mid-hierarchy solutions like segregation, recycling, and composting, as a foundational step toward eventual sanitary landfilling.

- ***Objectives of the Waste Management Plan***

According to the developed vision, the following strategic objectives are to be achieved by 2045:

- Implement a comprehensive and sustainable approach to improve waste management in Mohmand District, including the collection, storage, transfer, disposal, and treatment of all types of waste, with a focus on eliminating open dumping at informal "Deran" sites.
- Provide new, improved, economical, efficient, and cost-effective solutions for SWM to ensure minimal environmental and social impacts, considering the socio-cultural norms and the specific geographical challenges of the district.
- Establish Mohmand District as a Model District with minimum waste generation, plotting the state-of-the-art waste-to-energy, zero plastic, Material recovery through reuse, repurpose, and composting units, tailored to the local waste composition and economic opportunities.

➢ ***Capacity Building, Awareness, and Advocacy of the Local Community***

Strengthen the capacity of local communities through targeted training, awareness campaigns, and advocacy programs focused on sustainable waste practices. Emphasize behavior change, segregation at source, and the environmental and health risks of open dumping and burning. Engage local District offices, and TMAs, women, and youth as key agents of change to ensure community ownership and long-term impact.

➢ ***Capacity building of DOs, TMAs***

- Develop and implement a structured waste collection schedule across all four tehsils, ensuring regular pickup, designated storage points, and coverage of remote settlements.
- Invest in basic waste infrastructure, including litter bins, covered transport vehicles, and intermediate waste storage stations, in line with NEQS and KPEPA 2014.

- Establish a data-driven monitoring system for waste volumes, disposal practices, and service delivery efficiency to guide evidence-based planning and compliance reporting.

Table 103: Summarizing the Solid Waste Management Recommendations for Mohmand District

Sr. No.	Component	Required Corrective Action
1	Waste Storage	• Implement door-to-door collection to decrease littering on streets and improve waste collection efficiency. • Develop and implement effective behavior change communication programs to promote civic sense and encourage responsible waste disposal practices among citizens. • Consider the removal of roadside communal bins to encourage citizens to use household bins and discourage illegal dumping.
2	Waste Segregation	• Develop segregation and materials recovery facilities to facilitate waste separation and recycling. • Establish a system for the conversion of organic waste into compost, reducing the amount of waste sent to landfills. • Encourage source segregation by raising awareness and providing incentives for households and businesses to separate their waste.
3	Waste Collection	• Conducting behavior change communication programs to encourage citizens to properly dispose of waste. • Establishing a pool of collection vehicles for efficient waste collection. • Providing personal protective equipment (PPE) to all collection staff for their safety and well-being. • Ensuring citizen accountability in daily door-to-door waste collection.
4	Streets Sweeping	• Implementing a comprehensive door-to-door collection system would reduce the need for daily sweeping of all streets, allowing for more efficient and effective cleaning schedules, with a maximum frequency of twice a week.
5	Communal Storage	• All unnecessary communal storage points in residential areas would be removed; • Waste throwing in the streets should be banned and penalized;
6	Waste Transportation	• Commercial areas and institutions would have communal bins; • User charges would be levied to induce financial sustainability. • Waste would be carried in fully covered vehicles, in order to avoid any littering and pollution; • Number of vehicles would be minimized, with transfer stations and larger hauling containers; • Environment-friendly transfer facilities with dust & odor control.
7	Waste Disposal	• Landfill would be properly designed and operated; • Segregation, MRF, and Composting facilities would enhance the useful life of the Landfill;

Source: Devised by Consultant

6.9.4.2 Non-hazardous Waste Segregation, Labeling and Transportation

All non-hazardous waste shall be segregated from other types of hazardous waste at each Tehsil's community bins sites. At all facilities, the following types of containers, with color coding for easy identification, shall be kept to collect and segregate common wastes.

For the Solid Waste Management Plan of Mohmand District, Khyber Pakhtunkhwa, the collection and transportation of solid waste will be managed to ensure public health, environmental protection, and operational efficiency. Non-hazardous solid waste and materials separated for recycling shall be transported regularly to prevent odor, vector attraction, and public nuisance. Waste containing food residues will be collected at least once per week, while bulky waste—such as furniture and debris—will be removed at least once every three months. The collection schedule will align with public health and safety requirements while optimizing fuel use and operational costs. Determination of collection frequency will be based on waste generation rates, composition, and storage capacity at the community level. Where segregation at the source is practiced, specific collection frequencies will be assigned for each waste stream to maintain efficiency and quality of recyclables. Strict measures will also be enforced to prevent scavenging or unauthorized collection from designated segregation points and containers, ensuring compliance with district waste management regulations.

6.9.4.3 Community bins, Temporary Storage, and Handling

In Mohmand District, community bins and temporary storage systems will be established to ensure the safe and hygienic handling of non-hazardous solid waste. All recyclable or non-hazardous materials will be stored in a manner that prevents fire hazards, health risks, and vector breeding, with proper containment to avoid spillage. Solid waste containing food residues shall be securely kept in covered, leak-proof, nonabsorbent, and durable containers that are easy to clean and designed for safe manual handling. Bulky waste storage will follow safety measures such as removing doors from large appliances and covering items to prevent the accumulation of waste, water, or pests.

Reusable waste containers emptied manually shall not exceed 75 pounds (34.05 kg) when filled, ensuring worker safety and efficiency during collection. For temporary community-level storage, fixed, durable bins will be installed to hold non-hazardous waste before transportation. Storage and disposal areas will be clearly demarcated into separate zones or blocks, minimizing cross-contamination and preventing the generation of secondary dust or nuisances. This approach will promote safe, clean, and efficient waste handling practices across the district.

District Mohmand is characterized by a predominantly rural land base, with approximately 73.86% of land categorized as rangeland and 21.89% as agricultural land. Residential zones constitute less than 4%, concentrated in key tehsils such as Ghalanai (Halimzai), Yake Ghund, and Ambar Utman Khel, while commercial and industrial land uses are extremely limited and scattered.

Given this dispersed settlement pattern and topographical constraints, the district faces challenges in establishing a conventional municipal solid waste system. Instead, a decentralized, cluster-based model is proposed—integrating local collection with regional consolidation via transfer stations (TS) and a central landfill site.

6.9.4.4 Collection System Design

The Solid Waste Management Plan (SWMP) for Mohmand District, Khyber Pakhtunkhwa aims to establish an integrated system for the safe collection, segregation, temporary storage, and transportation of non-hazardous solid waste in alignment with public health, environmental protection, and operational efficiency standards.

All non-hazardous solid waste shall be segregated at source (households) and stored separately from hazardous and medical waste streams. At each Tehsil's community bin site, color-coded containers shall be provided for the segregation of common waste categories (e.g., organics, recyclables, inerts). The bins shall be durable, nonabsorbent, leak-proof, and designed for safe manual handling, ensuring protection from spillage, fire, and vector attraction. Reusable bins emptied manually shall not exceed 75 pounds (34 kg) when filled. Bulky waste, such as furniture and appliances, shall be stored separately with appropriate safety measures, including covering and removal of hazardous components (e.g., appliance doors).

Temporary storage sites shall be established at designated community collection points using fixed, covered bins to prevent odor and nuisance. Storage and disposal zones will be spatially separated to minimize cross-contamination and dust generation. Unauthorized scavenging or informal collection from designated containers shall be strictly prohibited to maintain safety and waste quality.

As per the international standards of solid waste management[22] during the short term, the focus will be on expanding access to basic collection infrastructure across tehsil centers and village clusters. This will include;

- ***Communal Bin Deployment:***
    - ~300 paired communal bins (organic + dry), sized 240–500L. (Ratio: 1 paired set per 20–25 households, or per 0.5–1 acre built-up area)
    - Placement prioritizes proximity to schools, mosques, commercial places, and markets.
- ***Trike/Cart-Based Collection:***
    - ~42 trikes deployed across tehsils, each servicing up to 650 kg/day via 2 trips
    - Rotation-based cluster servicing 3 days/week
    - Particularly effective in hilly and unpaved areas (Prang Ghar, Upper Mohmand, Safi)

[22] UN Habitat (2010)

Figure 25: Types of Containers for Segregation of Non-hazardous Waste



Source: General Search

6.9.4.5 Waste Transportation

The Tehsil Municipal Administrations (TMAs) shall ensure the provision of a safe, enclosed, and efficient transportation system for the transfer of solid waste and recyclables from collection points to designated transfer stations, treatment plants, or final disposal sites. Waste collection and transportation operations shall comply with applicable road safety and environmental regulations. All transportation vehicles shall be enclosed or covered to prevent spillage during transit. Vehicle operators will be responsible for immediate cleanup of any accidental spills and for preventing property damage or public nuisance. Vehicles shall undergo periodic maintenance and safety inspections, including checks of hydraulic systems, brakes, lights, reverse alarms, and tires, in accordance with manufacturer recommendations. Each vehicle shall be washed and sanitized weekly, and a maintenance and operation record shall be maintained for monitoring and audit purposes. To optimize logistics and fuel consumption, waste compaction at transfer stations shall be undertaken where feasible, reducing the number of trips to disposal sites and improving cost efficiency.

- ***Transportation and Collection Frequency***

Non-hazardous solid waste and recyclable materials shall be collected and transported frequently enough to prevent odor, vector breeding, and public nuisance.

- Food waste and other putrescible materials shall be collected at least once per week, while
- Bulky waste shall be collected once every three months or as per local need.

Collection frequency shall be established based on generation rates, waste composition, population density, and available storage capacity to ensure efficiency while minimizing

operational costs and emissions. In areas with source segregation, collection schedules will be differentiated for organic, recyclable, and residual waste streams, ensuring timely recovery and maintaining the integrity of recyclable materials.

To ensure efficient, cost-effective, and environmentally responsible solid waste transportation by optimizing routes, utilizing shared vehicles, and integrating waste compaction and segregation protocols across the district the shared transportation vehicles requirements, and alternate collection schedules are mentioned in table below.

- **Mini Dumpers (2–3 ton)** are rotated between Yake Ghund ↔ Upper Mohmand, and Prang Ghar ↔ Halimzai on alternate days.
- **5-ton Trucks** stationed centrally in Halimzai and Ambar serve high-density clusters and transfer stations.

Table 104: Solid Waste transportation vehicular requirements

Tehsil	Waste Generation (Tons/day)	Number of Trips/days	Main Transport Mode	Shared Corridors
Ambar Utman Khel	26.9	4 (Daily)	2 Trucks (5 tons), 2 Mini dumpers	With Halimzai
Halimzai	30.7	5 (Daily)	2 Trucks, 3 Mini dumpers	With Prang Ghar, Ambar
Prang Ghar	4.7	2 (Alt. days)	1 Mini dumper	With Halimzai
Safi	15.8	3 (Alt. days)	1 Truck, 2 Mini dumpers	With Upper Mohmand
Upper Mohmand	18.2	3 (Daily)	2 Trucks	With Safi, Yake Ghund
Yake Ghund	3.8	2 (Alt. days)	1 Mini dumper	With Upper Mohmand

6.9.4.6 Estimated number of vehicles

Assuming the increase in population and urbanization, the fleet expansion is estimated to increase by 50-60 50–60% to match volume, area expansion, and frequency increase. The compaction and route Optimization plans consider higher compaction ratio (up to 3:1) and centralized routing using GIS and digital tracking, reducing excess vehicle need. The vehicle Sharing Strategy includes;

- Shared use of 5-ton trucks between Ambar–Halimzai–Prang Ghar, and Upper Mohmand–Safi–Yake Ghund clusters.
- Mini dumpers scheduled on alternate-day rotations between adjoining tehsils to reduce idle time and capital costs.
- Handcarts/Trikes localized and scaled by number of communal bins and collection frequency.

Table 105: estimated number of vehicles required for Mohmand District

Vehicle Type	Short-Term (2025)	Long-Term (2045)	Remarks
5-ton Dump Trucks	6	9	For main transfer stations & landfill trips; shared across 3-4 tehsils
2–3-ton Mini Dumpers	12	18	For hilly/rural access and transfer station to MRF/composting stations
Handcarts / Trikes	60	90	For last-mile collection from households/communal bins to transfer stations
Sealed Vehicles (Hazardous)	2	3	Dedicated for any future hospital, lab or hazardous site waste
Support Vehicles (Maintenance, Staff)	2	4	For supervision, emergency and maintenance operations

6.9.4.7 Long term plan for waste collection and Segregation

1. At-source segregation using paired bins (organic/dry).
2. Separate loading compartments or dedicated trips for recyclables and organics every third day.
3. Hazardous/medical waste (where applicable) to be transported separately once a week, using sealed containers (as per WHO protocols).

6.9.4.8 Transfer Stations (TS) – Localized Waste Consolidation

To reduce long-haul transport costs and improve efficiency, 7 strategically located transfer stations are proposed—one per tehsil, co-located along regional roads and within 10–15 km of major settlements. Each transfer station in the district will also function as a Material Recovery Facility (MRF), operating primarily as a manual sorting unit for separating valuable recyclables, compostable organics, and screening out potentially hazardous waste before final disposal. Key Functions of this facility are;

1. Manual Sorting of mixed dry waste (plastic, metal, paper, glass)
2. Temporary Storage of separated recyclables in color-coded bins/sacks
3. Removal of Inert and Hazardous Materials for separate handling
4. Preparation of Compostable Organic Waste for local composting units
5. Transfer of Residual Waste to central landfill

6.9.4.9 Material Recovery and Organic Waste Management Framework

1. Plastic Waste Recovery and Recycling

Plastic waste constitutes approximately 10–15% of the dry waste stream across the district. Key constituents include HDPE, LDPE, polyethylene bags, PET bottles, and food-grade plastic wrappers. In the short term, manual sorting will be adopted at transfer stations, utilizing sorting belts, gloves, and protective gear to ensure worker safety.

Recovered materials will be temporarily stored in shaded storage units using baled or bagged formats and subsequently routed to regional recycling value chains—leveraging both the informal sector and registered contractors.

Essential equipment for each Material Recovery Facility (MRF) includes:

- Sorting tables with rollers or static surfaces
- Digital weighing scales
- Durable sacks or cages for material storage
- Basic baling machines (recommended for larger nodes such as Ghalanai and Yake Ghund stations)

Figure 26: Visualization of Transfer station and material recovery system in Mohmand District



2. Hazardous Waste Screening and Pre-Disposal Management

Each sorting station will be equipped to screen and isolate hazardous materials prior to transport to the designated engineered landfill. This will include:

- **Infectious medical waste** (e.g., syringes, gauze, sharps from BHUs and RHCs)
- **Sanitary products** (diapers, napkins)
- **Chemical and agro-waste** (e.g., pesticide containers, expired products)
- **Broken electronics or batteries**

Secure intermediate containment units (e.g., puncture-resistant bins with lids) will be stationed for temporary storage of these items until batch disposal is facilitated through approved landfill cells or third-party hazardous waste handlers.

3. Composting and Biodegradable Waste Management

Biodegradable materials constitute approximately 70–80% of the total municipal solid waste (MSW) generated, including food scraps, farm residues, vegetable waste, and leaf litter. Each transfer station will be equipped with 2–4 composting bins (1m³ each) following low-tech aerobic composting principles.

➢ *Design Specifications*

- Located behind the sorting/transfer slab
- Provided with shaded roofing**,** natural aeration**,** and drainage channels
- Made of masonry or durable polymer, as per local resource availability

The produced compost will be utilized for local agriculture**,** public parks**,** or roadside green belts, promoting circular economy principles. Pilot-scale implementation of this model is proposed for Safi, Pindiali, and Halimzai tehsils in the short term, based on their agriculture-dominated land use patterns and active farming communities.

6.9.4.10Material Flow at Sorting Station

1. **Inbound Waste** → Mixed (from trike bins)
2. **Sorting Process** → Dry (plastic, paper, metal) separated on table
3. **Organic Waste** → Placed into composting bins
4. **Hazardous** → Manually removed, stored separately
5. **Residual Waste** → Sent to landfill (non-recyclable, non-compostable)

Tehsil	Projected Waste (TPD)	Required Area (m²)	Resources Required	MRF Type	Plastic Recovery	Hazardous Screening	Compost Bins
Ambar Utman Khel	10	100	1 loading bay, 2 sorters, 1 shed	Manual	Yes (local resale)	Low-volume, basic red/yellow bins	2
Halimzai (Ghalanai)	12	120	1 loading bay, 3 sorters, 1 shed	Manual + baler	Yes (with scale)	Yes – BHUs nearby	4
Pindiali	12	120	1 loading bay, 3 sorters, 1 shed	Manual	Yes	Minimal	3
Safi	8	80	1 loading bay, 2 sorters, 1 shed	Manual	Minimal, mostly organics	Low	2
Prang Ghar	4	40	1 small bay, 1 sorter, 1 covered slab	Manual	Minimal	Not required	1–2
Upper Mohmand	7	70	1 bay, 2 sorters, 1 slab	Manual	Moderate plastics	Possible (pesticides)	2
Yake Ghund	14	140	2 loading bays, 4 sorters, 1 covered platform	Manual + baler (long term)	High volume	Moderate	4

Table 106: Material recovery Facility and transfer stations for Mohmand District

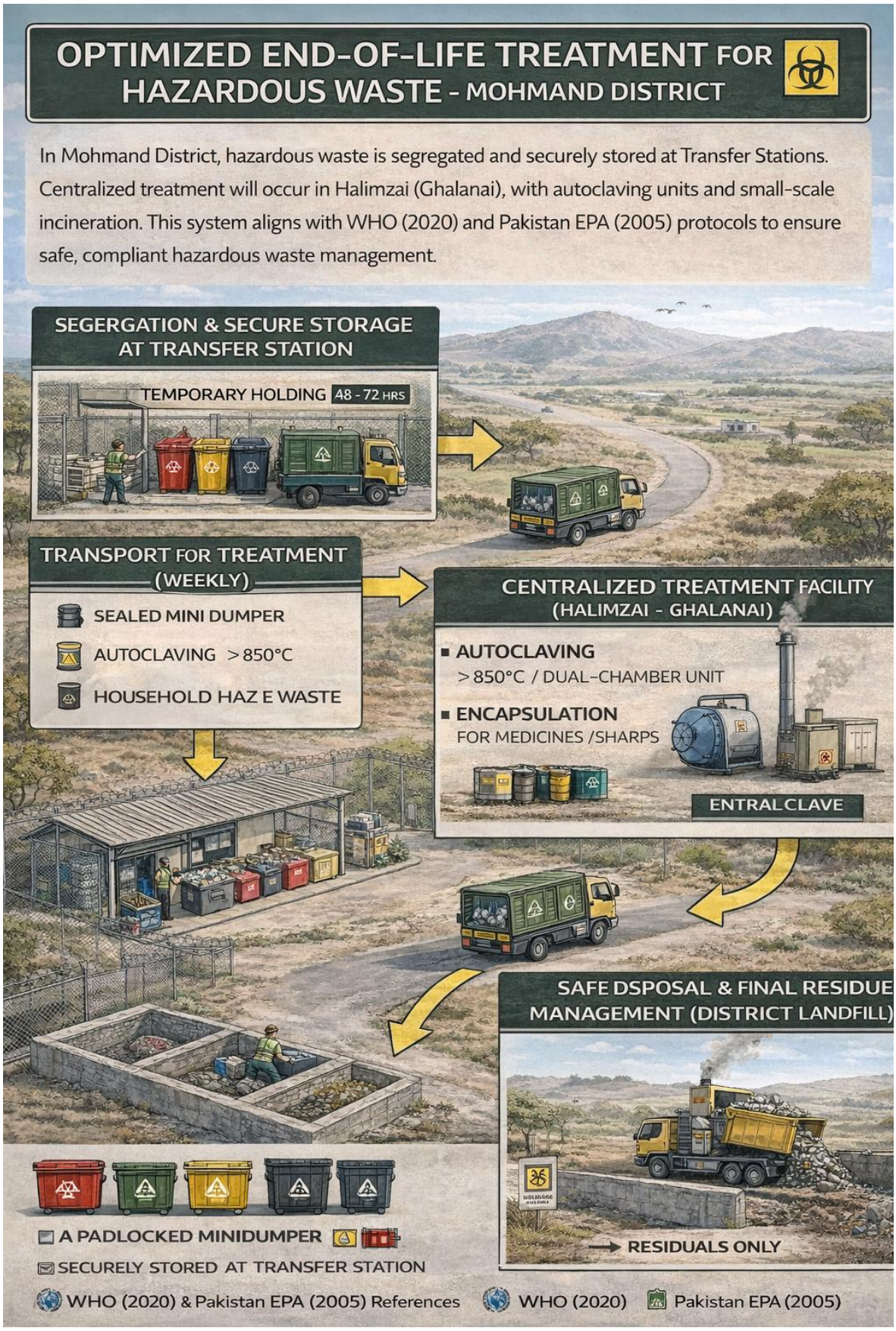
Tehsil	Projected Waste (TPD)	Required Area (m²)	Resources Required	MRF Type	Plastic Recovery	Hazardous Screening	Compost Bins
Ambar Utman Khel	10	100	1 loading bay, 2 sorters, 1 shed	Manual	Yes (local resale)	Low-volume, basic red/yellow bins	2
Halimzai (Ghalanai)	12	120	1 loading bay, 3 sorters, 1 shed	Manual + baler	Yes (with scale)	Yes – BHUs nearby	4
Pindiali	12	120	1 loading bay, 3 sorters, 1 shed	Manual	Yes	Minimal	3
Safi	8	80	1 loading bay, 2 sorters, 1 shed	Manual	Minimal, mostly organics	Low	2
Prang Ghar	4	40	1 small bay, 1 sorter, 1 covered slab	Manual	Minimal	Not required	1–2
Upper Mohmand	7	70	1 bay, 2 sorters, 1 slab	Manual	Moderate plastics	Possible (pesticides)	2
Yake Ghund	14	140	2 loading bays, 4 sorters, 1 covered platform	Manual + baler (long term)	High volume	Moderate	4

6.9.5 End of Life Treatment

6.9.5.1 Hazardous waste (autoclave and incineration)

In Mohmand District, the optimized end-of-life treatment for hazardous waste involves a decentralized yet regulated approach tailored to the district's low waste volumes and dispersed settlements. Hazardous waste—primarily from small health units and limited agro-chemical use—will be segregated at source using color-coded containers and temporarily stored at secure, designated areas within each tehsil's transfer station for up to 48–72 hours. Centralized treatment will be conducted at a proposed facility in Halimzai (Ghalanai), equipped with autoclaving units and, where feasible, a small dual-chamber incinerator operating at WHO-recommended temperatures (≥850°C). Expired medicines, sharps, and chemical residues will be encapsulated in secure cement-lined pits, while residuals post-treatment will be disposed of at the district's engineered landfill. This system, aligned with WHO (2020) and Pakistan EPA (2005) protocols, ensures environmental safety, cost-effectiveness, and compliance with national hazardous waste regulations.

Figure 27: Hazardous waste Management for Mohmand District



6.9.5.2 Landfill Site Selection and Final Disposal

A single engineered district landfill site is recommended at Ekka Ghund. It will require minimum 20 acres land (expandable). Designed with Cell-based landfill with liner, leachate pond, and methane flaring (Phase II),

Factor	Rationale
Land Use Compatibility	Located in predominantly rangeland, minimizing agricultural displacement
Accessibility	Proximity to Pindiali–Ghalanai Road, enabling inter-tehsil connectivity
Settlement Buffer	>500 meters from populated areas (in line with EPA 2015 standards)
Environmental Impact	Located away from watercourses or ecological reserves

6.9.5.3 Climate-Smart Organic Waste Management and Carbon Credit Potential

District Mohmand's waste composition is predominantly organic, with approximately 70–80% of the total solid waste stream comprising biodegradable materials such as food waste, agricultural residues, leaf litter, and green waste. Given the district's semi-rural landscape and absence of formal landfill infrastructure, the improper disposal of organic waste poses a substantial risk for uncontrolled methane (CH_4) emissions—one of the most potent greenhouse gases (GHG), with a global warming potential (GWP) 28–34 times higher than CO_2 over a 100-year period (IPCC, 2021).

To address this, the proposed district-level strategy includes the installation of low-tech aerobic composting units at each transfer station. Each unit will comprise 2 to 4 bins (each 1 m^3) designed with basic drainage, ventilation, and shade structures, conforming to UN-Habitat (2010) and JICA (2005) recommendations for decentralized organic waste management in low-income and rural settings.

6.9.5.4 GHG Mitigation Potential

Aerobic composting reduces GHG emissions by avoiding the anaerobic decomposition of organic matter that typically occurs in open dumps or uncontrolled landfills. According to the CDM Methodology AMS-III.F (UNFCCC, 2006), composting 1 metric ton of organic waste can prevent the emission of 0.62 tons of CO_2-equivalent (tCO_2e).

6.9.5.4.1 Calculation Example:

Assuming a single tehsil facility processes:

- **6 tons/day of organic waste**
- Operating **300 days/year**

  → Annual organic waste processed: **1,800 tons**

Avoided GHG emissions = 1,800 tons × 0.62 tCO_2e = 1,116 tCO_2e/year

This mitigation can be monetized under voluntary carbon markets (e.g., **Gold Standard** or **Verra VCS**) at an average carbon price of:

- **$5 to $10 per tCO_2e**

→ **Estimated carbon revenue = $5,580 to $11,160 per facility/year**

Scaling this model across **7 tehsils**, total carbon credits could yield:

- **7,812 to 15,624 tCO_2e annually**
- **$39,060 to $156,240** in potential annual climate finance

6.9.5.4.2 Methane Capture in Engineered Landfills (Long-Term Strategy)

In the long term (post-2040), with the establishment of a centralized engineered landfill (proposed between Upper Mohmand and Pindiali), provisions for methane gas capture and flaring will be integrated into the design. This includes:

- Gas venting pipes
- Leachate collection systems
- Optional flare units or small-scale bioenergy generation

These features enable further GHG reductions and qualify for additional landfill gas recovery credits under CDM AMS-III.G and similar VCS protocols.

6.9.5.5 Incineration

To safely dispose of infectious medical waste from the *operational hospital* in Mohmand District using a controlled, low-emission incinerator system that prevents open burning, toxic emissions, and groundwater contamination. The incinerator will be operationalized as per the guidelines of the Pakistan Hospital Waste Management Rules 2005[23].

It is recommended to install the dual-chamber design for complete combustion and control of atmospheric pollution. The wet scrubbers or dry filter system will ensure air quality. The ash removal tray will be installed for safe handling of the residue. As per the WHO guidelines[24] the chimney height will be a minimum of 10 meters. Incinerator will also be used for disposal of waste, but before burning the trash, plastics, metal, glass, and any other items that are not to be burned should be segregated first. Ash from the incinerator shall be buried in the lined landfill, as it may contain heavy metals.

[23] Pakistan Hospital Waste Management Rules (2005).
[24] WHO (2014). *Safe Management of Wastes from Health-care Activities*.

- ***Composting***

Compost is the stable end product derived from the biological degradation of organic material, which can vary from dead leaves and roots to kitchen waste and vegetable remains. Finished compost looks like soil– dark brown and crumbly[25]. The majority of the solid waste generated at the village level is composed of organic material, there for the composting can be an effective way to reduce waste amount as nature nature-based solution, as well as have an economic impact.

6.9.5.5.1 Waste Streams Accepted

Waste streams accepted includes Non-Recoverable Inerts & Plastics (e.g., broken ceramics, contaminated plastics, shredded textiles), Residual Ash (e.g., cooled incinerator ash from a hospital), Non-hazardous Bulky Items (e.g., broken furniture not suitable for reuse), while the Excluded Wastes, Hazardous (chemicals, batteries, e-waste) → route to incinerator or burial pits, Untreated Medical Waste → must be pre-treated/incinerated, and Liquid Wastes → not accepted (use separate wastewater treatment).

6.9.5.5.2 Site Selection Criteria

The site for landfill will be selected based on Hydrogeological Considerations (including; Minimum 100 m horizontal buffer from any surface water bodies (streams, springs) and 300 m from community water intakes), Underlain by a low-permeability soil layer (clay loam or silty clay) of at least 0.5 m thickness.

Avoid sites with shallow bedrock (<1.0 m) or coarse gravel aquifers, Topography & Accessibility (Gentle slope (5 – 15 %) to facilitate gravity drainage of surface run-on/out without excessive erosion), Accessible by trikes or small trucks year-round (consider snow and monsoon conditions).

Road grade ≤10 % where possible, Land Use & Buffer Zones (At least 300 m buffer from residences, schools, and places of worship to mitigate odor and vector nuisance), At least 50 m from cultivated lands to minimize crop-water contamination risks, Climate & Drainage (Avoid floodplains or areas prone to landslides during monsoon), Ensure natural drainage away from community; design perimeter berms if necessary to divert stormwater, Land Tenure & Permits (Verify land ownership; obtain written consent from local councils), and Secure a No Objection Certificate (NOC) from the Provincial Environmental Protection Agency (EPA).

[25] UN. ESCAP (2012). Operational Manual on Composting for an Integrated Resource Recovery Center (IRRC).

- ***Daily Environmental Inspection***

To send waste off-site, TMAs must make appropriate arrangements. The following actions are recommended;

All waste collection, transportation, and disposal activities must be tracked and carried out by designated staff members,

The compliance of the environmental waste management plan must be strictly followed for the appropriate segregation, material recovery, hazardous waste segregation, and final disposal.

6.9.6 Solid Waste Management Approaches (Tehsil-wise and Cluster-Wise)

6.9.6.1 Ambar Utman Khel Tehsil

The land use profile of Ambar Utman Khel Tehsil is overwhelmingly dominated by range land (67.72%) and agricultural use (28.52%), with only a marginal 2.04% allocated to residential settlements. The spatial dispersion of households across a rugged, semi-arid terrain, combined with the absence of industrial zones or major healthcare facilities, significantly reduces the presence of hazardous or biomedical waste streams within the tehsil.

Table 107: Solid waste Management for Utman Khel Tehsil, Mohmand District

Stage	Communal bins (#)	Waste collection Trikes	Key Siting / Design Considerations
Short-Term	135	15	• ~2 bin set (organic + dry) per 20–25 HHs or per 1-acre built-up area. With capacity of 240–500 liters • For Cluster 1 communal bins should be mounted within 100 while for Custer 2, 500-1000 meters walking distance from household. • **Transfer frequency:** 2-3 times a week • **Transfer station: E**stablish at least one transfer station, with compactors at the exit point of tehsil with appropriate aces to the road, and communal transportation trikes

Long-Term	300	26	• ~2 bin set (organic + dry). With capacity of 240–500 liters • **Transfer frequency:** 6 times a week • **Segregation of Hazardous waste:** with urbanization and development in case of health care facilities development, there should be appropriate segregation, collection, storage, and management of hazardous waste**.** • **Transfer station: E**stablish at least one transfer station, with material recovery facility, compost bins, and recycling collection at the exit point of tehsil with appropriate aces to the road, and communal transportation trikes

6.9.6.2 Halim Zai Tehsil

Halimzai Tehsil's solid waste management plan is shaped by its predominantly rural landscape, with 58.52% rangeland and 32.93% agricultural land, and only 4.01% residential area. In the short term, waste will be managed through communal bin clusters and low-cost trike collection (3 times/week) focused on residential and commercial pockets. Medium-term goals include improved coverage of scattered industrial areas, introduction of secure hazardous waste handling, and localized composting. Long-term, the system will scale to semi-mechanized operations with micro transfer stations and expanded recycling infrastructure.

Table 108: Waste Management Plan for Halim Zai Tehsil, Mohmand District

Stage	Communal bins (#)	Waste collection Trikes	Key Siting / Design Considerations
Short-Term	119	12	• ~2 bin set (organic + dry) per 20–25 HHs or per 1 acre built-up area. With capacity of 240–500 liters **Cluster 1:** there should be 51 communal bins, 5 trikes for waste collection and transportation to the transfer station. **Cluster 2:** there should be 39 communal bins, 3 trikes for waste collection and transportation to the transfer station. **Cluster 3:** there should be 29 communal bins, 3 trikes for waste collection and transportation to the transfer station. • Transfer frequency: 2-3 times a week • Transfer station: Establish atleast one transfer station, with compactors at the exit point of tehsil with appropriate aces to the road, and communal transportation trikes • Segregation and management of Hazardous Waste: from industrial and healthcare facilities appropriate segregation should be there
Long-Term	81	26	• ~2 bin set (organic + dry) per 20–25 HHs or per 1-acre built-up area. With capacity of 240–500 liters **Cluster 1:** there should be 81 communal bins, 8 trikes for waste collection and transportation to the transfer station. **Cluster 2:** there should be 63 communal bins, 6 trikes for waste collection and transportation to the transfer station. **Cluster 3:** there should be 46 communal bins, 5 trikes for waste collection and transportation to the transfer station. • Transfer frequency: twice a week • Transfer station: Establish at least one transfer station, with compactors at the exit point of tehsil with appropriate aces to the road, and communal transportation trikes • Segregation and management of Hazardous Waste: from industrial and healthcare facilities appropriate segregation should be there

6.9.6.3 Pindiali Tehsil

Table 109: Waste Management Plan for Pindiali Tehsil, Mohmand District

Stage	Communal bins (#)	Waste collection Trikes	Key Siting / Design Considerations
Short-Term	183	3-5	• ~2 bin set (organic + dry) per 20–25 HHs or per 1-acre built-up area. With capacity of 240–500 liters **Cluster 1:** there should be 34 communal bins, 3-4 trikes for waste collection and transportation to the transfer station. **Cluster 2:** there should be 50 communal bins, 5 trikes for waste collection and transportation to the transfer station. **Cluster 3:** there should be 46 communal bins, 5 trikes for waste collection and transportation to the transfer station. **Cluster 4:** there should be 53 communal bins, 5 trikes for waste collection and transportation to the transfer station. • **Transfer** frequency: 2-3 times a week • Transfer station: Establish atleast one transfer station, with compactors at the exit point of tehsil with appropriate aces to the road, and communal transportation trikes • Segregation and management of Hazardous Waste: from industrial and healthcare facilities appropriate segregation should be there. • Open dumper (01) is required for the transportation of bulk waste from industries.
Long-Term	361	36	• ~2 bin set (organic + dry) per 20–25 HHs or per 1 acre built-up area. With capacity of 240–500 liters **Cluster 1:** there should be 66 communal bins, 7 trikes for waste collection and transportation to the transfer station. **Cluster 2:** there should be 99 communal bins, 10 trikes for waste collection and transportation to the transfer station. **Cluster 3:** there should be 91 communal bins, 10 trikes for waste collection and transportation to the transfer station.

			Cluster 4: there should be 105 communal bins, 11 trikes for waste collection and transportation to the transfer station. • Transfer frequency: alternate days a week • Transfer station: Establish atleast one transfer station, with compactors at the exit point of tehsil with appropriate acess to the road, and communal transportation trikes • Segregation and management of Hazardous Waste: from industrial and healthcare facilities appropriate segregation should be there • Open dumper (02) is required for the transportation of bulk waste from industries. • Two compactors

6.9.6.4 Paranghar Tehsil

In the short-term waste collection will rely on 23 communal bin sets and 2–3 trikes operating on a 3-day/week schedule, focusing on scattered residential areas. By the long term, with population growth to over 15,000 and solid waste generation rising to ~6.6 tons/day, the system will scale to 33+ bin stations and 3–4 trikes, maintaining efficiency through rotational routing and seasonal waste handling. No hazardous waste infrastructure is needed unless future facilities (e.g., BHUs or workshops) are introduced.

Table 110: Waste Management Plan for Prang Ghar Tehsil, Mohmand District

Stage	Communal bins (#)	Waste collection Trikes	Key Siting / Design Considerations
Short-Term	23	2-3	• ~2 bin set (organic + dry) per 20-23 HHs or per 1 acre built-up area. With capacity of 240–500 liters • Transfer frequency: twice a week • Transfer station: Establish one transfer station, with compactors at the exit point of tehsil with appropriate aces to the road, and communal transportation trikes • Segregation and management of Hazardous Waste: from industrial and healthcare facilities appropriate segregation should be there.

			• Open dumper (01) is required for the transportation of bulk waste from industries.
Long-Term	33	3	• ~2 bin set (organic + dry) per 20–25 HHs or per 1 acre built-up area. With capacity of 240–500 liters • Transfer frequency: alternate days a week • Transfer station: Establish atleast one transfer station, with compactors at the exit point of tehsil with appropriate access to the road, and communal transportation trikes • Segregation and management of Hazardous Waste: from industrial and healthcare facilities (if developed) appropriate segregation should be there.

6.9.6.5 Safi Tehsil

Safi Tehsil is predominantly rural, with 46.95% rangeland and 46.36% agricultural land, while only 3.24% is residential, and commercial/industrial uses make up less than 0.15% combined. This profile indicates non-hazardous, organic-rich waste, and a scattered settlement pattern. Healthcare and civic land uses are minimal (<0.2%), eliminating the need for large-scale hazardous waste infrastructure.

The table outlines the Solid Waste Management Plan for Safi Tehsil, Mohmand District, covering the period 2017–2045. Waste generation is projected to increase steadily from 43.34 tons per day in 2017 to 66.17 tons per day by 2045, requiring structured and scalable interventions to manage the growing waste load in line with population growth.

Table 111: Waste Management Plan for Safi Tehsil, Mohmand District

Stage	Communal bins (#)	Waste collection Trikes	Key Siting / Design Considerations
Short-Term	154	15	• ~2 bin set (organic + dry) per 20–25 HHs or per 1 acre built-up area. With capacity of 240–500 liters **Cluster 1:** there should be 34 communal bins, 3-4 trikes for waste collection and transportation to the transfer station.

			Cluster 2: there should be 43 communal bins, 5 trikes for waste collection and transportation to the transfer station. **Cluster 3:** there should be 56 communal bins, 6 trikes for waste collection and transportation to the transfer station. • **Transfer** frequency: 2-3 times a week • Transfer station: Establish atleast one transfer station, with compactors at the exit point of tehsil with appropriate aces to the road, and communal transportation trikes • Segregation and management of Hazardous Waste: from industrial and healthcare facilities appropriate segregation should be there. • Open dumper (01) is required for the transportation of bulk waste from industries.
Long-Term	218	20-22	• ~2 bin set (organic + dry) per 20–25 HHs or per 1 acre built-up area. With capacity of 240–500 liters **Cluster 1:** there should be 77 communal bins, 8 trikes for waste collection and transportation to the transfer station. **Cluster 2:** there should be 61 communal bins, 6 trikes for waste collection and transportation to the transfer station. **Cluster 3:** there should be 80 communal bins, 8 trikes for waste collection and transportation to the transfer station. • Transfer frequency: alternate days a week • Transfer station: Establish atleast one transfer station, with compactors at the exit point of tehsil with appropriate acess to the road, and communal transportation trikes • Segregation and management of Hazardous Waste: from industrial and healthcare facilities appropriate segregation should be there (if applicable) • Open dumper (02) is required for the transportation of bulk waste from industries. • Two compactors

6.9.6.6 Upper Mohmand Tehsil

Upper Mohmand Tehsil is predominantly rural, with 68.2% rangeland and 27.95% agriculture, while only 1.47% of the land is residential, and less than 0.1% is designated for commercial, healthcare, or public use. With a projected population of over 42,442 by 2045 and daily waste generation rising to 16.5 tons/day, waste is primarily non-hazardous, organic, and dry domestic in nature.

The table outlines the Solid Waste Management Plan for Upper Mohmand Tehsil, Mohmand District, covering the period 2017–2045. Waste generation is projected to increase significantly from 22.51 tons per day in 2017 to 48.18 tons per day by 2045, more than doubling over the projection period and necessitating a proactive and scalable waste management strategy.

Table 112: Waste Management Plan for Upper Mohmand Tehsil, Mohmand District

Stage	Communal bins (#)	Waste collection Trikes	Key Siting / Design Considerations
Short-Term	79	8	• ~2 bin set (organic + dry) per 20-23 HHs or per 1 acre built-up area. With capacity of 240–500 liters • Bin placement in accessible, populated zones. • Establish basic storage and composting for agricultural waste. • IEC campaigns to support segregation and reduce open dumping. • Transfer frequency: twice a week • Transfer station: Establish one transfer station, with compactors at the exit point of tehsil with appropriate aces to the road, and communal transportation trikes • Segregation and management of Hazardous Waste: from industrial and healthcare facilities appropriate segregation should be there. • Open dumper (01) is required for the transportation of bulk waste from industries.
Long-Term	91	*9*	• ~2 bin set (organic + dry) per 20–25 HHs or per 1 acre built-up area. With capacity of 240–500 liters • Digitize tracking, introduce community reporting mechanisms. • Transfer frequency: alternate days a week • Transfer station: Establish atleast one transfer station, with compactors at the exit point of tehsil with appropriate access to the road, and communal transportation trikes

			• Segregation and management of Hazardous Waste: from industrial and healthcare facilities (if developed) appropriate segregation should be there.

6.9.6.7 Yake Ghund Tehsil

Yake Ghund Tehsil is characterized by extensive rangeland (84.26%) and limited residential (2.52%) and agricultural land (7.92%), with minimal commercial and industrial development. The solid waste stream is therefore largely organic and non-hazardous, generated from households, small markets, and dispersed rural activities. Given the low-density and rugged terrain, a decentralized, low-cost system is most feasible.

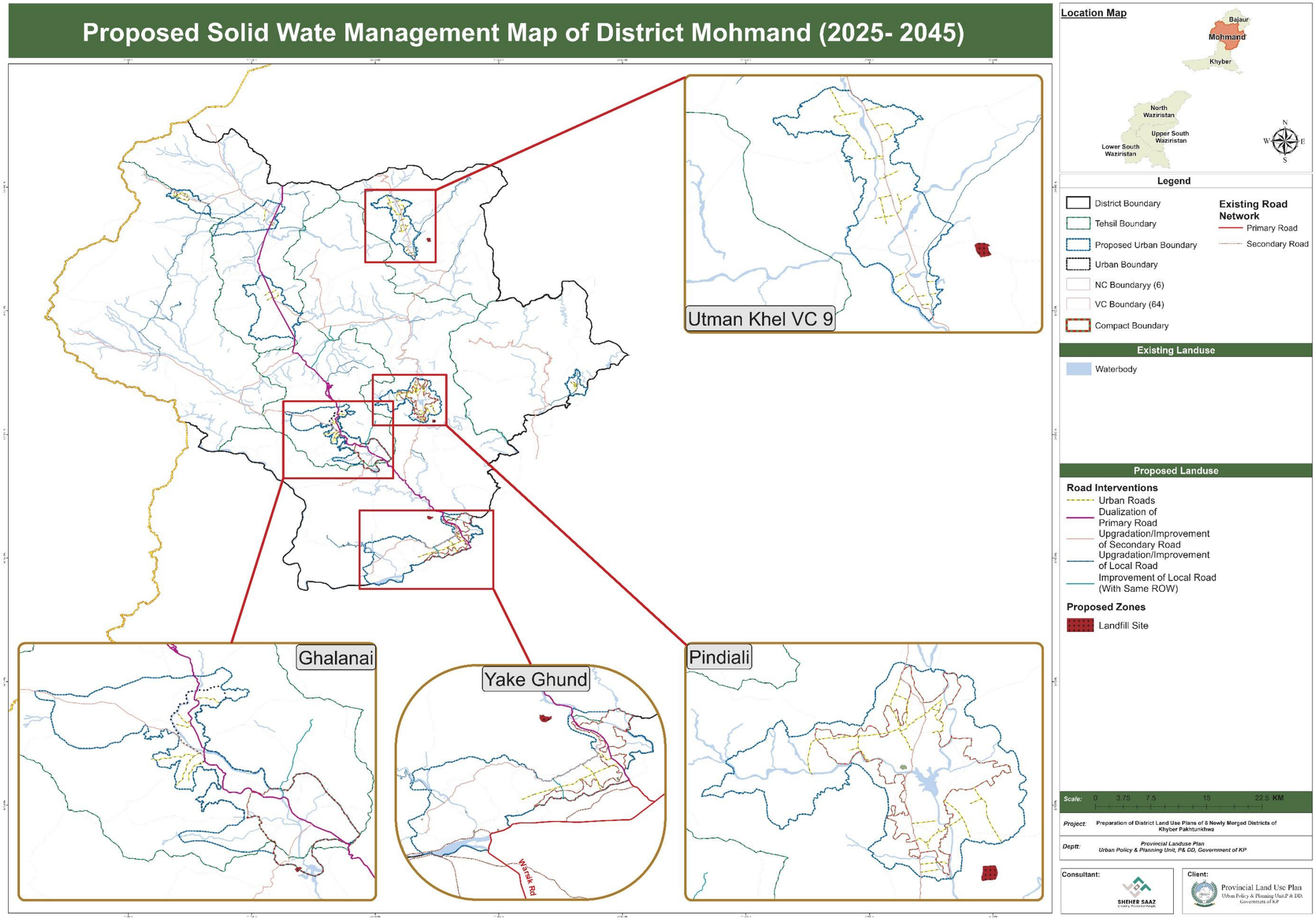
The Table outlines the Solid Waste Management Plan for Yake Ghund Tehsil, Mohmand District, covering the period 2025–2045. Waste generation is projected to increase steadily from 25.41 tons per day in 2017 to 37.74 tons per day by 2045, requiring consistent and phased interventions to manage the growing waste volumes in line with population growth.

Table 113: Waste Management Plan for Yake Ghund Tehsil, Mohmand District

Stage	Communal bins (#)	Waste collection Trikes	Key Siting / Design Considerations
Short-Term	12	1	• ~2 bin set (organic + dry) per 20-23 HHs or per 1 acre built-up area. With capacity of 240–500 liters • Bin placement in accessible, populated zones. • Serve primary residential concentrations and market areas • Encourage backyard composting and dry waste segregation • Launch awareness campaigns targeting school and mosque networks • Establish basic storage and composting for agricultural waste. • IEC campaigns to support segregation and reduce open dumping. • Transfer frequency: twice a week • Transfer station: Establish one transfer station, with compactors at the exit point of tehsil with appropriate aces to the road, and communal transportation trikes

			• Segregation and management of Hazardous Waste: from industrial and healthcare facilities appropriate segregation should be there.
Long-Term	19	***2***	• ~2 bin set (organic + dry) per 20–25 HHs or per 1 acre built-up area. With capacity of 240–500 liters • Digitize tracking, introduce community reporting mechanisms. • Transfer frequency: alternate days a week • Transfer station: Establish atleast one transfer station, with compactors at the exit point of tehsil with appropriate access to the road, and communal transportation trikes • Segregation and management of Hazardous Waste: from industrial and healthcare facilities (if developed) appropriate segregation should be there.

Map 57: Proposed Solid Waste Management - District Mohmand



6.9.7 Constraints and recommendations

Table 114: Current gaps identified in Solid Waste Management of Mohmand District

Sr. #	Component	Current Practice and Issues	Priority of risk
1	Waste Generation	• Solid waste generation across the tehsils of Mohmand District shows significant variation, with current daily volumes ranging from approximately 15 tons in Pran Ghar to over 87 tons in Ambar Utman Khel, and projections indicating steady growth. • The TMA lacks the financial and human resources to manage the current and projected waste loads effectively.	Medium
2	Storage of waste at source	• Widespread absence of household waste storage bins. • Lack of public awareness and poor civic sense, leading to littering. • Severe shortage of community bins in public areas and markets, with significant distances between available units.	Medium
3	Waste Collection	• Heavy reliance on informal disposal, with 67% of waste going to local "Deran" sites and 31.2% to open fields, indicating a near-total lack of formal collection services. • No segregation of waste at source. • The existing collection mechanism, where it exists, is informal and relies on resident initiative, leading to indiscriminate dumping on streets, drains, and open spaces.	High
4	Hazardous waste	• There is no appropriate segregation, storage, or overall management pathway for hazardous waste, which is mixed with general municipal solid waste.	High
5	Sweeping of Streets	TMA capacity is insufficient for regular street sweeping. Resources are stretched thin, focusing on minimal core areas, leaving most streets and public spaces unswept.	Medium
6	Transportation	• A complete lack of a dedicated, functional fleet of collection vehicles (e.g., trucks, compactors, trikes). • No formal scheduling or routing for waste transportation, leading to irregular and unreliable service. • Narrow lanes in many settlements are inaccessible to standard collection vehicles.	High
7	Disposal of waste	• A critical gap exists, with zero officially designated or engineered disposal facilities in the district. • Total reliance on approximately seven identified informal dumpsites (e.g., "Deran"), which are uncontrolled and pose severe environmental and public health risks. • No systems for composting, material recovery, or sanitary landfilling.	High

6.10 NATURAL HAZARDS

Climate change is intensifying natural disasters in Khyber Pakhtunkhwa, a region already strained by limited resources. Droughts, floods, and storms are becoming more frequent and severe, overwhelming communities. These extreme weather events threaten public health, ecosystems, food security, and displace people. Mohmand District is having a population of 553,933 as per the census of 2023 residing over an area of 2,296 sq. km. Mohmand District experiences both scorching summers and harsh winters, further compounded by monsoon dangers. Similarly, northwestern and western districts endure winter snowfall followed by summer floods, highlighting the diverse natural hazards Khyber Pakhtunkhwa faces. Vulnerable populations, particularly children, the elderly, and women, face heightened risks.

The Map below is a multi-hazard map of Pakistan, which highlights the areas that are prone to multiple natural hazards. Mohmand District is moderately vulnerable to multi-hazards which primarily include floods, earthquakes, and landslides.

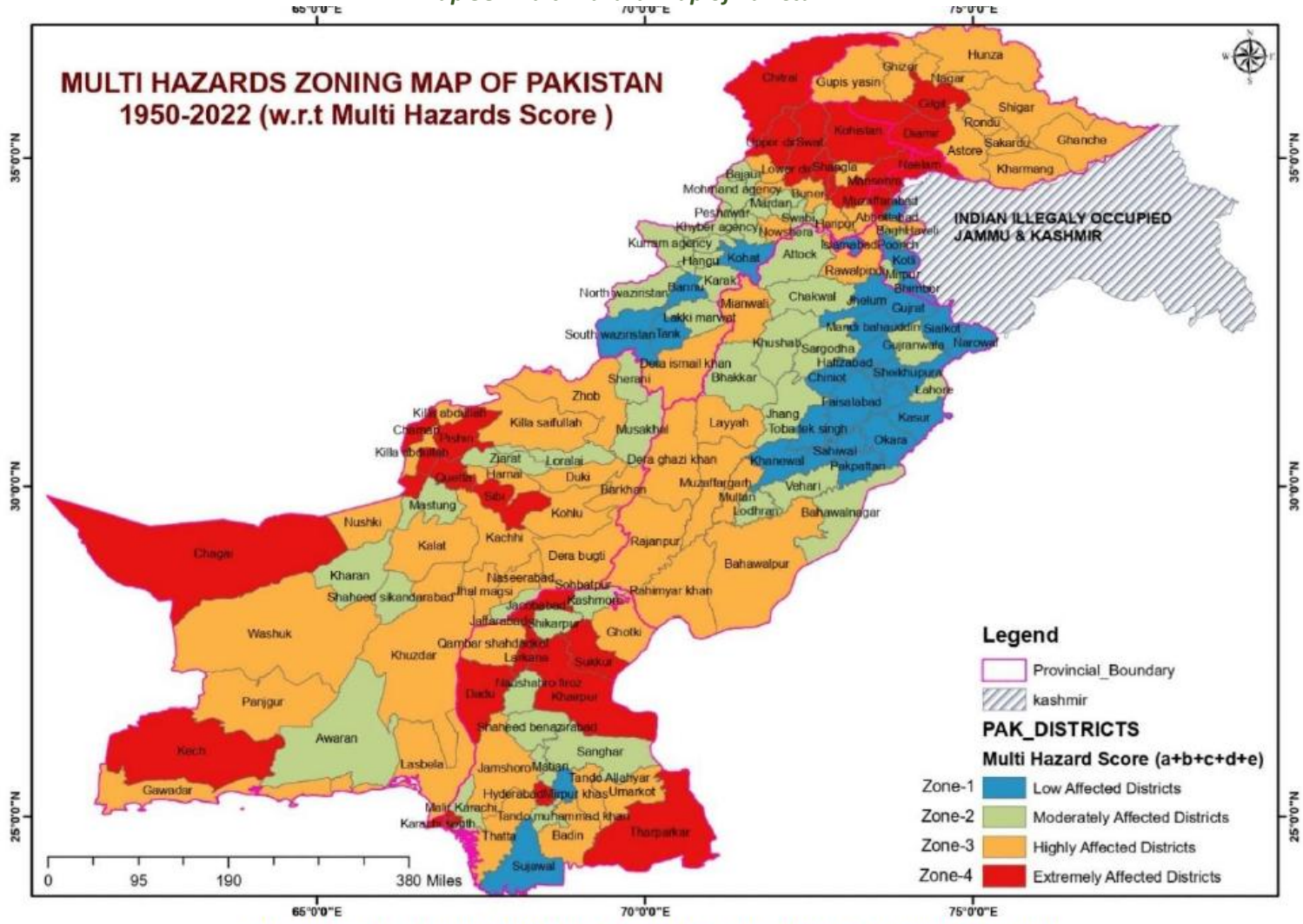
Given these risks, a localized Natural Disaster Management Plan (NDMP) is essential to strengthen resilience, reduce disaster-induced losses, and align community-based preparedness with provincial and national frameworks. This plan is informed by the Sendai Framework for Disaster Risk Reduction (2015–2030)[26], the National Disaster Management Plan of Pakistan (NDMA, 2019)[27], and the Sustainable Development Goals (SDGs 11 and 13), which emphasize the need for resilient infrastructure, risk-informed governance, and community-centered approaches to disaster management.

The NDMP for Mohmand District adopts a multi-hazard, multi-sectoral approach, focusing on short-term preparedness, medium-term mitigation, and long-term resilience-building measures. It also emphasizes institutional coordination between the District Disaster Management Authority (DDMA), line departments, and community structures to ensure effective prevention, preparedness, response, and recovery.

[26] United Nations Office for Disaster Risk Reduction. (2015). *Sendai Framework for Disaster Risk Reduction 2015-2030*. United Nations. https://www.undrr.org/publication/sendai-framework-disaster-risk-reduction-2015-2030

[27] National Disaster Management Authority. (2019). *National Disaster Risk Reduction Policy*. Government of Pakistan. https://www.ndma.gov.pk/

Map 58: Multi-Hazard Map of Pakistan



Source: Hussain, et. al., (2023). Assessing and Mapping Spatial Variation Characteristics of Natural Hazards in Pakistan. Land. 12(1), 140.

Source: Devised by Consultant

6.10.1 Hazard Profile of Mohmand District

The major natural disaster risks identified in Mohmand district and their vulnerability is provided below;

6.10.2 Earthquakes

According to the 2023 Population Census, Mohmand District hosts a total population of 553,923, with an average population density of 241 persons per square kilometer. This moderately high density, concentrated primarily in the valley settlements of Halimzai, Safi, and Pindiali, increases exposure to earthquake-induced structural collapse and secondary hazards such as landslides. The district lies within Seismic Zone III–IV, as classified in the *Pakistan Seismic Hazard and Risk Assessment Atlas*, making it part of the Himalayan seismic belt—a region of active crustal deformation due to the collision between the Indian and Eurasian plates. Tectonic stress generated along the Main Boundary Thrust (MBT) and Main Mantle Thrust (MMT), passing near the adjacent Bajaur and Khyber regions, frequently releases seismic energy that propagates through Mohmand's mountainous terrain

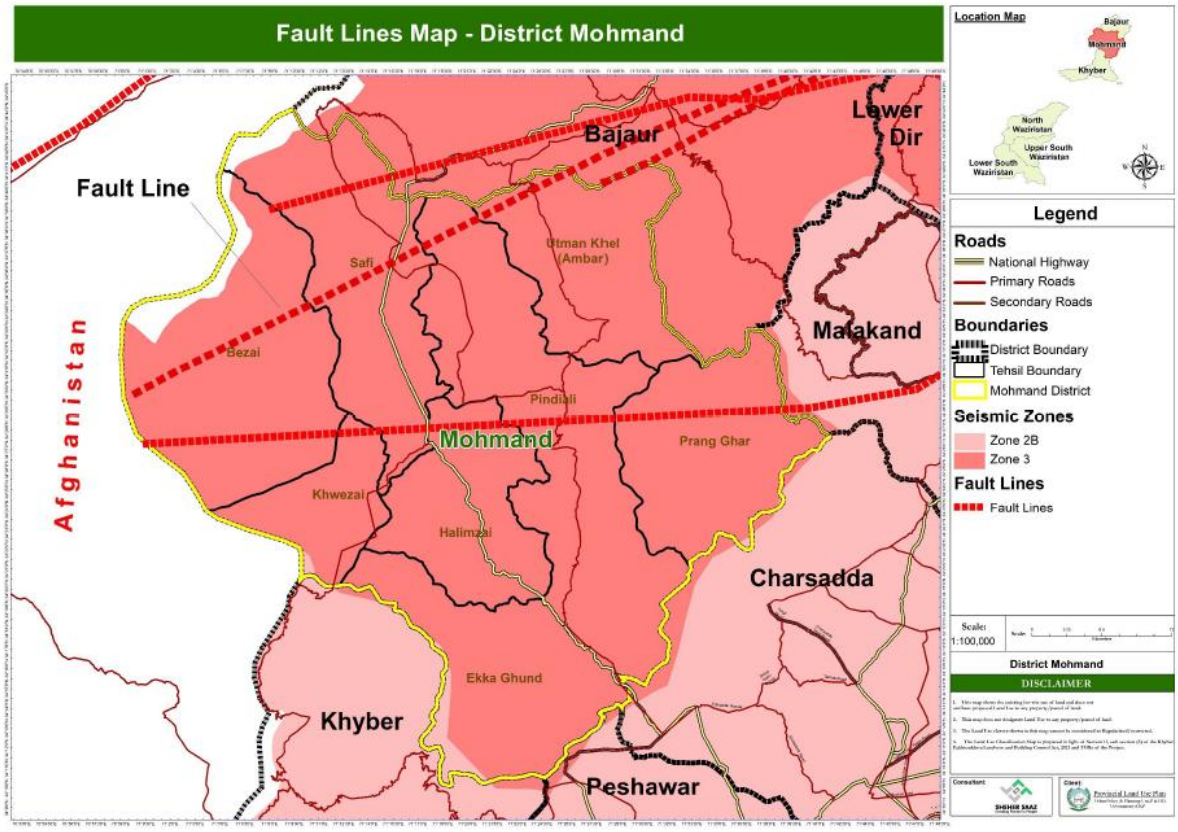
The district has two identified active fault lines, both crosses through the centre. As per the study, the Pg velocity which refers to the speed at which primary seismic waves (P-waves) travel through the upper part of the Earth's crust, is low in the district. The lower Pg velocity suggests that the rocks in this area are less rigid and possibly less dense than in regions with higher Pg velocities. Such areas might be more prone to deformation and fracturing under tectonic stress, potentially increasing the likelihood of earthquakes.

The Pn velocity refers to the speed of P-waves traveling through the upper mantle and Mohmand District has moderate to high Pn velocity which indicates typical rock properties for this depth. While not directly linked to earthquake frequency, a moderate Pn velocity indicates typical mantle conditions. This provides a baseline for comparison with other regions. Moho depth is the depth at which the Earth's crust transitions to the mantle and Mohmand district has high Moho depth which implies that the crust is thicker in this region compared to areas with lower Moho depths. A thicker crust can influence how seismic waves propagate and amplify ground shaking. In some cases, a thicker crust might trap seismic energy, leading to more intense ground shaking at the surface. The combination of low Pg velocity, moderate Pn velocity, and high Moho depth in the Mohmand District indicate a geological setting that could potentially contribute to a higher frequency or intensity of earthquakes. The figure 2 shows fault lines in Pakistan.

The district's vulnerability is exacerbated by the prevalence of unreinforced masonry and adobe structures, high household occupancy rates, and limited disaster-resilient infrastructure. With a population exposure index exceeding 0.65 (based on density and housing typology), even a moderate-magnitude earthquake (Mw 5.5–6.0) could result in significant structural damage and displacement, particularly in narrow valleys and densely clustered settlements. Limited access to emergency services and the absence of community-

based early warning systems further amplify the social vulnerability of women, children, and low-income families.

Map 59: Fault lines of District Mohmand



Source: Devised by Consultant

Mohmand District's steep mountainous terrain, combined with fragile lithology and erratic rainfall patterns, renders it highly susceptible to landslides and slope failures. The district lies along the northwestern extension of the Hindu Kush and Safed Koh mountain ranges, characterized by steep slopes (35–60°), loose sedimentary rock formations, and thin soil cover, which collectively contribute to slope instability. Areas such as Halimzai, Safi, Prang Ghar, and Upper Mohmand are particularly prone to land sliding due to a combination of tectonic uplift, intense seasonal rainfall, deforestation, and unregulated quarrying activities.

With a total population of 553,923 and a density of 241 persons/km² (PBS, 2023)[28], the exposure of communities living along valley slopes and road corridors is significant. The vulnerability index rises in tehsils like Safi and Halimzai, where marble extraction and slope excavation have altered the natural geomorphology, increasing the frequency of rockfalls, debris flows, and shallow landslides. The 2020 marble mine disaster in Safi Tehsil, which claimed over 18 lives, exemplifies the combined impact of anthropogenic destabilization and natural triggers such as monsoon rainfall (The Climate Watch, 2023)[29].

[28] Pakistan Bureau of Statistics. (2023). *Provisional results of 7th population and housing census - 2023*. Government of Pakistan. https://www.pbs.gov.pk/content/provisional-summary-results-7th-population-and-housing-census-2023
[29] World Resources Institute. (2023). *Climate Watch data: Historical GHG Emissions*. https://www.climatewatchdata.org/ghg-emissions

Technically, landslides in Mohmand are triggered by rapid infiltration of rainfall into fractured bedrock, which increases pore-water pressure and reduces shear strength along the slope interface. The seismic activity from nearby faults (Main Boundary Thrust and Main Mantle Thrust) further contributes to seismo-gravitational slope failures during or after moderate earthquakes. Spatial analysis using DEM-based slope gradient mapping and NDVI vegetation indices indicates a landslide susceptibility zone exceeding 40% of the district's land area, concentrated along the Safi–Prang Ghar–Upper Mohmand corridor.

Severity and Vulnerability:

Mohmand District exhibits a high vulnerability to landsliding, particularly in the tehsils of Safi, Halimzai, Upper Mohmand, and Prang Ghar. The 2020 marble mine landslide in Safi which caused 18 confirmed deaths, highlights how slope disturbance from quarrying compounds the underlying geological susceptibility (Mohmand marble mine landslide, 2020)[30]. National assessments by NDMA consistently list landslides among the foremost risks in mountainous zones of Khyber Pakhtunkhwa (NDMA, 2021[31]; NDMA, 2024[32]), affirming that districts like Mohmand should be prioritized in slope stability planning. Furthermore, technical designs for the Mohmand Dam consider slope instability and runoff effects as critical risk factors, showing that landslide risk is integral even in major infrastructure strategy (Mohmand Dam Project, 2025)[33]. Geospatially derived slope and mineral maps of Mohmand reveal substantial areas of steep terrain and altered land cover (e.g., clay, bare soils) which are common precursors to slope failure (Bilal et al., 2024)[34]. From a social vulnerability perspective, communities dependent on hill agriculture, fuelwood collection, and quarry labor are at greatest risk, with limited adaptive capacity and infrastructure resilience. Disruptions to road connectivity, especially along the Ghalanai–Safi and Prang Ghar access routes, hinder both evacuation and emergency response.

To reduce landslide impacts, geotechnical slope stabilization, afforestation on degraded slopes, and drone-assisted geospatial monitoring should be prioritized. Introducing community-based slope watch groups, coupled with rainfall threshold early warning systems, can significantly improve disaster readiness.

6.10.3 Floods

The 2024 Summary Flood Risk Ranking by the PDMA categorizes Mohmand as "Medium Threat" with a likelihood score of 2 (on a scale of 1 to 5, with 5 being most frequent), it's crucial to acknowledge the potential severity of a flood event. The likelihood of a flood event occurring in Mohmand District is classified as Rare. This suggests that while floods are

[30] Geo News. (2020, February 15). *At least nine dead, several trapped in Mohmand marble mine landslide*. https://www.geo.tv/latest/271574-several-feared-trapped-in-mohmand-marble-mine-collapse
[31] National Disaster Management Authority. (2021). *National Monsoon Contingency Plan 2021*. Government of Pakistan. https://www.ndma.gov.pk/
[32] National Disaster Management Authority. (2024). *National Preparedness Plan for La Niña 2024*. Government of Pakistan. https://www.ndma.gov.pk/
[33] Water and Power Development Authority (WAPDA). (2025). *Mohmand Dam Project*. Government of Pakistan. https://www.mohmanddam.wapda.gov.pk/
[34] Bilal, A., Ahmed, S., & Khan, R. (2024). Environmental impact of large-scale infrastructure projects in northern Pakistan. *Pakistan Journal of Science*, *76*(1), 45-60. https://doi.org/10.xxxxx/pjs.2024.76.1.45

possible, they are not a common occurrence in the district. The score of 2 reflects a lower probability of flooding, meaning that flood events are expected to happen infrequently.

The impact of potential floods on the population in Mohmand District is also rated as Rare Impact. This indicates that, in the event of a flood, the consequences for the population would likely be minimal. In contrast to the population impact, the potential impact on livelihood is rated as Substantial, with a score of 4. This highlights that a flood event could have a significant effect on the livelihoods of the district's residents. The higher score reflects the vulnerability of local economies, agriculture, and other livelihood-related activities to flooding, which could lead to considerable economic losses.

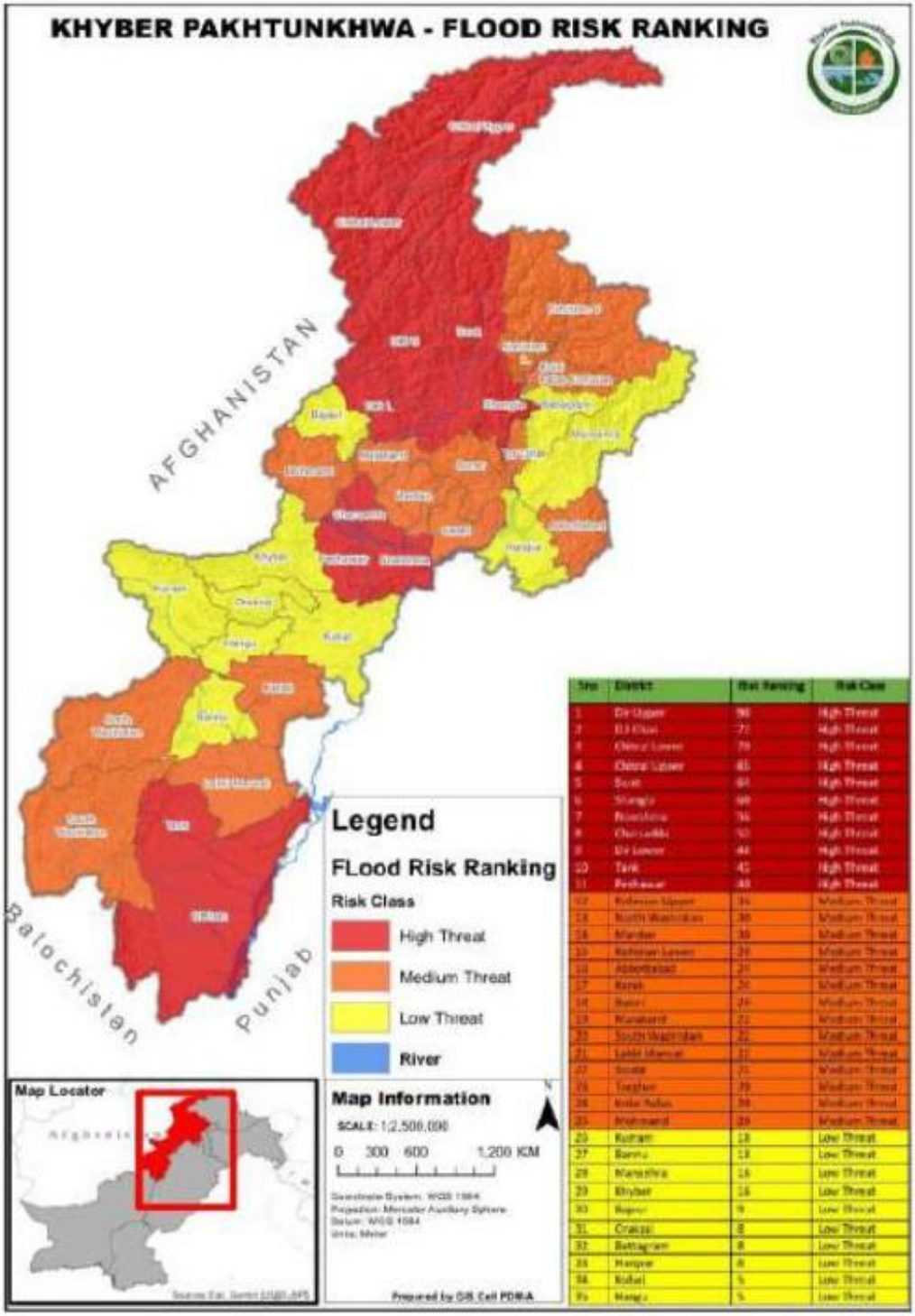
The assessment rates the impact on infrastructure as Rare Impact. Similar to the population impact, this suggests that the district's infrastructure, including roads, buildings, and public services, is expected to suffer minimal damage in the event of a flood. The score of 2 implies that infrastructure in Mohmand District is relatively resilient to flooding. The accessibility of the area during a flood is also rated as Rare Impact, with a score of 2. This indicates that flood events are not expected to significantly hinder access to or from the district. Roads and transportation routes are likely to remain functional, ensuring that emergency services and supplies can reach affected areas if needed.

Table 115: Flood Risk Ranking of 2024 – Mohmand District

District	Likelihood of flood event	Impact on Population	Impact on Livelihood	Impact on Infrastructure	Accessibility of the Area	Risk Score	Risk Class
	1. Very Rare 2. Rare 3. Occasional 4. Frequent 5. Most Frequent	1. Very Rare Impact 2. Rare Impact 3. Substantial 4. Major 5. Severe					
Mohmand	2	2	4	2	2	20	Medium Threat

Source: Summar Hazard Contingency Plan, Provincial Disaster Management Authority, KP

Map 60: Flood Risk Ranking of 2024 – KP



Source: Summar Hazard Contingency Plan, Provincial Disaster Management Authority, KP

6.10.4 Forest Fires

The Mohmand Forest Division reports that about 25,857 ha of forest / scrub land are under forest cover, which corresponds to approximately 11–12% of the division's area (226,115 ha). In Mohmand's dry-mountain environment, these forest patches are mainly thorn-scrub and sub-tropical scrub rather than dense woodland, which makes fire propagation less continuous, but also means individual patches may burn fully when ignition occurs.

At the provincial level, Khyber Pakhtunkhwa exhibits substantial forest-fire risk, with models indicating 53% of KP's area classified under high fire-risk zones using climatic and topographic predictors (temperature, wind, precipitation, slope) (Naseer et al., 2025). In KP's 2022 fire season, over 14,430 acres of forest and pasture lands were burned across multiple districts. Wikipedia Mohmand has reported forest fire incidents in border forests, including firefighting operations that resulted in human casualties.

Overall, while the absolute forest area in Mohmand is modest relative to other KP districts, the risk of forest fires remains moderate to high in vulnerable patches, especially during hot, dry months. The combination of climatic stressors, fuel buildup in scrubland, difficult access, and limited suppression capacity render these forested areas susceptible to fire. For risk mitigation, I recommend maintaining continuous fire break networks, community fire watch programs, and prioritized resource allocation for early detection and response in tehsils with higher forest density (e.g. Halimzai, Upper Mohmand).

6.10.5 Climate Change Risks

Mohmand District, sitting in the mountainous terrain of northern KP, is expected to experience intensifying thermal extremes under climate change, namely hotter summers (more frequent heatwaves) and milder winters (fewer cold extremes). A recent hydrological modeling study of the Mohmand Dam catchment using CMIP6-driven climate projections indicates precipitation increases of ~10.5–11.4% and temperature rises under SSP2/SSP5 by the end of the century (Masood et al., 2023)[35]. These changes translate into projected mean flow increases of 13.7%–34.8%, with seasonal shifts and altered peak timing. This localized climate simulation provides a strong basis for expecting increased slope saturation, surface runoff stresses, and landslide **triggering potential** across Mohmand's tehsils under future climate conditions

Empirical analyses in KP/ Northwest Pakistan also reveal shifting seasonal patterns: while mean rainfall shifts modestly, seasonal distribution and extreme events are becoming more erratic, and rising temperatures are affecting agro-ecology and human health (Nizami et al., 2020)[36] researcherslinks.com. In Mohmand itself, climate change assessments within the Mohmand Dam project climate component acknowledge that rising temperature extremes and shifts in precipitation patterns must be factored into hydrologic and infrastructure design (Mohmand Dam Project, 2025) pecongress.org.pk[37].

Given Mohmand's elevation gradient and microclimatic variability, some tehsils at lower elevation (Baizai, Pindiali) may face more severe heat stress (e.g. more days above 35–38 °C) than higher zones. Conversely, winter cold spells, including frost and very cold nights, may reduce in frequency, reducing risks of freeze damage but also affecting traditional cold-weather livelihoods, chilling needs, and snow-based hydrology. The combined effect is that differential vulnerability emerges: houses built for cold may become overheated; crop

[35] Masood, A., Khan, S., & Rehman, I. U. (2023). Analyzing the challenges of municipal solid waste collection in urban Pakistan. *Journal of Environmental Management*, *335*, 117512. https://doi.org/10.1016/j.jenvman.2023.117512
[36] Nizami, A. S., Shahzad, K., & Naqvi, M. (2020). The potential of waste-to-energy conversion as a sustainable waste management solution in Pakistan. *Renewable and Sustainable Energy Reviews*, *131*, 109990. https://doi.org/10.1016/j.rser.2020.109990
[37] Pakistan Engineering Congress. (n.d.). *Pakistan Engineering Congress*. Retrieved October 10, 2023, from https://www.pecongress.org.pk

varieties suited for cold may lose viability; and vulnerable population groups (elderly, children, those without cooling or heating) will suffer more.

6.10.6 Winter Hazard Risk Assessment

About Winters, the Winter Contingency Plan 2023-24 puts Mohmand district at Low Risk during the winters, however, the scoring is composite of various winter hazards. Table below illustrates the scoring different hazards in winter.

The winter hazard analysis gives Mohmand District the Composite Risk Score of 6. Snowfall, avalanches, and landslides are not significant threats, each scoring 0, indicating these events are either nonexistent or extremely rare in the district. Extreme cold and fog/smog both score 1, suggesting minimal impact on public health or transportation. The forecasted winter severity also holds a low score of 1, indicating mild overall winter conditions. However, heavy rainfall stands out with a score of 3, representing the highest risk among the hazards assessed, potentially leading to flooding or waterlogging. Despite this, the overall winter risk for Mohmand District remains low, reflecting a generally stable winter environment with limited threats to infrastructure, livelihoods, and population safety.

Table 116: Winter Hazard Risk Assessment – Mohmand District

Sr. No.	Winter Hazard	Score
1	Snowfall(A)	0
2	Extreme Cold, Cold Waves (B)	1
3	Avalanches (C)	0
4	Landslides (D)	0
5	*Heavy Rainfall (E)*	*3*
6	FOG/SMOG (F)	1
7	Forecast- ed Winter Severity (G)	1
8	Composite Risk Score (A+B+C+D+E+F+G)	6
9	Risk Level	Low

Source: Winter Contingency Plan 2023-24, Provincial Disaster Management Authority, KP

6.10.7 Resources required at District level

Below is a resource requirement table (Short-term and Long-term) for Mohmand District's environmental monitoring and hazard resilience system, with proposed locations aligned to natural hazard exposure, waste infrastructure growth, and operational feasibility.

Table 117: Resources required for Natural Hazards Monitoring and Managing

Resource / Facility	Short Term (2025–2035)	Proposed Location (Short Term)	Long Term (2035–2045)	Proposed Location (Long Term)
Automatic Weather Stations (AWS)	1 AWS	Ghalanai (Halimzai Tehsil HQ) – central siting for district coverage and data management	3 AWS	Ghalanai (central) + Upper Mohmand / Safi corridor (flood & heat exposure) + Yake Ghund / hill belt (wind/landslide sensitivity)
Rain Gauges (manual/telemetry)	3 units	Safi, Upper Mohmand, Ambar (to track localized rainfall variability/flash floods)	7 units	One per tehsil (Ambar, Halimzai, Pindiali, Safi, Prang Ghar, Upper Mohmand, Yake Ghund)
Mobile Environmental Monitoring Unit (air/noise/basic water)	1 unit	District HQ / Ghalanai (rotational deployment across tehsils)	2 units	Ghalanai + Upper Mohmand (to reduce response time in remote areas)
Fixed Ambient Air Quality Monitoring Station (PM2.5/PM10, met sensors)	—	—	1 station	Ambar (higher transport activity and settlement density; representative for exposure monitoring)
Environmental Laboratory – Level 1 (field/basic tests: pH, turbidity, EC, basic soil/water)	1 lab	Ghalanai (co-located with district administration/health offices)	— (upgrade)	—
Environmental Laboratory – Level 2 Upgrade (BOD/COD, heavy metals screening, compliance testing)	—	—	1 upgraded lab	Ghalanai (centralized capacity for district-wide sampling + reporting)
Groundwater Monitoring Wells (near landfill/TS)	2 wells	Proposed landfill influence zone + 1 major transfer station	6 wells	Landfill (3 wells: upgradient/downgradient) + 3 high-load transfer stations
Flood/Flash Flood Early Warning Displays (community boards/SMS linkage)	3 community points	Safi, Upper Mohmand, Yake Ghund (high hazard sensitivity areas)	7 community points	One per tehsil, linked to AWS and district control room
GIS-based Environmental & Hazard Dashboard	1 basic system	DC Office / District Planning Unit (Ghalanai)	1 upgraded system	District Control Room (Ghalanai) with tehsil-level access nodes

6.10.7.1 Vulnerability & Risk Assessment (Tehsil-wise)

Mohmand District is exposed to multiple natural hazards including landslides, flash floods, earthquakes, and droughts, with varying intensity across tehsils. Halimzai, Safi, and Upper Mohmand are the most vulnerable due to steep terrain, mining activity, and fragile infrastructure. The Safi marble mine disaster (2020) exemplifies anthropogenic slope failure risks, while Prang Ghar's proximity to the Swat River and Mohmand Dam increases flood susceptibility. Limited drainage systems, deforestation, and poor construction practices further heighten community vulnerability across all tehsils.

Table 118: Tehsil-wise Hazard Identification of Mohmand District

Tehsil	Major Natural Hazards	Description / Key Observations	Vulnerable Groups / Areas	References / Source
Halimzai	▪ Earthquakes, Landslides, Flash Floods	Located in hilly terrain, prone to seismic shocks (Zone 3–4). Landslides during monsoon; poor drainage causes flash floods.	Mountain communities, school buildings, marble miners.	NDMA Risk Atlas (2025)[38]; Dawn PDMA alert (2024)[39]
Upper Mohmand	▪ Landslides, Flash Floods, Drought	High altitude; steep slopes cause frequent slope instability and water scarcity in dry seasons.	Hilltop villages, farmers, and women fetching water.	NDMA 2025[40]; PDMA KP flood alerts[41]
Safi	▪ Flash Floods, Landslides, Mine-related slope collapse	Known for marble mines, a 2020 landslide killed >18 workers. High rainfall areas cause slope failures.	Quarry workers, small settlements.	Wikipedia (Mohmand marble mine landslide, 2020)[42]; The Climate Watch (2023)
Prang Ghar	▪ Floods (Swat River proximity), Landslides	Adjacent to the Swat River and Mohmand Dam, risk of flood or dam-related overflow.	Downstream farmers, riverside communities.	Wikipedia (Mohmand Dam 2024)[43]; [15]
Pindiali	▪ Flash Floods, Landslides, Earthquakes	Receives runoff from upper tehsils; poor drainage; seismically active.	Farmers, settlements near nullahs.	PDMA KP Contingency Plan (2024)[44]
Ambar (Utman Khel)	▪ Flash Floods, Landslides	Semi-arid area with steep slopes; floodwater from upstream creates flash floods.	Rural settlements, marginal lands.	Dawn (2024)[45]; NDMA Atlas (2024)[46]

Source: Devised by Consultant

6.10.7.2 Institutional Framework

The institutional framework for early warning system, disaster preparedness, mitigation and response is;

- District Disaster Management Authority (DDMA Mohmand) as lead.

[38] National Disaster Management Authority. (2025a). *Pakistan national risk atlas 2025*. Government of Pakistan. https://www.ndma.gov.pk/
[39] Dawn. (2024, July 15). https://www.dawn.com/news/1845678
[40] National Disaster Management Authority. (2025b). *Annual report 2025*. Government of Pakistan. https://www.ndma.gov.pk/
[41] PDMA KP flood alerts
[42] Wikipedia. (n.d.-a). *Mohmand marble mine landslide*. In *Wikipedia*. Retrieved October 26, 2023, from https://en.wikipedia.org/wiki/Mohmand_marble_mine_landslide
[43] Wikipedia. (n.d.-b). *Mohmand Dam*. In *Wikipedia*. Retrieved October 26, 2023, from https://en.wikipedia.org/wiki/Mohmand_Dam
[44] Provincial Disaster Management Authority Khyber Pakhtunkhwa. (2024). *Monsoon contingency plan 2024*. Government of Khyber Pakhtunkhwa. https://pdma.gkp.pk/
[45] Dawn. (2024, August 20). *PDMA KP issues alert as river levels rise across the province*. https://www.dawn.com/news/1854321
[46] National Disaster Management Authority. (2024). *Pakistan national risk atlas 2024*. Government of Pakistan. https://www.ndma.gov.pk/publications/risk-atlas-2024

- Coordination with PDMA KP**,** Rescue 1122**,** Health, Police, Education, Forest, and Local Government**.**
- Community Disaster Management Committees (CDMCs) in each Tehsil.
- Integration with NGOs, UN agencies, and civil society.

6.10.7.3Available Relief Stock

According to PDMA every district is equipped with a certain amount of relief equipment which is available in case of emergency. Below is the list of available stock.

Table 119: Available of Stock of District Mohmand

Stock	Quantity
Tables	116
Blankets	215
Cooler	50
Buckets	75
Net Mosquito	235
Quilts	225
Cylinder	53
Kitchen Set	200
Hygiene Kit	100
Plastic Matts	40
Daris	50
Tarpaulin Sheets	100

Source: Monsoon Contingency Plan 2025[47], Provincial Disaster Management Authority, KP

Although several items, such as tents, chairs, soap, and other essentials, are missing, the overall stock is reasonably well-equipped, as the district experiences relatively fewer hazards.

6.10.7.4Interventions for reduction of Natural Hazards Vulnerability and Impacts in Mohmand District, KP

For effective management of natural disasters, the following interventions are required to be initiated and require continuous actions throughout the implementation period at District Mohmand;

Intervention 1: Strengthening the functional disaster management cell at the district level

Intervention 2: Prepare disaster management plans for each tehsil

Intervention 3: conduct hazards and vulnerability assessments

Intervention 4: infrastructure development for Disaster Risk Reduction

Intervention 5: Establish Emergency Response System

[47] National Disaster Management Authority. (2025). *National monsoon contingency plan 2025*. Government of Pakistan. https://www.ndma.gov.pk/

Intervention 6: Capacity Building for Post-Disaster Recovery

The detailed phase and disaster-specific proposal is provided in Table 5.

- ***Short Term (2025-2030)***

- Install community-level early warning systems for flash floods.
- Conduct monthly disaster preparedness drills, especially in snow-affected southern areas.
- Fill critical gaps in relief stock (tents, soap, chairs, medical kits).
- Ensure decentralized storage for quick access in remote valleys.
- Awareness campaigns on earthquake safety and winter hazard preparedness.
- Train local volunteers as **first responders** for snow emergencies and landslides.

- ***Medium Term (2030-2035)***

- Upgrade rural roads (especially Tirah access routes) with snow/landslide protection structures.
- Retrofit public buildings (schools, health units) against earthquakes in line with NDMA seismic codes.
- Establish basic winterized shelters in southern mountainous settlements.
- Equip local BHUs/health posts with supplies for cold waves and snowfall emergencies.
- Develop a District Disaster Management Plan (DDMP) integrating floods, earthquakes, and winter hazards.
- Strengthen PDMA coordination with local councils.

- ***Long Term (2035-2045)***

- Develop a multi-hazard risk mapping system (GIS-based) for earthquakes, floods, and winter risks.
- Promote land-use planning to prevent settlements in high-risk flash flood zones.
- Support climate-resilient agriculture in Tirah and other valleys.
- Introduce alternative livelihoods to reduce dependency on vulnerable mountain farming.
- Invest in climate-smart housing and earthquake-resistant designs for new settlements.

Table 120: Detailed Natural Hazards Risk Management Framework for Mohmand District (2025–2040)

Hazard Type	Timeframe	Capacity Building	Infrastructure / Engineering	Afforestation / Environmental	Early Warning & ICT	Community Engagement	Responsible Department(s)
Earthquakes	Short-Term (2025–2030)	Train 500 volunteers & teachers in earthquake drills	Rapid safety audit of 50 schools & 10 health centers	N/A	Establish SMS & mosque-based alerts in 4 Tehsils	Awareness sessions in 30 villages	DDMA, Education, Health, Rescue 1122
	Medium-Term (2030–2035)	Advanced training for 200 engineers & masons in seismic construction	Retrofit 30 schools & 5 hospitals		Install seismic monitoring stations in each Tehsil	District-wide earthquake simulation exercises	PDMA, C&W Dept., Building Authority
	Long-Term (2035–2040)	Institutionalize DRM curriculum in all schools & colleges	100% new govt. buildings earthquake-resilient		Research & monitoring hub establishment in Peshawar/Khyber	Regular district-wide preparedness campaigns	MoCC, Academia
Landslides	Short-Term	Train 200 locals as slope watch volunteers	Slope stability surveys in all Tehsils, and identification of high risk areas	Small-scale reforestation of 200 ha	GIS hazard mapping (pilot)	20 community workshops	DDMA, C&W, Forest Dept.
	Medium-Term	Training 50 technicians in slope stabilization methods	Build check dams & retaining walls	Reforest 1,000 ha on degraded slopes	Expand GIS mapping to all Tehsils	School awareness in high-risk zones	Forest Dept., PDMA
	Long-Term	Institutionalize slope risk management at DDMA	Climate-resilient road standards in all Tehsils	Reforest 5,000 ha by 2040	District-wide landslide monitoring	100% communities integrated in CDMCs	NHA, Forest, DDMA

Floods / Flash Floods	Short-Term	Train 1000 community members in evacuation drills	Identify 20 flood shelters; stockpile 3-month rations	Rehabilitate riverbank vegetation (50 km)	SMS alert pilot in Bara & Jamrud	Safe school programs	Irrigation, PDMA, Rescue 1122
	Medium-Term	Training 100 engineers in flood defense design	Build 15 embankments & 10 drainage improvements	Expand riverbank rehabilitation to 100 km	Install 20 hydrological monitoring stations	Community-based flood warning system	Irrigation, C&W
	Long-Term	Institutionalize flood response in DDMA	Large-scale flood protection covering 250 km	Integrated watershed management	District-wide flood forecast center	Annual flood preparedness drills	PDMA, Irrigation
Drought & Water Scarcity	Short-Term	Train 500 farmers in water conservation	Install 200 rainwater harvesting tanks	N/A	Awareness campaigns on water saving	Women water committees in 20 villages	Agriculture, PHE, NGOs
	Medium-Term	Training in climate-smart agriculture	Build 20 reservoirs & check dams	Plantation along water channels (500 ha)	Pilot groundwater monitoring	Youth mobilization programs	Irrigation, Agriculture
	Long-Term	Integrate drought management in education curricula	District-wide water supply network	Afforestation of 2,000 ha for water recharge	GIS-based water resource monitoring	100% union councils with water user associations	MoCC, Irrigation
Forest Fires	Short-Term	Train 200 volunteers in firefighting	Fire breaks in 100 ha	Reforest 500 ha with fire-resistant species	Community hotlines	Fire watch groups in 50 villages	Forest Dept., DDMA
	Medium-Term	Training of 100 forest guards	Watchtowers in 5 hotspots	Reforest 2,000 ha	Satellite-based monitoring pilot	Village-level fire management plans	Forest, PDMA
	Long-Term	Institutionalized fire training in KP Forest School	District fire risk monitoring system	Reforest 10,000 ha with resilient species	GIS + drones for fire detection	District-wide forest user committees	KP Forest Dept.

Snowfall / Extreme Weather	Short-Term	Train 200 responders in snow rescue	Pre-position 50 winter relief kits	N/A	Weather alerts through FM radios	Awareness in Landi Kotal schools	C&W, DDMA
	Medium-Term	Build local capacity in snow clearance	Snow clearance equipment at 3 key passes	N/A	District weather stations	Community winter task forces	NHA, PDMA
	Long-Term	Establish mountain hazard training center	Climate-adaptive housing in uplands	N/A	Regional weather monitoring center	Institutionalized resilience programs	MoCC, C&W
Climate Change	Short-Term	Train 200 DDMA officials in adaptation, Establishing weather monitoring stations in each Tehsil	Developing regulations for vulnerability and high-risk areas constructions	Pilot 200 ha afforestation	Awareness on climate change	Student eco-clubs	MoCC, PDMA
	Medium-Term	Establishing weather simulation laboratory, Academic training programs (climate resilience, adaptation, mitigation)	Mainstream resilience in 50% of projects	Expand afforestation to 2,000 ha	GIS-based climate data sharing	NGO-led campaigns	KP Climate Change Dept.
	Long-Term	adaptation to Climate resilience Farm practices, infrastructure development	at least 80% infrastructure climate-proof	promoting urban forestry	Regional climate department	Youth-led climate action networks	MoCC, Academia

Source: Devised by Consultant

6.10.7.5Phase-Wise Development Proposal

The detailed phase and disaster specific proposal:

Short Term (2025-2030)

- Install community-level early warning systems for flash floods in Takhta Baigh Khwar and snowfall-prone Tirah Valley.
- Conduct monthly disaster preparedness drills, especially in snow-affected southern areas.
- Fill critical gaps in relief stock (tents, soap, chairs, medical kits).
- Ensure decentralized storage for quick access in remote valleys.
- Awareness campaigns on earthquake safety and winter hazard preparedness.
- Train local volunteers as **first responders** for snow emergencies and landslides.

Medium Term (2030-2035)

- Upgrade rural roads (especially Tirah access routes) with snow/landslide protection structures.
- Retrofit public buildings (schools, health units) against earthquakes in line with NDMA seismic codes.
- Establish basic winterized shelters in southern mountainous settlements.
- Equip local BHUs/health posts with supplies for cold waves and snowfall emergencies.
- Develop a District Disaster Management Plan (DDMP) integrating floods, earthquakes, and winter hazards.
- Strengthen PDMA coordination with local councils.

Long Term (2035-2045)

- Develop a multi-hazard risk mapping system (GIS-based) for earthquakes, floods, and winter risks.
- Promote land-use planning to prevent settlements in high-risk flash flood zones.
- Support climate-resilient agriculture in Tirah and other valleys.
- Introduce alternative livelihoods to reduce dependency on vulnerable mountain farming.
- Invest in climate-smart housing and earthquake-resistant designs for new settlements.

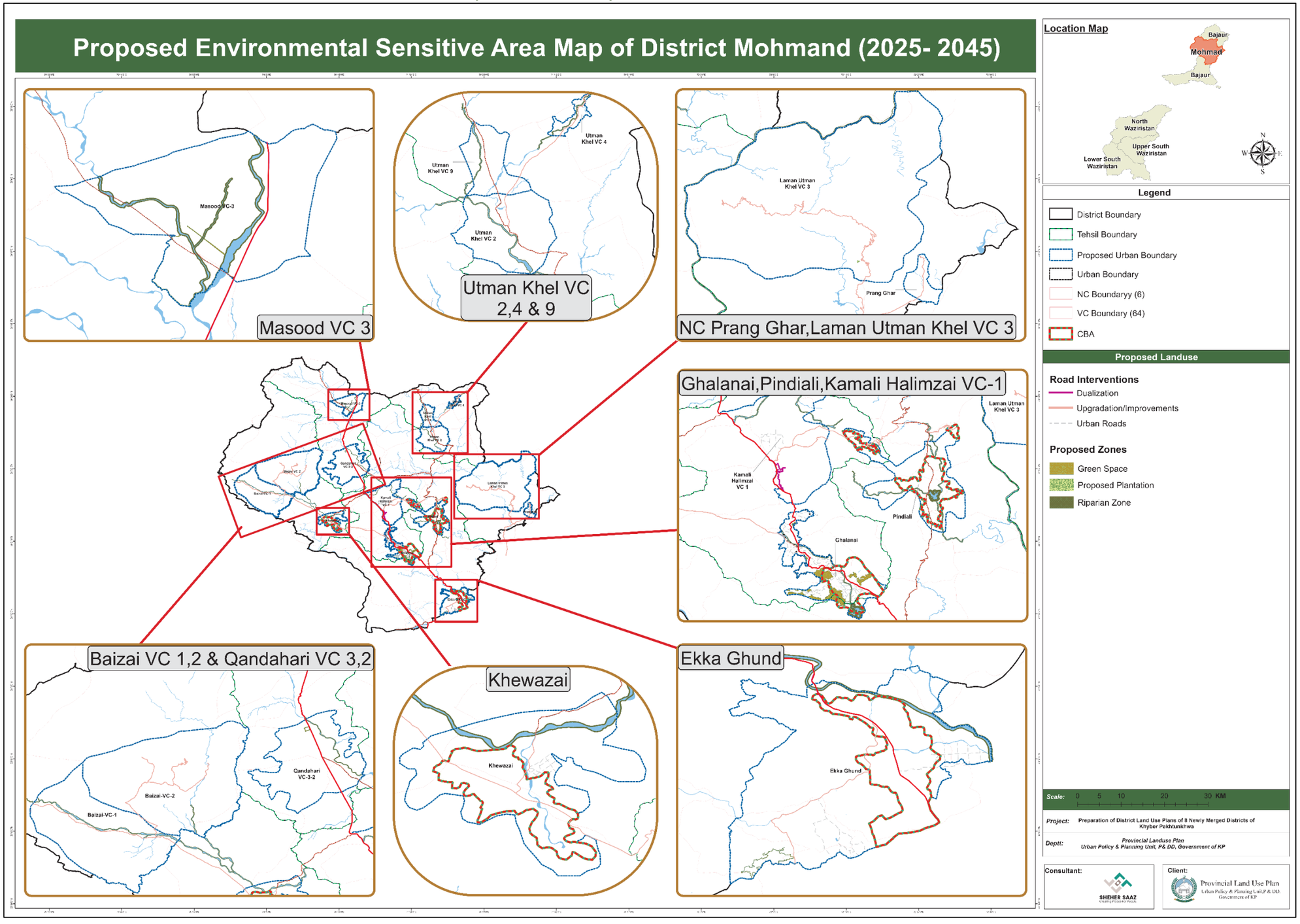
Table 121: Detailed Natural Hazards Risk Management Framework for Mohmand District (2025–2040)

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	Medium-Term	Training 50 technicians in slope stabilization methods	Build check dams & retaining walls	Reforest 1,000 ha on degraded slopes	Expand GIS mapping to all Tehsils	School awareness in high-risk zones	Forest Dept., PDMA
	Long-Term	Institutionalize slope risk management at DDMA	Climate-resilient road standards in all Tehsils	Reforest 5,000 ha by 2040	District-wide landslide monitoring	100% communities integrated in CDMCs	NHA, Forest, DDMA

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	Long-Term	Institutionalized fire training in KP Forest School	District fire risk monitoring system	Reforest 10,000 ha with resilient species	GIS + drones for fire detection	District-wide forest user committees	KP Forest Dept.
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	Long-Term	adaptation to Climate resilience Farm practices, infrastructure development	atleast 80% infrastructure climate-proof	promoting urban forestry	Regional climate department	Youth-led climate action networks	MoCC, Academia

Map 61: Environmentally Sensitive Areas - District Mohmand



6.11 PHYSICAL ENVIRONMENTAL STUDY

6.11.1 Introduction

Increasing development and industrialization in global emerging markets have led to rapid migration from rural areas, escalating poverty and significantly undermining the environmental and social stability of underdeveloped regions. These issues are further exacerbated by political instability. At the same time, climate change, environmental challenges, and natural disasters are becoming more intense, increasing the vulnerability of people who rely on ecosystem goods and services for food and livelihood. These problems in rural and underdeveloped areas highlight the need for durable solutions to complex economic, political, environmental, and social challenges.

Pakistan inherited the Federally Administered Tribal Areas (FATA) in 1947 following partition. Spanning about 27,224 square kilometers along the northwestern border of the country, the FATA region along the Durand Line is considered one of the most volatile regions. Historical political conflicts and the presence of terrorist groups have hindered the region's development. Despite its beautiful landscape, the region has experienced environmental degradation and biodiversity loss due to high poverty levels, climate change, poor legal and governance structures, and urban sprawl.

In 2017, the federal government proposed merging FATA with the adjacent Pashtun-dominated Khyber Pakhtunkhwa (KP) province, a move supported by a majority of political parties and the tribal areas. The merger was officially accepted in 2018. Considering these developments, the Government of Khyber Pakhtunkhwa now aims to develop the urban areas of the merged districts into sustainable, livable, and well-managed engines of economic growth.

6.11.2 Environmental Governance Legal Framework

The 25th Constitutional Amendment serves as the legal foundation for integrating and expanding all state institutions and legislations into the Merged Districts. Finalized in May 2018, the FATA Reform Bill, known as the 25th Amendment, merged FATA with Khyber Pakhtunkhwa (KP), fundamentally changing FATA's constitutional status. The administrative system underwent significant changes following the merger, eliminating the colonial legacy of political administration under the discretionary powers of political agents. The offices formerly known as political agents were re-designated as Deputy Commissioner and Assistant Commissioner, and the oppressive Frontier Crimes Regulation (FCR) was abolished.

Before the merger, the executive authority over FATA was exercised by the governor of KP. Post-merger, this authority shifted to the chief minister and his cabinet, and the merged areas no longer retained a special status. All provincial laws now apply equally to these areas, and FATA received due representation in the provincial assembly with about 16 general seats out of 21, including 4 seats for women and 1 seat for non-Muslims. Prior to the merger, the 1973 Constitution provided FATA with a unique yet legally inferior status. According to Article 1, FATA was considered a separate entity within the country, like the four provinces. Article 246 placed the president of Pakistan as the constitutional head and chief executive of the tribal areas. However, following the merger, Clause 'C' of Article 246, which dealt with the tribal

areas, was omitted, and Article 247, which granted discretionary powers to the president, was also removed.

Before 2018, FATA was governed by the Frontier Crimes Regulations, a set of laws enacted in 1901 by the British Empire to manage Pashtun revolutionaries. Decades of conflict and poor administrative and governance setups had left the region vulnerable and deprived, affecting local people's health, education, and livelihoods. Since 2000, FATA's development priorities and resource allocation were primarily guided by various charters, but these efforts were often insufficient to address the region's complex challenges. The merger with KP marked a significant step towards improving governance, development, and integration of these historically neglected areas.

6.11.2.1Environmental Legal Landscape at National Scale

The Government of Pakistan has taken concrete steps towards the protection of the environment in the shape of passing the Pakistan Environmental Protection Act (PEPA), 1997. Later, after the passage of the 18th constitutional amendment in 2010 which devolved the subject of the environment from the federal government to the provincial government, the government of Khyber Pakhtunkhwa (KP) passed its own environmental protection law called Khyber Pakhtunkhwa Environmental Protection Act (KPEPA), 2014. The province got an exclusive power-related environment. All the provincial governments then subsequently passed their own environmental protection laws and the government of KP was the last to legislate its own KPEPA, in 2014. It is almost an amended and modified act of PEPA, 1997 with certain changes, keeping in view new experiences.

6.11.2.2Environmental Laws/ Rules/ Regulations/ Policies at National Level

Pakistan's Vision 2025 recognizes the vital role of creative, smart, and green cities in driving economic growth and achieving sustainable development. The vision acknowledges climate change as a significant threat, with its impacts including more frequent and intense floods, droughts, and a decline in biodiversity and natural resources. There is a strong national consensus, reflected in the manifestos of all leading political parties, to allocate substantial new resources through public and private sector collaboration to address these challenges. This commitment includes ensuring adequate production and storage capacities while focusing on conservation, efficient resource distribution, and usage, as well as preventing contamination and environmental degradation.

The Pakistan Penal Code addresses offenses that affect public or private property and human lives due to intentional or accidental misconduct by individuals or groups. Regarding environmental issues, the Penal Code empowers local authorities to regulate individuals based on relevant laws. The Pakistan Environmental Protection Act (PEPA) of 1997 was the first comprehensive environmental law in the country, establishing a regulatory framework for environmental protection, preservation, conservation, treatment, and rehabilitation. It aims to prevent or control pollution and promote sustainable development.

The Constitution of Pakistan has significantly redefined the division of legislative powers between the National and Provincial Assemblies, enhancing provincial autonomy. Following the approval of the 18th Amendment, environmental regulatory powers were delegated to

the Provincial Environmental Protection Agencies and Departments (EPAs/EPDs). The table below outlines the various laws, rules, regulations, policies, strategies, and standards present at the national level (highlighted in light green) and their applicability to the provinces. The frameworks in grey color depict those which are either adopted as it is, or similar drafts are available at the provincial scale.

Table 122: Environmental Laws/ Rules/ Regulations/ Policies at National

Acts	Rules	Regulations	Policies	Strategies	Guidelines	Standards
Pakistan Environmental Protection Act 1997	The Compound of Offences and Payment of Administrative Penalty Rules October 2015	Pakistan Environmental Protection Agency Ban on (Manufacturing, Import, Sale, Purchase, Storage, and Usage) Polythene Bags Regulations, 2019	National Environmental Policy, 2005	Pakistan National Conservation Strategy, 1992	Guidelines for Sensitive Areas	National Environment Quality Standards (NEQS) 2010
Cutting of Trees Act, 1975	Pakistan Biosafety Rules 2005	National Environmental Quality Standards (Certification of Environmental Laboratories) Regulations, 2000	National Climate Change Policy 2012	Clean Development Mechanism (CDM), National Operational Strategy	Guidelines for Public Consultation	
The Forest Act 1927	Self-Monitoring and Reporting by Industries Rules, 2001	Pakistan Environmental Protection Agency (Review of IEE and EIA) Regulations, 2000	National Forest Policy Pakistan, 2001			
Pakistan Trade Control of Wild Fauna and Flora Act, 2012	Hospital Waste Management Rules, 2005		National Water Policy, 201848			
	The Pollution Charge for Industry (Calculation and Collection) Rules, 2001					
	Environmental Samples Rules, 2001					
	Environmental Tribunal (Procedure and Functions) Rules, 1999					

[48] National Water Policy 2019, Section 21(1)

This structured approach reflects Pakistan's commitment to tackling environmental challenges through comprehensive legislation and collaborative efforts across different levels of government and the private sector.

6.11.2.3Environmental Legal Landscape at Provincial Scale

Environmental management and regulation have not been in practice in the MDs as the environmental legislation has only recently been extended to the Areas after the 25th Constitution amendment. Therefore, an Environment Cell is established, as an ad hoc arrangement, at the NMD Secretariat Financed by the Swiss Agency for Development and Cooperation (SDC) and managed by IUCN Pakistan.[49] This Environment Cell is set up to provide following tasks:

- Environmental review of public sector schemes
- Environmental awareness and education
- Baseline studies

Currently, a proposal (PC-1) to set up an Environment Directorate within the Khyber Pakhtunkhwa Environmental Protection Agency (KP EPA), dedicated to the Merged Areas/MDs, is in the approval process. [50]

In the MDs, the Forest Directorate of the FATA Secretariat[51] is mainly dealing with forest (including non-timber forest products) management and wildlife conservation. However, the existing capacity of the technical staff is limited and very few conservation and management efforts have been taken, except extensive tree plantation drive.[52] Moreover, community involvement in sustainable resource management and in conservation efforts is low. A strong commitment at the local scale and involvement of the private sector (public-private partnerships) are essential to achieve sustainable development in the region. Literature is evident that the mining, extractive, and manufacturing industries are operating without following the environmental quality standards due to the absence of the regulatory regime (institutions and legal framework) in all MDs (including Orakzai) which has negatively impacted the environmental quality of the area.[53] However, the KP-FATA merger is an opportunity to manage environmental resources under the ambit of KP and the national legal framework, when and where required.

6.11.3 Physiography and Geology

District Mohmand, with a population of approximately 553,933 as of 2023 census and covering an area of about 2,296 square kilometers, represents around 10% of the total area of the Merged Districts (MDs) of Khyber Pakhtunkhwa. The district's physiography is characterized by rugged mountains and hilly terrain, with barren slopes dominating the landscape. The general slope of the district is from the northeast, with an average elevation of over 1,450 meters. Among the notable peaks is Ilazai, the highest peak in the district,

[49] Technical Studies of Water Resources in FATA. 2019. FATA Water Governance Project, FATA Environment Cell. IUCN. pp. 130.
[50] Government of Khyber Pakhtunkhwa. 2019. Tribal Decade Strategy (2020 -2030). Planning & Development Department, GoKP.
[51] Upgraded to the Directorate in 2006 from the FATA Forest Circle, which was there since 1976. It is headed by Conservator Forests. Government of Khyber Pakhtunkhwa. 2019. Tribal Decade Strategy (2020 -2030). Planning & Development Department, GoKP
[52] Government of Khyber Pakhtunkhwa. 2019. Tribal Decade Strategy (2020 -2030). Planning & Development Department, GoKP.
[53] ibid

standing at 2,716 meters near the Pakistan-Afghanistan border. Other significant peaks include Yarisar at 1,929 meters and Silai of Mohmand Agency. The district's valleys and glens, such as those of Shilman, Gandab, and Pindiali, extend from the mountains of Tartarra, located south of the Kabul River, to Ilazai, north of the river. These areas are characterized by dry and arid watercourses that transform into raging torrents during heavy rain. The beds of these watercourses are typically stony and shingled, with barren ground slopes leading up to the rocky spurs and ranges that flank them.

Agriculture and minerals are the prominent sectors within the district, although cultivated land comprises only about 9% of the total area. Water availability remains a significant challenge across much of the district, limiting agricultural productivity. Despite these challenges, Mohmand is rich in mineral resources, including reserves of marble, chromite, dolomite, manganese, quartz, emerald, nephrite, and feldspar. To capitalize on its marble reserves and promote industrialization, the Mohmand Economic Zone, also known as Mohmand Marble City, was established near Mamud Gat, covering an area of 350 acres. This area has been declared a Special Economic Zone (SEZ), with proposals to expand the zone by an additional 2,000 acres to further enhance its industrial potential.

Mohmand District's mineral wealth including marble, chromite as well as emerald serves as a substantial economic resource base without providing beneficial extraction frameworks. Uncontrolled mining leads to major environmental degradation because it causes forests to be destroyed and water becomes polluted, and the soil suffers degradation. The district must establish environmental regulation through compulsory Environmental Impact Assessments that combine it with low-impact mining techniques and complete land rehabilitation plans. The protection of water courses requires sedimentation ponds together with strict waste disposal procedures. Locals should participate in monitoring activities because this oversight method helps both miners and residents build confidence through enforcement of compliance standards.

The development of Mohmand Economic Zone as a Special Economic Zone requires planned sequential improvements to roads and utility networks including electricity, water recycling along with digital communication infrastructure that connects the SEZ to regional trading routes. The economic advantages generated by value-added industries will benefit residents when the government implements tax incentives together with employment quota requirements for district residents. The establishment of an independent SEZ authority must provide streamlined permit issuance while carrying out labor regulation and blocking speculations of land purchases. The SEZ will remain underutilized when appropriate measures are not implemented, which prevents its transformation into an effective industrial hub.

The geological composition of Mohmand District is both diverse and complex. In the southern region, the rock assemblage includes the northwestern marginal mass of the Indo-Pakistan plate, indicating the district's position on the edge of this significant tectonic structure. Moving toward the central part of the district, geology is dominated by an abducted ophiolite, a remnant of ancient oceanic crust and upper mantle that has been thrust onto the continental crust. In the northern part of the district, the rock formations bear a striking

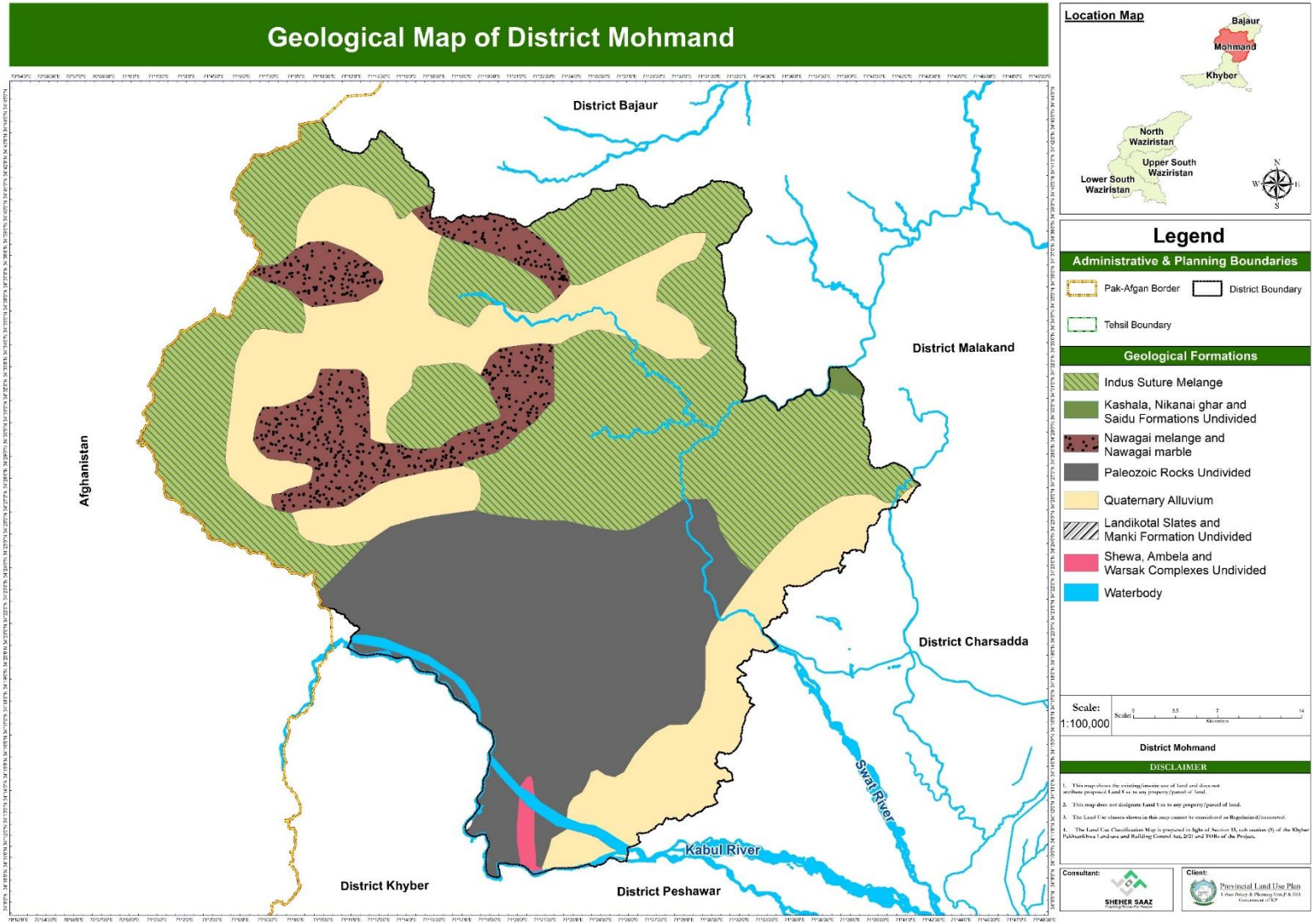
resemblance to those found in the Kohistan Island arc, suggesting a geological continuity with this well-known tectonic feature. The general geological sequence is given below in the table:

Table 123: Geology of Mohmand District

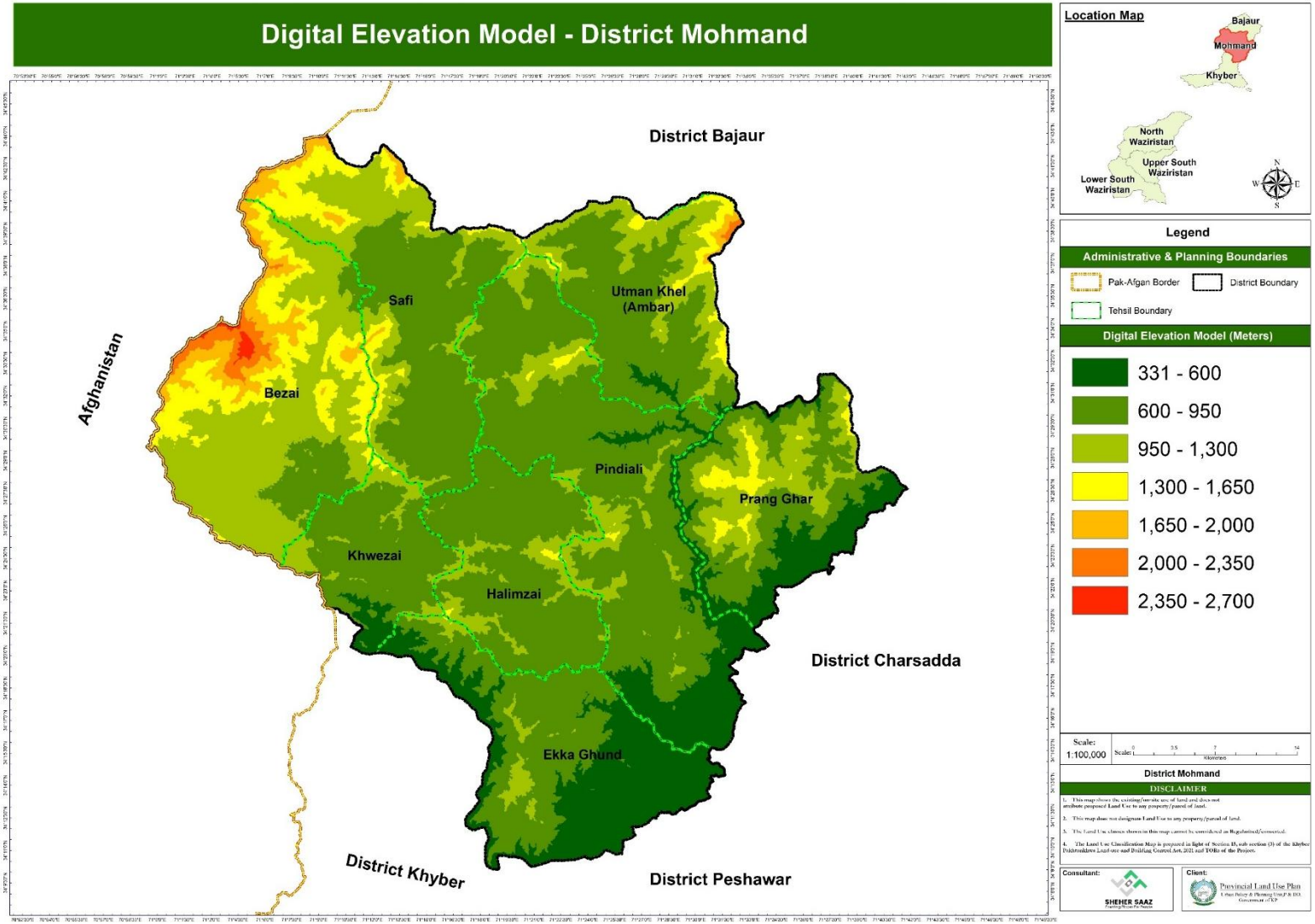
Sr. No	Alluvium, Gravels, and Terrace Deposits (Rock)	Recent-sub recent Age
1	Fossiliferous limestone.	Eocene
2	Ophiolite with layer 1 serpentinized	Cretaceous
3	Ultrabasic, layer-2 volcanic, and layer-3 cherts.	Paleocene
4	Marbleized limestone	Jurassic
5	Dolomite & silica sand	Siluro-Devonian
6	Schists phyllites with numerous intrusive	Paleozoic

Source: Initial Environmental Examination Report for Madar Irrigation Sub-Project, District Mohmand

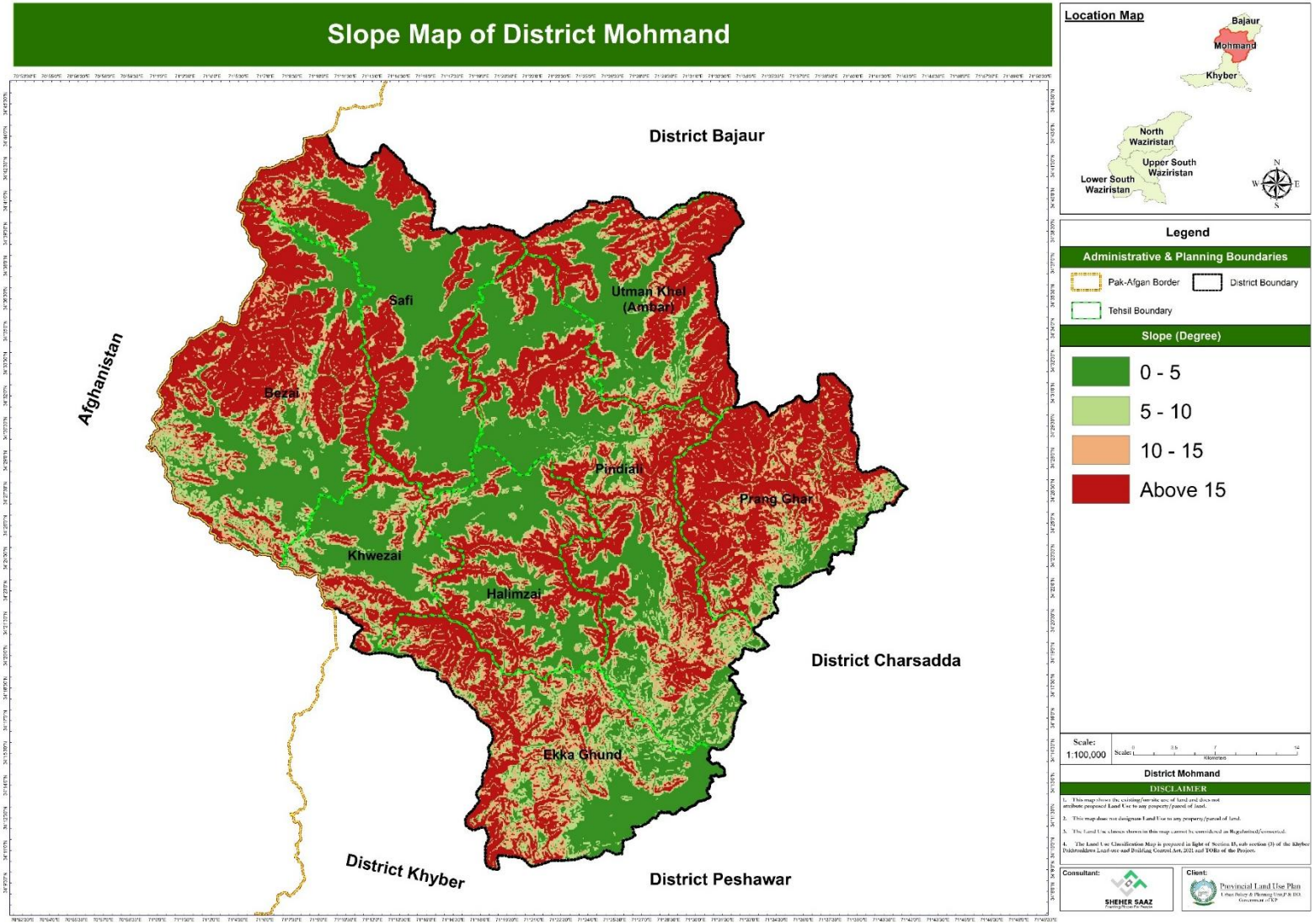
Map 62: Geological Map - District Mohmand



Map 63: Digital Elevation Model - District Mohmand



Map 64: Slope Map - District Mohmand



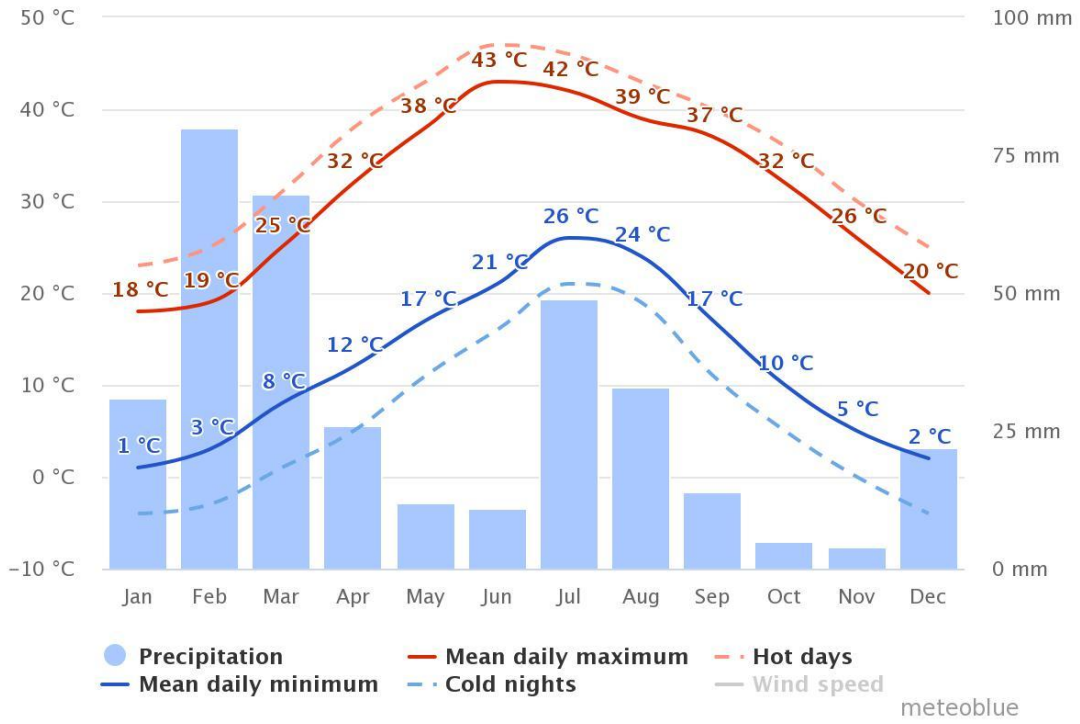
6.11.4 Climate

The climate of District Mohmand is generally characterized as arid to semi-arid, with hot summers and cold winters. The summers are hot and dry, with temperatures often exceeding 40°C (104°F). The winters are cold, with temperatures dropping below freezing point, and the region occasionally experiences snowfall.

Temperature and Precipitation Analysis

Extreme changes in temperature during the year due to a combination of semi-arid and sub-tropical climates describe the Mohmand District, found in Khyber Pakhtunkhwa. For a long time, summers in Asia (May to September) have been very hot, with temperatures frequently reaching between 35°C and 45°C, rising to a peak in June and July, when heatwaves might bring extremely high temperatures in dry areas. From November through February, winters are cool with temperatures as low as 0°C, but January can drop below freezing point, mostly near the Hindu Kush foothills. Spring is slowly replaced by the pre-monsoon season from March until April, with highs around 30–34°C in April. During May and June, temperatures and dryness reach their highest, but once July and August come, there is a bit of relief thanks to monsoon showers, although there is more humidity. While September experiences residual heat, the temperature drops as autumn approaches and October nights are descending into cool temperatures. By December, it's noticeably colder and drier outside, with daytime highs dropping to 18–20°C.

Figure 28: Average temperatures and precipitation



Source: Meteoblue

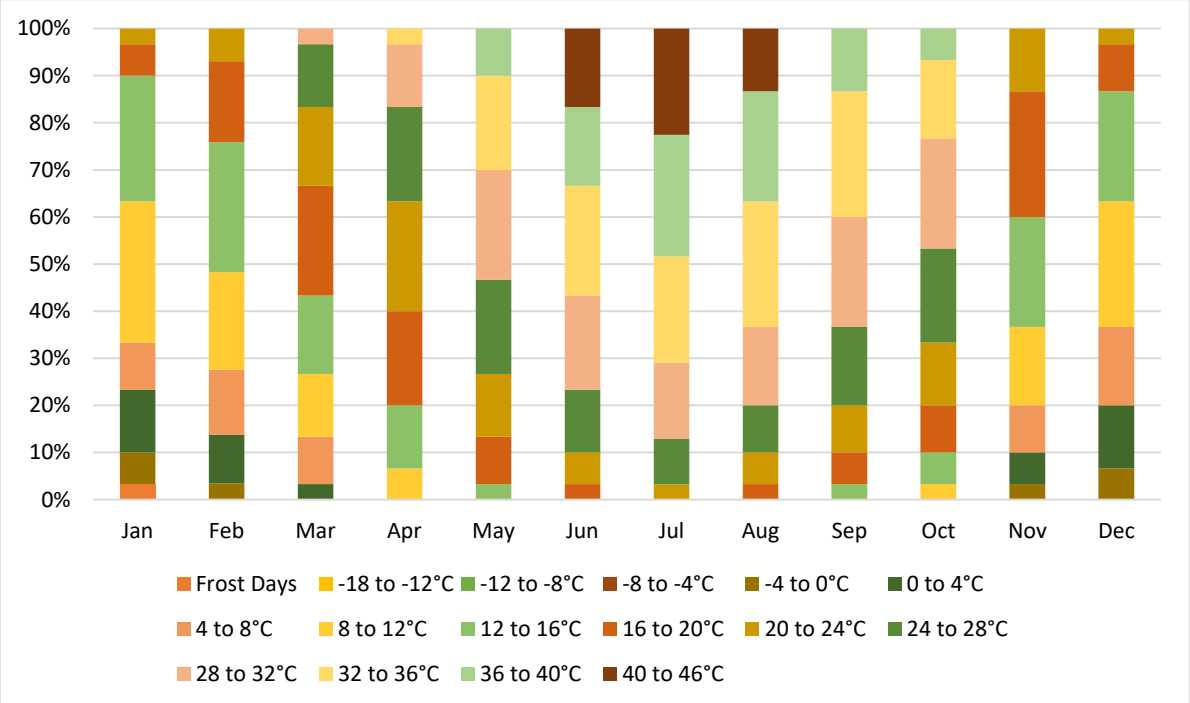
Range and monthly distribution of temperature

During the winter months (December–February), temperatures are predominantly concentrated within the 8–16°C and 16–20°C ranges, with limited occurrences of temperatures below 4°C and negligible frost days. January and February exhibit the highest frequency of cool days, reflecting stable but mild winter conditions rather than severe cold extremes.

The spring period (March–April) marks a transitional phase characterized by a rapid increase in moderate temperatures. Days within the 16–24°C and 24–28°C ranges become increasingly common, while cooler categories gradually diminish. April demonstrates a balanced distribution, indicating climatic variability typical of seasonal change.

A pronounced shift occurs during the summer months (May–August), where the data shows a strong dominance of high and extreme temperature ranges. From May onward, the majority of days fall within 28–36°C, with 32–40°C and 40–46°C ranges peaking in June and July. This concentration of extreme heat highlights prolonged heat stress conditions and limited thermal relief during the summer season.

Figure 29: Maximum temperatures analysis District Mohmand

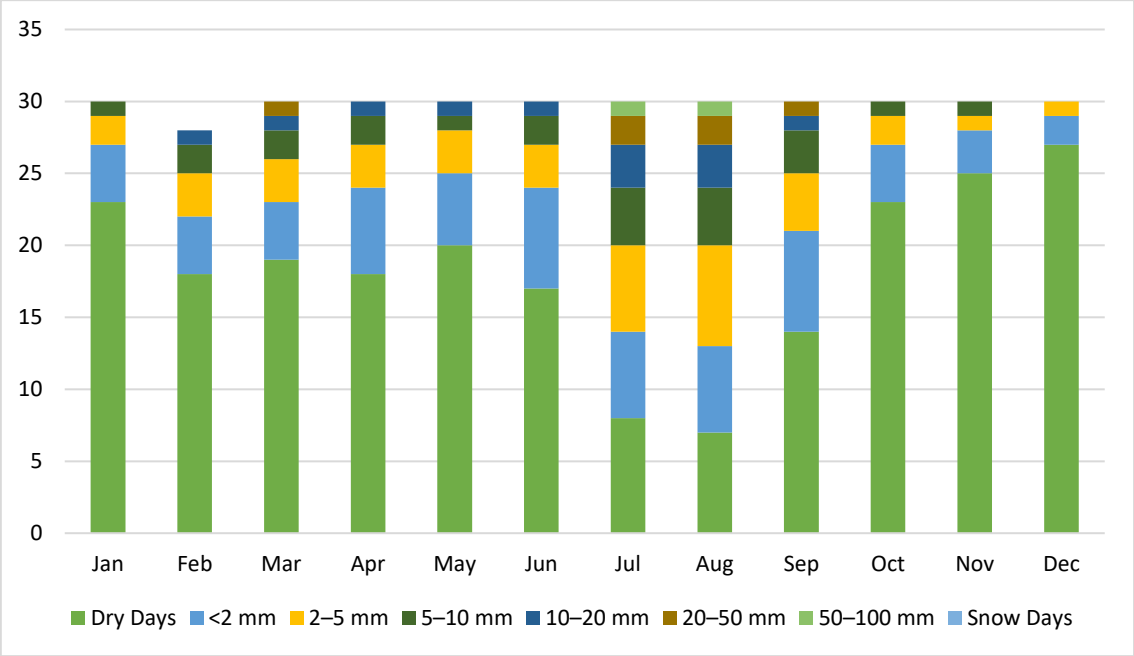


Monthly precipitation distribution pattern

Mohmand has a semi-arid climate in which rainfall is greatly affected by the monsoon and often experiences considerable changes in rain intensity. There is usually very little rain in January and February, roughly between 5 and 15 mm for the month and sometimes light showers from western disturbances fall during that time. Starting in March and April, isolated thunderstorms cause rainfall to rise slightly to between 10 and 30 millimeters each month. May and June see very hot and dry weather, along with little rain (5–20 mm/month) and lots

of dust storms. Most of the district's annual rain (60–70%) falls in the July–September monsoon season, with July bringing the first heavy showers (80–120 mm), August bringing the heaviest (100–150 mm) and occasionally causing flash floods in the valleys and September with a decrease (50–100 mm), despite occasional serious downpours. During October–December, the weather becomes dry, sometimes with slight showers (20–40 mm) in October from the fading monsoon and November and December have very little rain (5–15 mm combined). On average, the region gets between 300 and 500 millimeters of rain annually, but there are unequal amounts and more irregular patterns due to climate change, harming rain-fed farming and leading to higher risks of droughts and floods.

Figure 30: Rainfall and Precipitation Characteristics - District Mohmand



Prevailing wind direction around the year and monthly wind direction

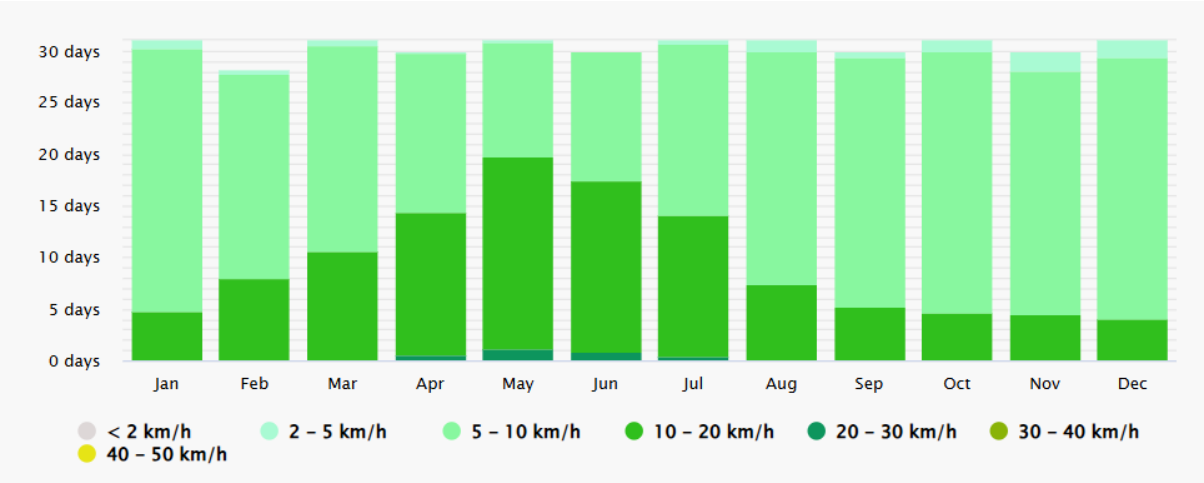
Because of regional climate, the topography in this district and changes during the monsoon, the wind flows from one direction to another through this region. Winds in the region are affected all year long by large groups of cool air from Central Asia, seasonal weather from the Indo-Gangetic monsoon and local structures such as the Hindu Kush mountains.

During the winter months November to February, it is the cold, dry northwest to west wind from Central Asia high pressure systems that rules. Occasionally, western disturbances mix with these winds, producing light precipitation over high regions in the north. In spring, March to April, the wind gradually moves from northwest through to southwest as warm weather sets in. In May and June, before the monsoon arrives, southwesterly to westerly winds from Afghanistan dust regions cause many dust storms and poor visibility.

The change in season to summer monsoon July to September makes a big difference, as southeasterly to easterly winds transport water and moisture from both the Bay of Bengal and the Arabian Sea into the Indian subcontinent. Most of the district's precipitation is caused by the humid, rain-bringing winds, until August, when there are strong downpours that often

cause flooding in the steep valleys. The monsoon season in October is coming to an end and northwesterly winds bring drier and cooler weather from that month on through winter.

Figure 31: Wind speed analysis District Mohmand



6.11.5 Hydrology and Water Resource

Mohmand District, characterized by its rugged mountains with barren slopes and expansive valleys along the banks of the Kabul River, relies primarily on surface water for its agricultural needs. The district's limited income sources are primarily derived from agriculture and some trade or business activities, with a significant portion of the population earning their livelihood abroad, particularly in the Gulf States[54].

Despite its high potential for farming, spate irrigation has received minimal investment in the District Mohmand. There has been a lack of significant efforts to develop sustainable spate irrigation systems, which could help recharge groundwater and mitigate the impact of floods. As a result, flash floods continue to damage infrastructure and agriculture in the region.

Surface Water

The surface water in Mohmand District, while crucial, remains underutilized for irrigation and agricultural purposes. The Kabul River, flowing along the district's boundary, is a significant source of water. However, the district lacks extensive development in sustainable irrigation systems, which could help manage and utilize the available water resources more effectively. This has led to a dependency on seasonal streams and floodwater, with minimal investment in infrastructure to harness these resources fully. The district's agricultural potential is thus hampered by the inadequate use of available surface water, which is vital for sustaining the local economy.

Ground Water

Groundwater is a critical resource for drinking water in Mohmand District, with open wells being the primary source, supplying 67% of households. The reliance on open wells underscores the challenges in accessing safe and reliable water, especially in areas where

[54] Technical Studies of Water Resources in FATA, IUCN Pakistan, SDC and FATA Environment Cell, https://pcrwr.gov.pk/wp-content/uploads/2020/Water-Management-Reports/FATA-water-studies.pdf

public infrastructure is less developed. The second most common source of drinking water is tapping water, provided through pipelines by the public health engineering department in major towns. In more remote areas, many households depend on ponds for their drinking water, reflecting the scarcity of accessible and clean water sources. Additionally, a small percentage of households (4%) use hand pumps, while the remaining 8% rely on alternative sources such as stream water, rainwater harvesting, or perennial water sources.

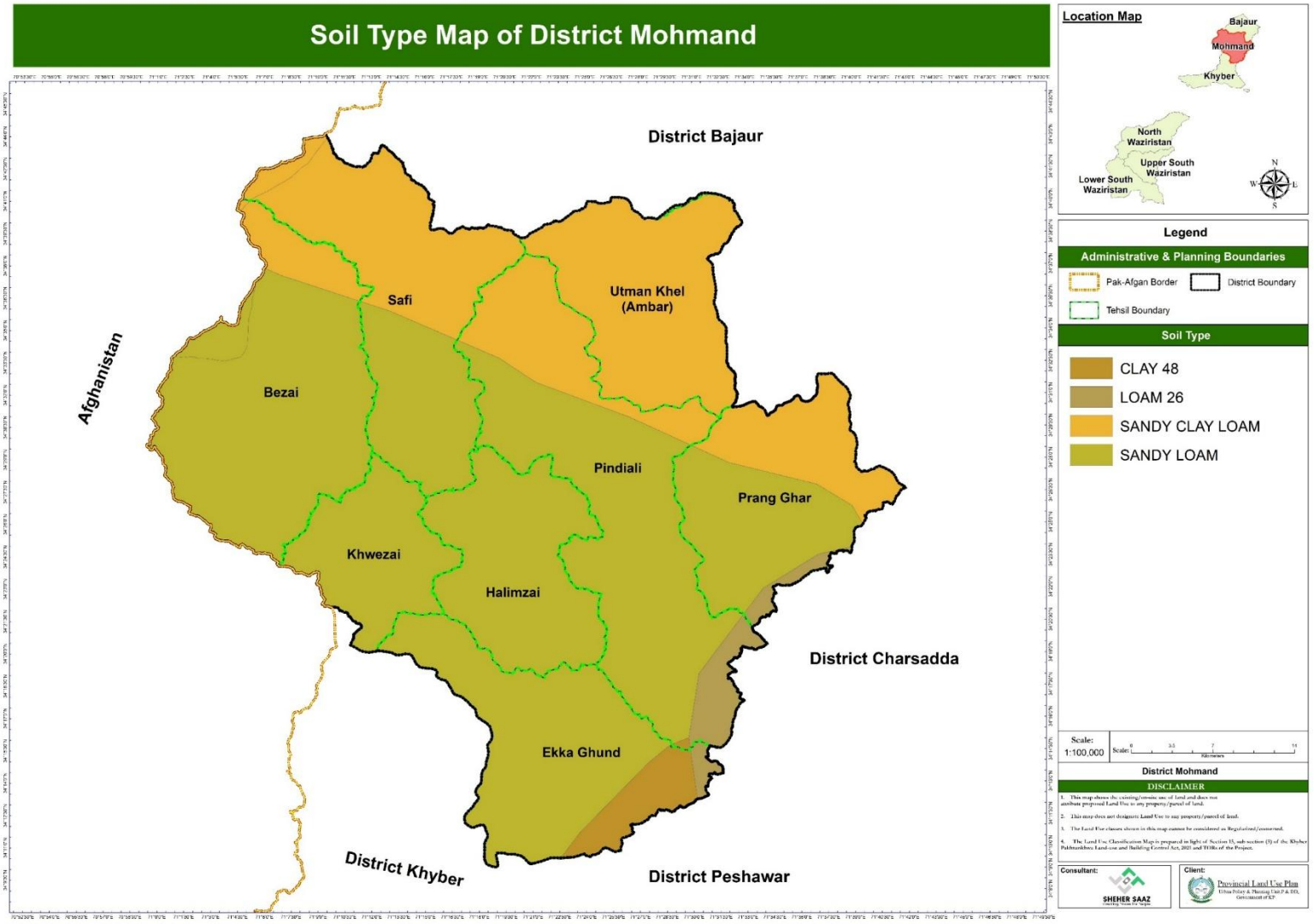
The district faces significant challenges in water resource management, with a declining water table due to uncontrolled groundwater extraction. This has caused many existing waters supply schemes to become non-functional, leading to increased reliance on shared wells in communities. The ongoing ecological changes, combined with regional instability, have further exacerbated these issues, reduced aquifer recharge and drying up many natural watercourses. Without the development of alternative water sources or sustainable groundwater management practices, the district's water scarcity will likely worsen, impacting both domestic and agricultural water availability.

6.11.6 Soil

The soils in Mohmand District are primarily derived from residuum and colluvium originating from schist and slate parent materials. These soils vary from shallow to moderately deep, with good to somewhat excessive drainage. They are slightly to moderately calcareous and possess a coarse texture, ranging from sand, loamy sand, sandy loam, fine sandy loam to loam. The soil is slightly eroded and is typically found on the lower mountain slopes, as well as on piedmont alluvial plains and water-reworked loess plains, which occupy nearly level to gently sloping areas. These areas feature soils that are moderately deep, well-drained, and moderately calcareous, with slight erosion.

The district experiences a semi-arid, subtropical continental climate, contributing to the fertility of the soils, which are well-suited for the cultivation of a wide range of cereal crops, vegetables, and fruits, including off-season vegetables. The district is particularly known for the cultivation of tomatoes and chilies, especially in frost-free pockets. Key crops grown in the region include wheat, maize, and oilseeds, benefiting from the fertile soil conditions.

Map 65: Soil Map – District Mohmand



6.11.7 Sustainable forest management

In District, sustainable forest management will open promising avenues. Community-based Forest management fosters local involvement, while ecotourism harnesses natural beauty, attracting visitors. Agroforestry integrates trees with agriculture, optimizing land use. These strategies align conservation with development, paving a sustainable path for the district's forests and communities. All the planning will be done considering the Sustainable Development Goals in addition to IPCC recommendations.

6.11.8 Proposed Intervention

There are four specific proposals given to maintain the physical characteristics in the area and promote greenery in the area. These include green space, plantation, riparian zone, and green belt.

- ***Green Space/Buffers***

According to the Khyber Pakhtunkhwa Urban Policy, a mandatory green buffer zone of approximately 61 meters must be established around all designated industrial zones to mitigate environmental impacts, reduce pollution exposure for nearby communities, and preserve ecological balance. This standardized green space requirement is strictly implemented in the proposed and existing industrial zones, where the buffer serves as a critical barrier between industrial activities and residential or agricultural areas.

Figure 32: Industrial Buffer Zone as per KP policy



However, in the areas, which experiences significantly higher population density compared to the other tehsils, the green buffer has been intentionally expanded beyond the standard 61-meter width. This augmented green space not only enhances environmental protection but also provides additional recreational areas, improves air quality, and supports urban heat island mitigation in a more densely populated setting. Such adaptive planning reflects a

responsive approach to local demographic pressures while upholding the core objectives of sustainable industrial development and public health safeguards across the region.

- ***Plantation***

To foster a healthier urban environment and enhance ecological resilience, extensive plantations are mandated within the major cities of the region, in full alignment with sustainable development goals. These afforestation initiatives will employ the renowned Miyawaki method, a proven technique for creating dense, native, multi-layered forests that rapidly establish biodiversity, improve air quality, sequester carbon, and stabilize soil within just a few years. By mimicking natural forest ecosystems, Miyawaki plantations promote self-sustaining green cover that requires minimal maintenance after the initial establishment phase, thereby ensuring long-term environmental stability across urban and peri-urban landscapes.

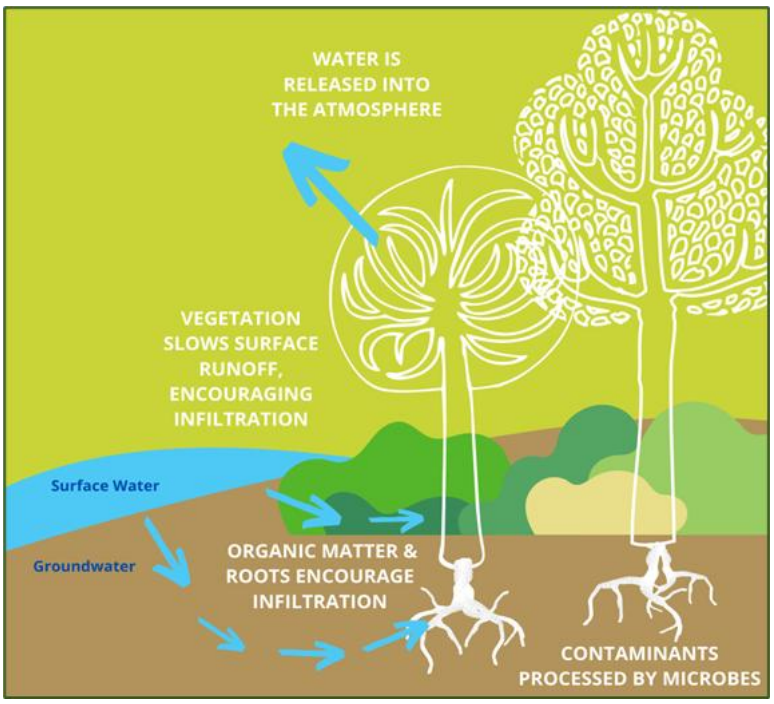
Figure 33: Miyawaki Methods and approaches[55]



The selection of plant species will prioritize locally adapted, indigenous, and ecologically significant trees and shrubs that are well-suited to the region's soil, climate, and topography. The plantation should be done given the area most frequently grown plants such as the kikar (Prosopis juliflora), phulai (Acacia modesta), kao (Olea cuspidata), ber (Ziziphus; Ziziphus numularia), gurgura (Monotheca boxifolia), blue pine (Pinus wallichiana), cedar (Cedrus deodara), oak (Quercus incana), sanatha (Dodonea viscosa), eucalyptus (Eucalyptus camaldulensis), poplar (Populas sp), mulberry or toot (Morus alba), shisham (Dalbergio sissoo), and farash (Tamarix articulate).[56]

[55] https://currentaffairs.chetanbharat.com/miyawaki-plantation-method/
[56] November 7, 2025. Almanac, https://pakistanalmanac.com/kp-khyber/#1633497144852-f0a014d6

➢ *Green Belt*



A green belt is strategically established around each settlement wherever the need arises, primarily to impose a definitive boundary that curtails uncontrolled urban sprawl, preserves agricultural land, and safeguards natural ecosystems from encroachment.

A robust 500-meter-wide green belt has been mandated to encircle these areas, serving as both a physical and ecological barrier. This expansive buffer not only prevents the merging of settlements but also enhances biodiversity, improves groundwater recharge, and acts as a natural shield against dust, noise, and industrial emissions. Furthermore, it promotes climate resilience by mitigating urban heat islands and provides potential space for community recreation and agroforestry, aligning with sustainable land-use principles under the KP Urban Policy.

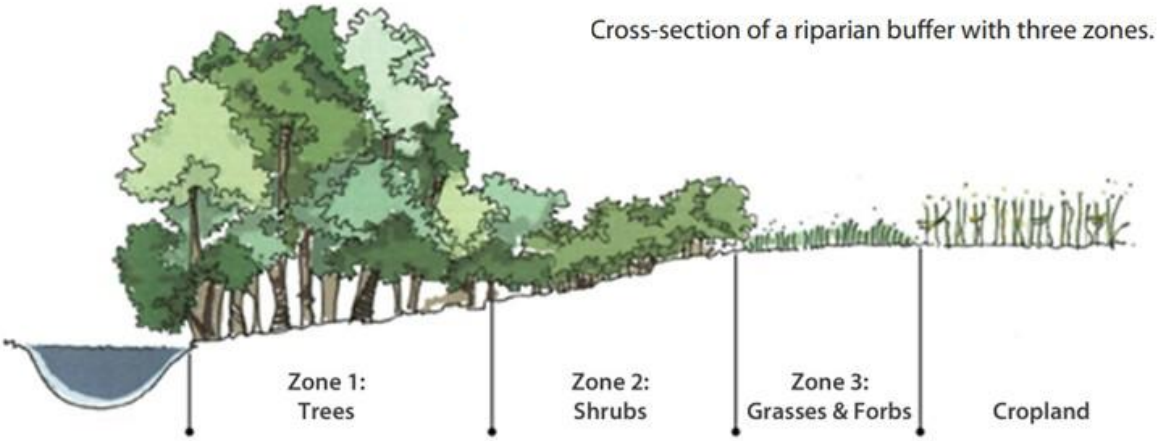
Riparian Zone

A riparian buffer is a transitional zone between land and water where a mixture of trees, shrubs, grasses, and wildflowers grow. Riparian buffers are located along streams, rivers, lakes, and reservoirs. They perform essential ecological functions that support local plant and animal biodiversity, water quality, and soil quality.[57]

A riparian buffer zone is mandated around all water bodies within the project area to prevent infiltration of pollutants, control erosion, and maintain water quality by filtering sediments, nutrients, and contaminants before they enter the stream. These protective corridors are specifically proposed along the rivers, as well as key watercourses that traverse the designated industrial and urban development zones. A minimum 200-meter-wide riparian zone is established on both banks of these water bodies, comprising dense native vegetation.

[57] https://riparian.utk.edu/why-riparian-zones/

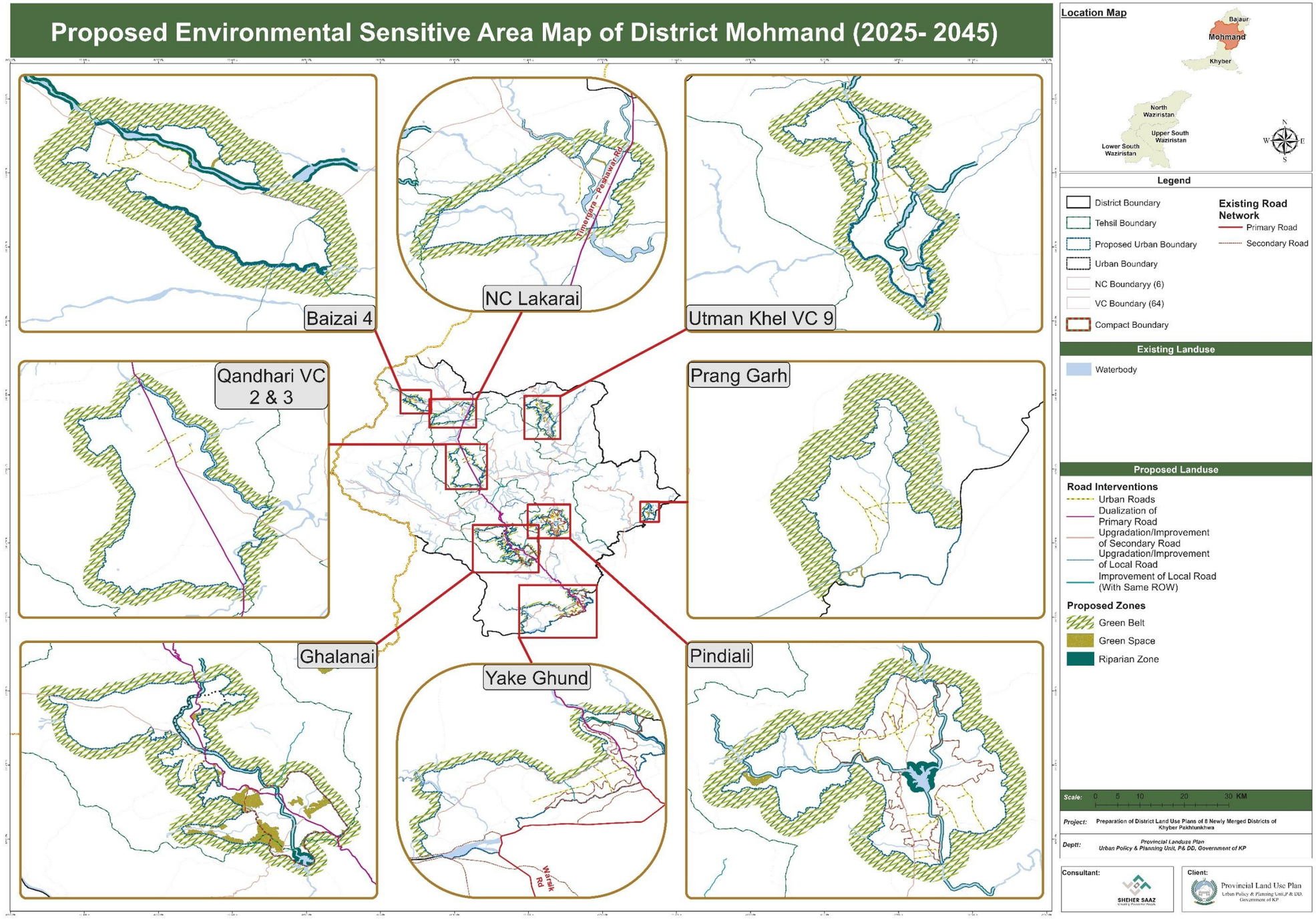
Figure 34: Concept Design for Riparian Zone[58]



This buffer not only safeguards aquatic ecosystems and groundwater recharge but also aligns with the Khyber Pakhtunkhwa Environmental Protection Act and National Water Policy standards.

[58] https://www.herefordshire.gov.uk/directories/nutrient-neutrality-private-mitigations/riparian-buffer/

Map 66: Environmentally Sensitive Areas - District Mohmand



6.12 AGRICULTURAL AND LIVESTOCK

6.12.1 Agriculture

6.12.1.1 Existing Condition

Agriculture is the backbone of District Mohmand's rural economy, with a substantial portion of the population directly or indirectly dependent on farming and livestock for their livelihoods. At the national level, agriculture contributes about 22.9 percent to the Gross Domestic Product (GDP) and employs 37.4 percent of the workforce. In Khyber Pakhtunkhwa, the sector accounts for 19.2 percent of provincial GDP and provides employment to 31.77 percent of the labor force, with the majority of residents living in rural areas. The sector plays a critical role in ensuring food security, supplying raw materials to agro-based industries, and generating foreign exchange through crop and livestock products. For District Mohmand, addressing food security and controlling food inflation are central to poverty reduction, requiring integrated strategies to make agriculture more productive, competitive, and sustainable.

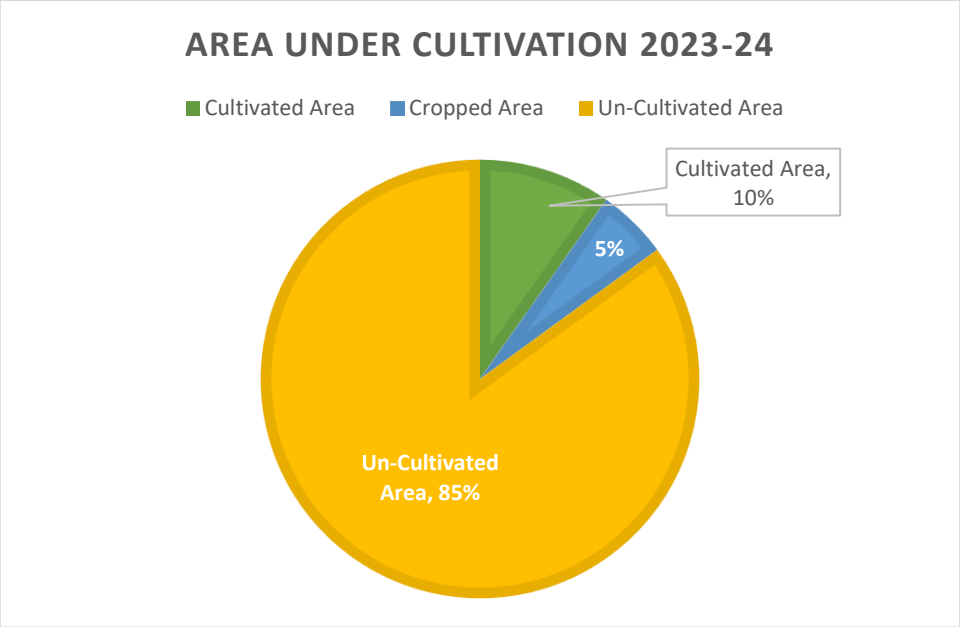
The cultivated lands of District Mohmand are primarily concentrated in valley bottoms, terraced hill slopes, and riverine tracts along the Swat and Kabul Rivers. The soils, ranging from sandy loams to silt loams, support a diverse range of crops including wheat, maize, barley, pulses, fodder, and seasonal vegetables. Irrigation is mainly dependent on perennial and seasonal streams, karezes (traditional underground water channels that tap groundwater and convey it to the surface by gravity, minimizing evaporation losses), dug wells, and tube-wells, though a considerable portion of farmland remains rain-fed, leaving yields vulnerable to variable rainfall. The district's agricultural potential is also shaped by its rugged terrain, where smallholder farming dominates and mechanization remains limited. Mohmand produces both subsistence food crops such as wheat, maize, pulses, and barley, and market-oriented cash crops including vegetables and tobacco, along with orchard produce like apricot, peach, plum, grapes, and pomegranate. In certain valleys, off-season vegetables enjoy strong market demand in Peshawar and nearby districts. Livestock also plays a crucial role in the rural economy, with cattle, goats, sheep, and poultry providing milk, meat, and income support, while donkeys and mules remain essential for transport in hilly terrain.

However, urbanization and population growth are emerging as significant threats to Mohmand's agricultural land. The expansion of housing, shops, markets, and other infrastructure is steadily encroaching upon cultivable areas, leading to reduced farmland and declining yields of major crops and vegetables. Additionally, the marble industry has become a major contributor to the degradation of the agricultural ecosystem, as quarrying and industrial runoff disrupt irrigation systems, alter water quality, and negatively affect the flora and fauna of the surrounding landscape. These combined pressures underscore the urgent need for planned land-use management, protection of fertile soils, and sustainable farming practices to preserve Mohmand's agricultural productivity for future generations.

6.12.1.2Area Under Cultivation

According to the existing land use classification[59], the total reported area of District Mohmand is 567,403 acres. Out of this, about 58,489.8 acres (10.3 percent) is classified as agricultural land, while only 3 acres are recorded as orchards under a land use category. However, as per the Development Statistics 2025, merely 10% (as shown in figure below) of this agricultural share is actually cultivated, whereas the remaining land consists of fallow fields and other agricultural uses. The rest of the district's land, accounting for nearly 77.5 percent, is categorized as non-agricultural, which includes barren mountains, rocky terrain, settlements, roads, rivers, and forested areas. This distribution highlights both the potential and constraints of Mohmand's agriculture, where a substantial portion of reported farmland remains underutilized.

Figure 35: Area Under Cultivation in District Mohmand[60]



6.12.1.3Crop Production Profile

Agricultural activities in District Mohmand, similar to the rest of Khyber Pakhtunkhwa, follow two major cropping seasons. During the Rabi season, farmers primarily cultivate wheat, barley, spinach, turnip, mustard, grams, and pulses, while in the Kharif season, crops such as maize, tomato, onion, cucurbits, bitter gourd, and coriander dominate cultivation.

Wheat is the dominant crop, with production rising from 9,682 tons in 2021-22 to 13,227 tons in 2023-24, accompanied by improved yields from about 528 kg/acre to 638 kg/acre. Maize, the second important cereal, produced between 468 and 539 tons, maintaining yields in the range of 488–502 kg/acre. Among minor cereals, jowar output remained small at 63–69 tons, with yields of around 249–263 kg/acre, while barley production was steady at 372–383 tons, yielding 272–278 kg/acre.

[59] District wise land use utilization in KPK, Development Statistics of KPK-2025
[60] District wise land use utilization in KPK, Development Statistics of KPK-2025

Sugarcane appeared only in 2021-22, producing 4,543 tons with an exceptionally high yield of nearly 12,679 kg/acre, but it disappeared from cultivation in subsequent years. Oilseed crops, primarily mustard, recorded modest production of 85–94 tons, but yields improved consistently from 125 kg/acre in 2021-22 to 153 kg/acre in 2023-24.

Overall, Mohmand's agriculture remains dominated by wheat, with gradual productivity improvements in cereals and oilseeds. However, limited diversification, water scarcity, and reliance on traditional practices continue to constrain the district's agricultural potential.

Table 124: Distribution of Area by Crops in District Mohmand

Year		Crop					
		Wheat	Maize	Jowar	Barley	Sugarcane	Mustard
2021-22	Area (Acre)	18,345	932	269	1,411	358	677
	Production (Tons)	9,682	468	69	383	4,543	85
	Yield per Acre (Kg)	528	502	256	272	12,679	125
2022-23	Area (Acre)	20,547	966	257	1,391	-	652
	Production (Tons)	13,100	471	64	373	-	94
	Yield per Acre (Kg)	637	488	249	272	-	144
2023-24	Area (Acre)	20,732	1,080	240	1,339	-	615
	Production (Tons)	13,227	539	63	372	-	94
	Yield per Acre (Kg)	638	499	263	278	-	153

Source: Khyber Pakhtunkhwa Development Statistics 2025, Bureau of Statistics, KP

6.12.1.4 Water Management and Type of Irrigation

According to the Food and Agriculture Organization, OECD, and World Bank (2025), Pakistan's renewable internal freshwater resources stood at approximately 1,253 cubic meters per person per year in 2017, well below the internationally recognized threshold of 1,700 m^3/person/year, placing the country in the "high water-stress" category. Population growth, urbanization, industrial development, and climate variability continue to intensify pressure on these limited water resources. In many areas, over-extraction of groundwater has resulted in declining water tables, while contamination and salinity further restrict both the availability and quality of freshwater.

In District Mohmand, agriculture depends on a combination of surface and groundwater irrigation, though the overall irrigated area remains modest relative to the district's total cultivable land. The total irrigated area has gradually increased from 17,014 acres in 2021-22 to 17,246 acres in 2023-24. Government canals (nehri) serve as the principal irrigation source, supplying between 6,493 and 6,540 acres, while private canals contribute a similar share, ranging from 6,240 to 6,279 acres. Groundwater sources, mainly dug wells, irrigate around 2,242 to 2,406 acres, though water levels have reportedly dropped below 300 feet, making extraction costly and unsustainable. Lift-pumps provide irrigation for about 776 to 820 acres, while other localized systems support 803 to 854 acres of farmland. Limited use of tubewells is also observed, largely constrained by high installation and operational costs. In some areas, particularly in Yake Ghund Tehsil, the Left Canal from Warsak Dam experiences reduced flow,

further affecting irrigation reliability. Rainfed (barani) farming continues in upland areas where surface irrigation is unavailable, leaving farmers dependent on erratic rainfall.

This irrigation profile highlights Mohmand's dependence on traditional canal networks and shallow wells, with limited adoption of modern water-efficient technologies. As a result, agricultural productivity remains highly sensitive to rainfall variability and canal water availability, underscoring the urgent need for small-scale storage structures, improved irrigation efficiency, and groundwater recharge initiatives to strengthen agricultural resilience in the district.

Table 125: Year-wise Irrigated Area in Mohmand District through Different Sources

Year	Total	Canals		Tanks	Tubewells	Wells	Lift-pumps	Others
		Govt.	Private					
2021-22	17,014	6,493	6,240	-	2,242	776	845	17,014
2022-23	17,116	6,520	6,259	-	2,272	781	854	17,116
2023-24	17,246	6,540	6,279	-	2,406	820	803	17,246

**Area is in hectares*

Source: Khyber Pakhtunkhwa Development Statistics 2025, Bureau of Statistics, KP

6.12.1.5 Future Plans and Direction

6.12.1.5.1 Future Proposals

- ***Proposal for Preserve Agriculture, Orchard Zone***

1. Preserve Agriculture Zones (Total Area: 127,369.33 Acres)

District Mohmand possesses extensive fertile agricultural land, which forms the backbone of rural livelihoods and food security in the district. Existing cultivated areas demonstrate the district's strong potential for the expansion and intensification of agricultural activities.

Establishing Preserve Agriculture Zones (127,369.33 acres) will safeguard these lands exclusively for crop production, ensuring long-term food security, sustainable land use, and economic resilience for farming communities. The zones will focus on staple and high-value crops, including wheat, maize, vegetables, and pulses, with locations selected based on soil fertility, water availability, and accessibility to local markets.

These zones will also support modern and climate-resilient farming practices, such as improved irrigation systems, soil conservation measures, and the adoption of high-yield and drought-resistant crop varieties. By protecting these lands, the district ensures sustainable rural livelihoods, improved agricultural productivity, and long-term food security.

2. Preserve Orchards Zones (Total Area: 620.57 Acres)

District Mohmand's climate and soil conditions are highly favorable for fruit cultivation, with existing orchards covering more than 2,130 acres, highlighting strong potential for further orchard-based farming.

The establishment of Reserved Orchard Zones (620.57 acres) will protect these lands exclusively for high-value fruit production, ensuring crop diversification, income generation, and sustainable land use. Priority crops will include apples, peaches, apricots, and grapes, with zones selected in areas that have reliable water resources and proximity to markets.

These zones will also support value addition and agro-processing activities, including cold storage, packaging, and transportation facilities, while promoting modern horticultural practices through extension services and farmer training. This approach will strengthen rural incomes, employment, and market-oriented horticulture across the district.

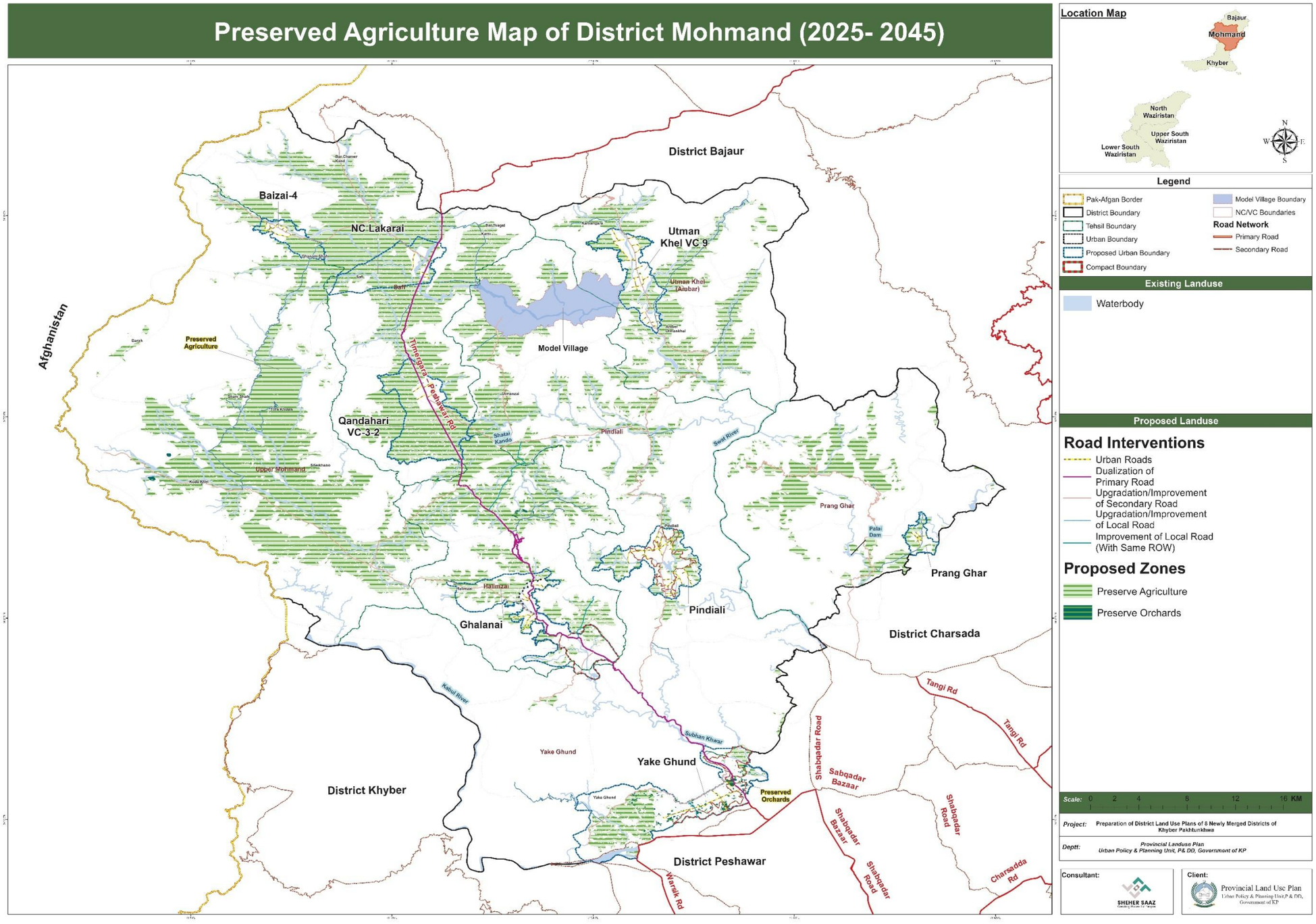
- ***Proposal for Preserve Agriculture, Orchard Zone***

Table 126: Proposal for Preserve Agriculture & Orchard Zone

Land Use Category	Area (Acres)	Detailed Description & Planning Considerations
Preserve Agriculture	127,369.33	This zone is dedicated to safeguarding arable and productive agricultural land across the district. Objectives include maintaining food security, ensuring long-term soil fertility, and supporting sustainable farming practices. Activities allowed include crop cultivation, irrigation, farm-based enterprises, and agricultural training centers. Planning considerations emphasize: - Protection from urban encroachment and non-agricultural development. - Implementation of soil and water conservation measures. - Encouragement of modern farming technologies and sustainable land management practices. - Maintenance of connectivity to rural settlements for labor and market access.
Preserve Orchards	620.57	Orchards and horticulture areas are preserved to support high-value crop production, including fruits and cash crops. Objectives include boosting rural income, enhancing biodiversity, and supporting agro-processing and related micro-enterprises. Planning considerations: - Protection of existing orchards from fragmentation and land-use conversion. - Promotion of horticulture extension services and irrigation support. - Encouragement of value-added activities such as cold storage, packaging, and processing facilities. - Integration with local markets to strengthen rural economies and ensure profitability.
Livestock & Dairy Development Zone	1,069.28	This zone is specifically designated for livestock rearing, dairy production, and related support services. Objectives include increasing livestock productivity, generating employment, and supporting local food systems. Planning considerations: - Provision of land for dairy farms, fodder cultivation, veterinary clinics, and animal husbandry

		training centers. - Encouragement of value-added livestock processing, including milk chilling, packaging, and small-scale meat processing. - Integration of environmental safeguards, including waste management, water supply, and controlled grazing areas. - Ensuring compatibility with surrounding agricultural and residential areas.

Map 67: Proposed Agriculture Zones-District Mohmand



6.12.1.6Recommendations

- Line and concrete water channels and tube-well outlets to minimize seepage losses and reduce pumping costs.
- Promote modern irrigation systems such as drip and sprinkler methods to make the most of scarce water resources and improve yields.
- Establish small water reservoirs, rainwater harvesting structures, and check dams in rainfed areas to enhance water availability for off-season crops.
- Reclaim and cultivate idle or underused lands through land leveling, soil preparation, and improved irrigation practices.
- Encourage multiple cropping and efficient rotation (e.g., wheat–maize, wheat–vegetables) to increase output from limited acreage.
- Expand production of high-value crops such as sugarcane, onion, potato, tomato, and fruits (including orchard development) to increase farmer income.
- Introduce plastic tunnel technology for off-season vegetables to enable early market entry and better prices.
- Promote organic farming and compost use to improve soil fertility and reduce dependence on costly chemical inputs.
- Provide timely access to certified seeds, fertilizers, and pesticides at affordable rates, with strict monitoring of seed and fertilizer quality.
- Encourage adoption of high-yield, disease-resistant varieties of wheat, maize, potato, and vegetables suited to the district's climate.
- Strengthen agricultural extension services to educate farmers on pest management, irrigation scheduling, and modern farming techniques.
- Expand credit and loan facilities through commercial banks and microfinance institutions, enabling smallholders to purchase quality inputs and equipment.
- Improve farm-to-market roads and transport services to reduce post-harvest losses and provide farmers easier access to urban markets.
- Support establishment of storage and processing facilities (e.g., cold storage for potatoes and onions, sugarcane processing units) to stabilize prices and add value locally.
- Promote water conservation measures, agroforestry, and soil conservation to safeguard natural resources.
- Encourage women's participation and small-scale agribusiness ventures to boost household income and food security.

6.12.1.7Zoning Regulation for Agriculture Land Use

Table 127: Guidelines developed for Agricultural zone development

Category	Regulations / Activities
Permitted Uses	• Development of land strictly for agricultural purposes in designated areas. • Crop cultivation, horticulture, orchards, and greenhouse farming. • Livestock farming, poultry, and related animal husbandry.

	• Aquaculture and small-scale fish farming (where suitable). • Establishment of farmer's markets and direct sale outlets for agricultural products. • Construction of basic storage facilities (silos, cold storage, warehouses) directly linked to farming activities.
Permissible Uses	• Agro-processing and value addition industries (e.g., food processing, packaging). • Renewable energy generation integrated with farming (e.g., solar panels, biogas units). • Rural tourism initiatives (e.g., farm stays, guided agro-tours, demonstration farms). • Agroforestry and sustainable land management practices. • Agricultural research and demonstration centers. • Accommodation and housing for farmers and farm labor (subject to local authority approval).
Prohibited Uses	• Conversion of agricultural land to non-agricultural uses such as residential, commercial, or industrial development. • Cultivation of crops or rearing of livestock not suitable for the local climate or requiring excessive water/resources. • Use of harmful agrochemicals or practices that degrade soil quality, reduce productivity, or pollute water sources. • Encroachment or fragmentation of reserved agricultural areas for unplanned development. • Any activity harmful to public health, the natural environment, or biodiversity.

6.12.2 Livestock Sector

6.12.2.1 Existing Available Livestock and Services

The livestock sector in Mohmand District is a critical component of its economy, especially given the limited agricultural land available. With a total livestock population of 2,225,619, Mohmand accounts for 4.65% of Khyber Pakhtunkhwa's overall livestock population. Cattle farming is significant, with 457,710 cattle making up 5.18% of the province's total, contributing notably to local milk and beef supply. Sheep farming is particularly prominent, with 411,011 sheep, representing 9.74% of the provincial total, highlighting its importance in wool production and mutton supply. Goats also play a crucial role, with 681,375 in the district, constituting 6.79% of the province's goat population.

Buffaloes, while less common, still contribute with a population of 19,362, accounting for 0.57% of the provincial total, indicating some involvement in dairy production. Poultry farming, with 631,064 birds, represents 3.30% of the province's poultry, showing room for growth in this sector. Camels and donkeys, with populations of 1,908 and 9,375 respectively, reflect the adaptation to the district's terrain, though their numbers suggest limited economic impact. Horses and mules are the least common, with minimal presence in the district.

The district's reliance on sheep and goat farming underscores the vital role of pastoralism in sustaining livelihoods, ensuring food security, and bolstering the local economy. While buffalo, camel, and poultry populations are comparatively smaller, they present opportunities for

growth and income enhancement through focused development efforts. The table below provides an overview of the livestock population in the province and the district.

Table 128: Existing Livestock Population in 2021 – Mohmand District

Animal	Khyber Pakhtunkhwa	Mohmand District	Portion of Mohmand District (%)
Total	47,911,692	2,225,619	4.65%
Cattle	8,837,227	457,710	5.18%
Buffaloes	3,402,135	19,362	0.57%
Sheep	4,219,238	411,011	9.74%
Goats	10,041,678	681,375	6.79%
Poultry	19,100,442	631,064	3.30%
Camel	124,663	1,908	1.53%
Horse	268,953	379	0.14%
Donkey	502,821	9,375	1.86%
Mules	3,022,101	868	0.03%
Other	112,325	12,567	11.19%

Source: Khyber Pakhtunkhwa Development Statistics 2022, Bureau of Statistics, KP

According to the Livestock and Dairy Development Department of Khyber Pakhtunkhwa, Mohmand District hosts around 71 poultry farms in addition to a network of veterinary and animal husbandry services. The district is equipped with civil veterinary hospitals, dispensaries, centers, artificial insemination facilities, and diagnostic labs that support livestock health and productivity. However, compared with some other merged districts, the overall number of service facilities in Mohmand remains moderate, highlighting the need for expansion and modernization.

Table 129: Existing Animal Husbandry Facilities and Level of Services

Sr. No	District	CVH	CVD	CVC	AIC	District MVC	Mobile Milk Lab	Diag. Lab	SPU	Model Dairy Farm	Total
1	**Mohmand**	3	18	35	35	2	–	–	1	–	94
Key: **CVH = Civil Veterinary Hospital, CVD = Civil Veterinary Dispensary, CVC = Civil Veterinary Centre, AIC = Artificial Insemination Centre, MVC = Mobile Veterinary Centre, SPU = Semen Production Unit**											

Source: Livestock and Dairy Development Department of Khyber Pakhtunkhwa

6.12.3 Fisheries Sector

6.12.3.1 Existing Status and Resources

Although fisheries in District Mohmand were earlier considered underdeveloped, recent assessments by the Livestock and Dairy Development Department, Khyber Pakhtunkhwa show that the sector holds strong potential for sustainable growth. The district is endowed with significant aquatic resources, including the River Kabul, the Warsak Left Canal, and the

Monda Barrage, which collectively provide favorable conditions for freshwater aquaculture. In addition, a series of rainfed and small dams, namely Motoshah, Khurshid Delay, and Pandiali (already auctioned for fish farming), along with Saligoo, Agarb Dug, Michni, Ghalanai, and Ghandaw Dams (the last two still under construction), offer valuable opportunities for developing both community-based and commercial fish farms across the district.

6.12.3.2Developmental Projects

The Government of Khyber Pakhtunkhwa has initiated several developmental projects to strengthen the fisheries infrastructure in District Mohmand. A major intervention is the Training Center and Carp Hatchery at Mohmand District, where Phase-I has been completed, and Phase-II is currently under construction, pending handover from the C&W Department. Once operational, this hatchery will serve as a central facility for seed production, fish breeding, and farmer training, thereby promoting aquaculture self-sufficiency in the region.

Another important milestone is the establishment of 38 fish farms in the private sector, supported through departmental guidance and technical assistance. Furthermore, 1,845 fish farmers have been trained under government-led programs, significantly improving community awareness and skill development in aquaculture practices. The district's climate supports a variety of warm-water fish species, including silver carp, mori, rahu, thela, grass carp, and China fish, which have demonstrated good adaptability and strong market demand. However, 50 new applications for establishing additional farms remain pending due to non-availability of funds, underscoring the need for continued financial and institutional support.

6.12.3.3Suitable Sites for Fish Farming

The site has been identified as highly suitable for fish farm development.

- Pandiali

These sites possess favorable water availability, terrain conditions, and accessibility, making them ideal for establishing small to medium-scale aquaculture enterprises.

6.12.3.4Opportunities and Challenges

The fisheries sector in Mohmand offers significant opportunities for income generation, employment creation, and nutritional improvement. With appropriate investment and technical support, aquaculture can also contribute to eco-tourism, particularly around scenic dam sites. However, the sector faces persistent challenges such as limited hatchery capacity, absence of cold storage and feed processing units, low adoption of modern aquaculture technologies, and inadequate market connectivity. Addressing these gaps will be essential for scaling up production and improving value chain efficiency.

6.12.3.5Way Forward

The sustainable development of fisheries in District Mohmand depends on the completion of the Carp Hatchery, expansion of training and extension programs, and mobilization of financial resources for private fish farm establishment. Integration under the KP Fisheries and Aquaculture Act (2022) and alignment with Blue Economy initiatives will further strengthen

governance, promote sustainable resource utilization, and attract private-sector participation. With these interventions, the fisheries sector has the potential to become a vibrant component of Mohmand's local economy, contributing to food security, livelihood enhancement, and environmental conservation.

6.12.4 Existing and Future plans

6.12.4.1 Existing Plans by Government

The Government of Khyber Pakhtunkhwa, through the Livestock and Dairy Development Department, is implementing several initiatives aimed at improving livestock health, productivity, and service delivery across District Mohmand. One of the key ongoing interventions is the Provision of Artificial Insemination (A.I.) Facilities and Veterinary Medicines in existing veterinary institutions, designed to enhance animal breeding efficiency, promote genetic improvement, and ensure timely access to essential veterinary supplies.

In addition, the Construction of Functional Veterinary Centers is underway to replace outdated or rented facilities with purpose-built structures that meet modern standards for livestock healthcare and management. These centers are intended to strengthen on-ground service delivery, expand outreach to remote areas, and support disease control and vaccination campaigns.

A Special Campaign for the Control of Ecto and Endo Parasites has also been launched across the district to reduce losses associated with parasitic infestations in cattle, goats, and sheep. This initiative focuses on mass treatment, farmer awareness, and improved hygiene practices to safeguard animal health and productivity.

Furthermore, the government is pursuing the Strengthening, Improvement, and Construction of Existing Livestock Facilities, with a particular emphasis on establishing a breed improvement system within District Mohmand. These efforts aim to enhance the quality and yield of local breeds through selective breeding, better feeding regimes, and improved veterinary care.

Collectively, these projects represent a strategic effort to modernize the livestock sector in District Mohmand, ensuring sustainable development, higher productivity, and greater economic returns for rural farming communities.

6.12.4.2 Future Proposals

6.12.4.2.1 Livestock and Dairy Development Zones (Total Area: 1,069.28 Acres)

Livestock farming is a key component of the rural economy of District Mohmand, providing nutrition, income, and employment for local communities. Current practices indicate significant potential for expansion and modernization of dairy and livestock production systems.

The proposed Livestock & Dairy Development Zones (1,069.28 acres) will allocate land specifically for dairy farms, animal husbandry, fodder cultivation, and veterinary services, supporting sustainable livestock development. These zones will promote value-added

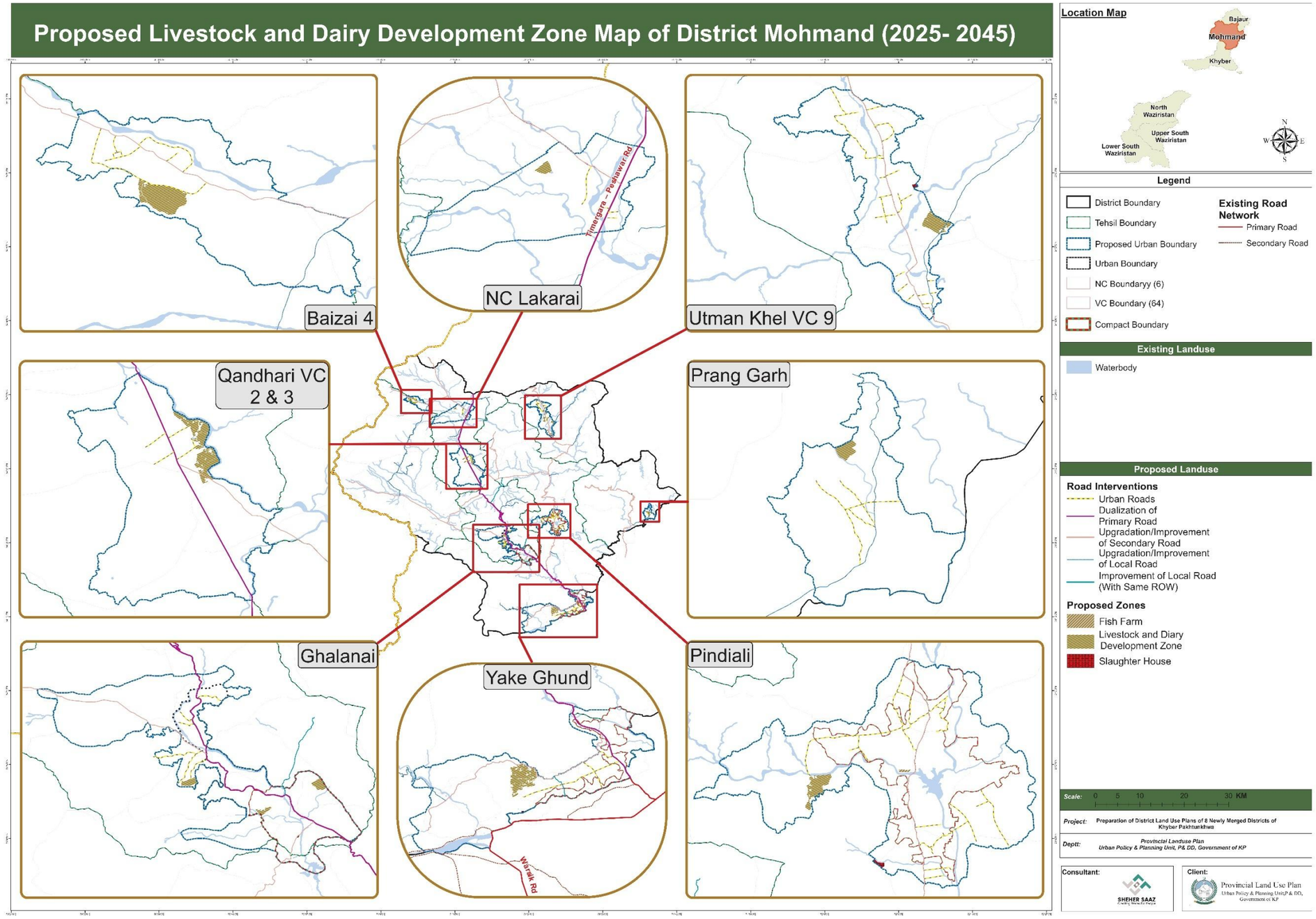
activities, such as milk collection, chilling, processing, and local distribution, enhancing food security and rural income generation.

Table 130: Livestock and Dairy Development Zones – District Mohmand

Proposal Location	Area in acre
Ghalanai	96.26
Yeka Ghund	434.91
Pindiali	55.98
Utman Khel Vc-2&9	95.42
Qandahari Vc-3&2	261.26
Prang Ghar	12.37
Lakarai	39.97
Baizai -4	73.08
Total	44.52

Source: Proposed District Mohmand Land Use Plan, 2025

Map 68:Livestock Dairy Development Zones- District Mohmand



6.12.4.3Recommendations

- Strengthen and expand existing veterinary hospitals, dispensaries, and centers to ensure accessible livestock healthcare and vaccination coverage across all tehsils.
- Construct new veterinary facilities in underserved areas and upgrade rented or temporary centers into permanent functional buildings.
- Provide regular vaccination and deworming campaigns for the control of endemic diseases and parasites among cattle, goats, and sheep.
- Introduce improved and high-yielding breeds of cattle, buffalo, goats, and poultry through selective breeding and artificial insemination programs.
- Promote integrated livestock management systems with improved feeding, housing, and healthcare facilities to enhance milk and meat productivity.
- Establish small-scale dairy farms and milk collection centers at community level to support rural livelihoods and strengthen the dairy value chain.
- Introduce mobile veterinary and animal health units for disease control and emergency response in remote areas.
- Develop fodder cultivation programs and promote dual-feed strategies using locally available crops and by-products for both livestock and fish feed.
- Encourage private sector participation in establishing feed mills, fodder processing, and cold storage units to reduce input costs and post-harvest losses.
- Provide microfinance and insurance facilities to small livestock and poultry farmers to reduce vulnerability and promote investment in productive assets.
- Promote backyard and semi-commercial poultry farming by providing subsidized chicks, feed, and vaccination support to small farmers, especially women.
- Establish modern poultry breeding and rearing units in suitable locations to ensure consistent supply of quality birds and eggs to local markets.
- Conduct regular farmer awareness and training sessions on improved husbandry, disease control, vaccination, and marketing practices.
- Develop organized livestock and poultry markets with auction halls, weighing stations, and hygienic slaughtering and meat-processing facilities.
- Promote hygienic meat handling and cold chain systems to improve food safety standards and market competitiveness.
- Encourage establishment of slaughterhouse and meat-processing units on modern lines to enhance value addition and ensure compliance with food regulations.
- Promote livestock-based cottage industries such as dairy processing (cheese, yogurt, ghee), leather goods, and poultry by-products to enhance rural income.
- Introduce community-managed model farms and breeding centers for goats and sheep in hilly areas with strong grazing potential.
- Promote eco-friendly livestock practices and improved waste management to minimize pollution and enhance environmental sustainability.
- Strengthen extension services by deploying trained livestock and fisheries officers for regular field visits and farmer guidance.

- Support establishment of cooperative societies for collective livestock marketing, input supply, and value chain development.
- Encourage women's participation in livestock and poultry rearing through training, credit access, and backyard enterprises.
- Integrate livestock and fisheries development into broader rural development programs to enhance food security and employment.
- Promote pond and dam-based aquaculture using small water bodies such as Motoshah, Khurshid Delay, Pandiali, Saligoo, Michni, and Ghalanai for warm-water species.
- Establish fisheries training and hatchery centers to produce quality seed and provide technical training to local farmers.
- Promote cultivation of fast-growing fish species like silver carp, grass carp, rahu, mori, and China fish suitable for the district's climate.
- Prevent illegal fishing and promote sustainable harvesting practices through awareness and strict enforcement.
- Develop recreational fisheries and eco-tourism facilities around scenic dam sites to attract visitors and diversify rural incomes.
- Introduce public–private partnerships for establishing integrated livestock, poultry, and fisheries clusters to enhance productivity and marketing efficiency.
- Expand research, data collection, and monitoring programs to support evidence-based planning and sustainable resource management in the livestock and fisheries sectors.

6.13 FOREST/RANGELAND ZONES

6.13.1 Existing Status of Rangelands

District Mohmand historically supported extensive natural vegetation across its rugged hills and valleys, forming the backbone of local ecology and subsistence. According to the existing land use classification, the district has about 381125.54 acres under rangeland, these rangelands serve as critical grazing grounds for livestock while also encompassing the district's dispersed forest patches, which are not separately categorized in some provincial records. The vegetation includes phulai (Acacia modesta), sanatha (Dodonaea viscosa), wild olive (Olea ferruginea), and isolated stands of oak and chilghoza pine at higher elevations. In recent years, small-scale plantations of eucalyptus, poplar, and shisham have also been introduced through initiatives like the Billion Tree Afforestation Project (BTAP).

6.13.2 Regional Comparison

Unlike northern forest-rich districts such as Swat, Dir Upper, Kohistan, and South Waziristan, Mohmand's natural resources are limited and fragile, concentrated mainly in scrublands and community-managed rangelands. While these landscapes may not yield high commercial timber, they play a vital role in sustaining household energy needs, livestock fodder, slope stability, and soil fertility. Traditionally, tribal communities regulated these resources through informal systems such as rotational grazing and seasonal access, but increasing population pressure, fuelwood demand, and unregulated use have led to deforestation within rangelands, overgrazing, and vegetation loss.

6.13.3 Community Dependency and Traditional Practices

Today, fuelwood remains the dominant energy source for households, and small-scale firewood sales in local markets provide supplemental income during winters. Rangelands also supply fodder grasses, wild fruits, medicinal plants, and resin that contribute to household livelihoods. However, continuous grazing pressure and unchecked cutting have reduced vegetative regeneration, degraded soils, and increased the district's exposure to erosion, flash floods, and droughts.

6.13.4 Environmental Impacts of Deforestation

The environmental consequences are already evident. Drying of natural springs, declining soil fertility, and higher surface runoff are weakening both agriculture and livestock productivity. On a broader scale, the reduction in vegetative cover undermines carbon storage, watershed functions, and resilience against climate change, leaving Mohmand highly vulnerable to ecological shocks. With Pakistan's national forest cover at barely 5% of land area, far below the 25% stability benchmark, and Mohmand lacking a distinct "forest" land use classification, the district's dependence on fragile rangelands highlights the urgency of sustainable management.

6.13.5 Ecological Functions and Way Forward

Future planning must therefore prioritize rangeland rehabilitation and integrated land management. Key measures include reseeding native grasses, enforcing rotational grazing

systems, and promoting agroforestry along farms, irrigation channels, and degraded slopes. Afforestation drives such as BTAP should be adapted to Mohmand's ecology with greater emphasis on drought-tolerant native species. In parallel, the promotion of fuel-efficient stoves, solar energy, and alternative livelihoods can reduce unsustainable fuelwood extraction. Strengthening community-based governance of rangelands will be essential to restore vegetative cover, support livestock productivity, and secure long-term ecological resilience in the district.

6.13.6 Plans and Future direction

6.13.6.1 Future Proposals

Proposal for Protected Rangeland Conservation Zone

These proposed areas collectively represent a district-wide rangeland conservation system, designed to stabilize soil, restore vegetation cover, and sustain livestock productivity under a changing climate.

Table 131: Proposed Rangeland Area for Conservation Zone – District Mohmand

Tehsil	Proposed Rangeland Area for Conservation (Acres)
Halimzai	30,569.66
Upper Mohmand	79545.72
Yake Ghund	59593.80
Safi	36971.23
Utman Khel	38238.54
Prang Ghar	50011.12
Pindiali	86195.48
Total	381125.54

Source: Proposed District Land Use Plan Mohmand, 2025

Zoning and Management Approach

Each tehsil's rangeland area will be designated under three broad management zones according to ecological sensitivity and land-use pressure:

a) Core Conservation Zones (Strict Protection)

Located primarily in **Upper Mohmand, Pindiali**, and **Yake Ghund**, where natural vegetation and slope conditions are relatively intact.

Activities: Controlled access, erosion control, soil stabilization, native species restoration.

b) Sustainable Use Zones (Managed Grazing)

Proposed in **Halimzai**, **Safi**, and **Utman Khel**, where communities depend heavily on grazing.

Activities: Rotational grazing, fodder plantation belts, and regulated livestock movement.

c) Rehabilitation Zones (Degraded Land Restoration)

Targeted in **Upper Mohmand** and **Prang Ghar**, where overgrazing and soil erosion have reduced productivity.

Activities: Reseeding, afforestation with native shrubs, and water conservation micro-projects.

Key Proposed Actions

a) Ecological Restoration and Soil Conservation

- Reseeding with native, drought-tolerant grasses such as *Cenchrus ciliaris* and *Lasiurus sindicus*.
- Constructing small **check dams, contour bunds, and water harvesting ponds** to retain runoff and restore soil moisture.
- Introducing **vegetative barriers** and **live fencing** to prevent erosion on steep slopes.

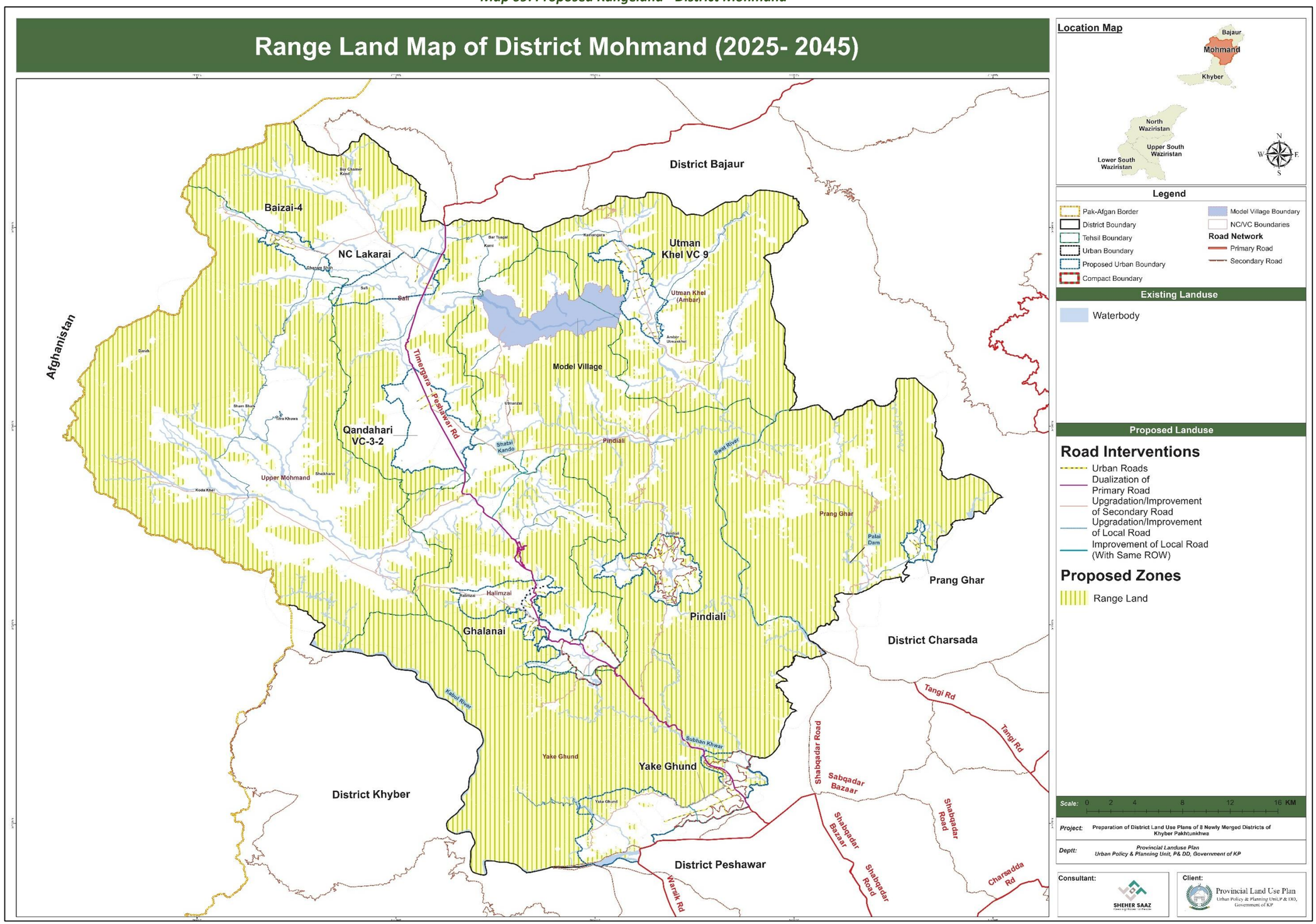
b) Sustainable Grazing Management

- Implement **rotational and deferred grazing systems** aligned with vegetation recovery cycles.
- Develop **seasonal grazing calendars** through community participation.
- Introduce **fodder crop belts** (e.g., sorghum, alfalfa) around villages to reduce grazing pressure on natural rangelands.

c) Community and Institutional Involvement

- Form **Community Rangeland Committees (CRCs)** under local governance structures for monitoring and enforcement.
- Capacity building through **training workshops** on pasture management, livestock balance, and soil-water conservation.
- Encourage women's participation in fodder preservation and small livestock management.

Map 69: Proposed Rangeland - District Mohmand



7 CHAPTER VII: DISTRICT LAND USE PLAN

7.1 Overview

District Mohmand occupies a strategically important position along Pakistan's northwestern frontier, bordering Afghanistan. The district serves as a connecting corridor between the tribal highlands and the settled plains of Khyber Pakhtunkhwa, with growing potential for trade, energy, and regional integration. Despite this strategic importance, Mohmand has historically developed without a coherent spatial or land use framework, resulting in fragmented growth, overlapping departmental functions, and unsystematic land conversions. The absence of an integrated land use plan has led to competing demands between agriculture, settlement expansion, infrastructure development, and environmental conservation, with each sector pursuing its objectives in isolation.

The preparation of the Mohmand District Land Use Plan marks the first structured effort to rationalize competing land uses and align them with provincial and national development goals. The plan recognizes land as a finite and valuable resource that must be allocated on the basis of suitability, sustainability, and long-term socio-economic benefit. Accordingly, agricultural land and ecological zones will be safeguarded from unplanned urban expansion, while future growth will be directed towards designated urban centers, particularly Ghalanai, Yakeghund, and Prang Ghar identified as key growth nodes within the district. These centers will accommodate planned residential, commercial, and institutional development, thereby promoting balanced regional growth.

The plan also reflects the district's unique socio-economic and environmental context. Large portions of Mohmand remain dependent on agriculture, livestock, and natural resource extraction, yet these sectors face mounting pressure from land degradation, overgrazing, and deforestation. The construction of the Mohmand Dam introduces new opportunities for irrigation, energy generation, and water supply, but also requires clear land zoning to prevent settlement encroachment near reservoir areas and to maintain ecological balance. Similarly, the demand for housing and social infrastructure particularly in areas affected by displacement and population growth calls for well-defined land allocation to prevent unplanned sprawl and ensure equitable access to public services.

In spatial terms, the settlement hierarchy established under the plan follows the Central Place Theory, ensuring efficient service distribution across all tiers. Ghalanai (Tehsil Halimzai) serves as the primary central place, providing high-order services including district-level healthcare, education, and commerce. Yakeghund (Tehsil Yake Ghund) and Prang Ghar (Tehsil Prang Ghar) act as secondary centers, offering intermediate-level services and strengthening linkages with rural areas. Meanwhile, Safi (Tehsil Safi) and Upper Mohmand (Tehsil Upper Mohmand) function as tertiary centers, delivering basic services such as primary healthcare, local markets, and education to surrounding villages. Beyond these urban centers, rural settlements provide minimal facilities but rely on the higher-order nodes for administrative and socio-economic needs.

By assigning each parcel of land to its most appropriate and sustainable use, the Mohmand District Land Use Plan seeks to balance development and conservation. It establishes a guiding framework for provincial departments, local governments, and development partners to coordinate their interventions in a structured and evidence-based manner. Ultimately, the plan envisions a future of spatially balanced development, economic diversification, and improved quality of life for the people of Mohmand ensuring that growth remains sustainable, inclusive, and aligned with the province's long-term development vision.

7.2 Planning Methodology and Settlement Hierarchy

The preparation of the District Land Use Plan for Mohmand District was based on a structured methodology that integrated settlement hierarchy analysis, review of existing master plans, and spatial planning tools at urban, rural, tehsil, and district levels.

Hierarchy of Human Settlements was established using multiple criteria, including population size and density, administrative status, education and health facilities, and accessibility through major roads. This analysis categorized Ghalanai as the primary city, Prang Ghar with Yakeghund as the secondary city, Safi as a tertiary urban center, and Upper Mohmand with other smaller settlements as potential growth nodes for future urbanization. The results highlighted a key imbalance: although Landi Kotal functions as the district headquarters, it lacks the service base expected at this administrative level, while Jamrud has organically developed into the most dominant urban center.

To ensure continuity with ongoing initiatives, the approved Master Plans of Ghalanai were thoroughly reviewed and refined to align with recent ground realities and updated data. For, Prang Ghar, Yakeghund, Safi, Upper Mohmand and emerging rural settlements projected to urbanize by 2045, new spatial frameworks were developed. These included delineation of compact settlement boundaries, land suitability analysis, growth trend assessments, and accessibility mapping for key services such as health and education.

At the district-wide scale, spatial zoning was carried out to distinguish between development zones and no-development zones, the latter including protected forests, reserved agricultural land, and environmentally sensitive areas. The zoning process prioritized the use of vacant or underutilized land for future growth, while also factoring in slope and terrain constraints to ensure sustainable expansion.

This integrated approach provided a coherent framework that balances urban consolidation, rural transformation, and environmental conservation, while also setting a staged direction for development up to the year 2045.

7.3 Framework for District Land Use Plan and Guidelines

Land use planning in District Mohmand requires a well-structured and coordinated framework due to its evolving socio-economic and institutional dynamics. As one of the newly merged tribal districts, Mohmand faces multiple challenges, including overlapping departmental roles, weak enforcement of planning and building regulations, and limited institutional capacity at both the Tehsil and local government levels.

Historically, Khyber Pakhtunkhwa lacked a unified system for land use planning, and responsibilities were fragmented among various agencies. Under the Khyber Pakhtunkhwa Local Government Act, 2013, Tehsil Municipal Administrations (TMAs) were legally mandated to undertake land use planning and building control. However, due to limited technical resources, manpower, and overlapping mandates, TMAs largely focused on building regulation within urban centers, while broader spatial and land use planning remained unaddressed. This institutional gap led to fragmented decision-making, inconsistent land allocations, and uncoordinated development projects initiated by different departments without a shared planning framework.

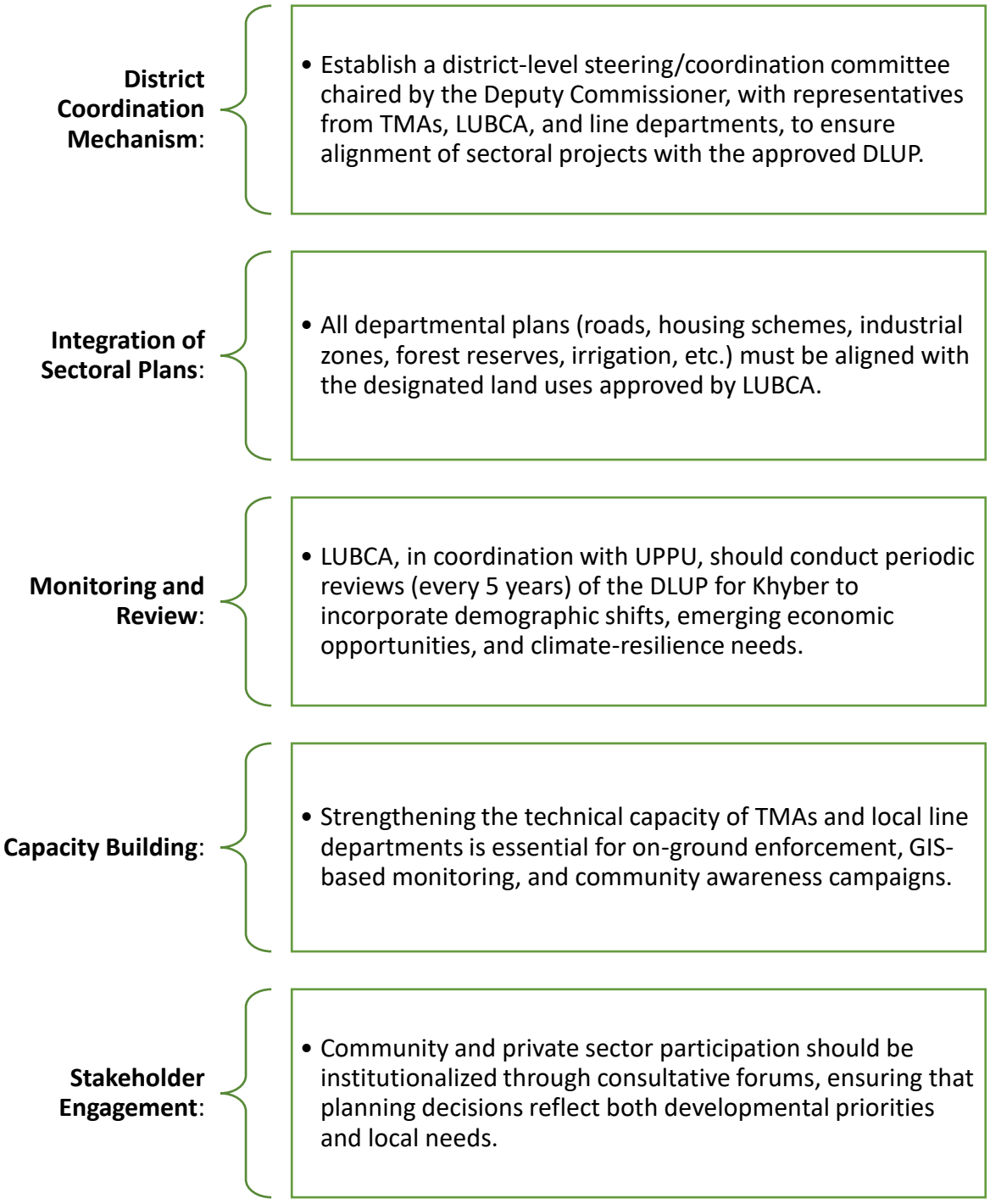
To address these issues, the Khyber Pakhtunkhwa Land Use and Building Control Authority (LUBCA) Act, 2021 was enacted, establishing a dedicated authority to regulate and oversee land use planning across the province. LUBCA's mandate is to bring coherence, transparency, and uniformity to the planning process by preparing, implementing, and monitoring District Land Use Plans (DLUPs). The authority is also empowered to enforce zoning regulations, manage land use conversions, and ensure that development aligns with provincial and district planning objectives.

In practice, the Urban Policy and Planning Unit (UPPU) under the Planning & Development Department plays a key technical and coordination role by guiding the preparation of DLUPs and ensuring alignment with the Provincial Land Use Plan (PLUP). At the district level, TMAs and line departments such as Housing, Agriculture, Forests, and Industries collaborate in providing sectoral inputs and executing land use initiatives within their jurisdictions.

For District Mohmand, this institutional framework is particularly important as it transitions from traditional governance systems toward modern spatial planning mechanisms. Effective implementation of this framework will help integrate local priorities with provincial planning standards, ensuring sustainable, balanced, and well-regulated land use development across the district.

To operationalize this framework effectively in Mohmand District, the following guidelines are proposed:

Figure 36: Guidelines for District Land Use Plan



This framework ensures that land use in Mohmand District transitions from an ad-hoc, fragmented approach to a coherent, legally backed, and evidence-based system. By anchoring the process within LUBCA's mandate while enhancing coordination with local institutions, the plan provides a sustainable mechanism for guiding urban expansion, protecting agricultural and forest resources, and accommodating industrial and commercial growth.

7.4 Proposed District Land Use Plan

7.4.1 Recommended Land Uses for Existing Urban Centre

7.4.1.1 Ghalanai Urban Center

Ghalanai, located in Tehsil Halimzai within the Upper Mohmand Sub-Division, lies between 34°10' to 34°43' north latitudes and 70°58' to 71°42' east longitudes. Geographically, the area is strategically positioned, bordered by Bajaur Agency to the north, Malakand Protected Area and Charsadda District to the east, Peshawar District to the southeast, Khyber Agency to the south, and Afghanistan to the west. The total area of the Ghalanai urban center spans approximately 27.70 square kilometers.



As of 2025, Ghalanai's urban population stands at 46,012, with projections indicating an increase to 73,704 by the year 2045. This steady population growth highlights the need for proactive planning and urban management to accommodate future demands. The existing education facilities in Ghalanai include 48 primary schools, 10 middle schools, 4 high schools, and 2 higher secondary schools/colleges. This indicates a strong presence of primary-level institutions, while facilities at the middle, secondary, and higher secondary levels are comparatively limited.

Agriculturally, the area supports a variety of seasonal crops, including maize, wheat, and a range of vegetables such as tomatoes, onions, cucumbers, and potatoes. The natural vegetation consists of common shrubs like *sanatha*, *ak*, small red poppy (*spera*), camel-thorn, *paighambari-gul*, and drab grass. The region also hosts a diverse collection of trees, including mesquite, ber, several species of acacia, *jhand*, *gurgura farnaciana*, and kikar. In addition, local herbs such as *polli* and *chaulai* are widely found across the landscape.

According to the 1998 Census Report for Mohmand District, wildlife diversity in the region is modest but notable. Commonly observed species include wild pigs, foxes, jackals, rabbits, and monkeys. A variety of bird species also inhabit or migrate through the area, such as chakor, partridge, see-see partridge, ducks, snipe, quail, wild geese, and sandgrouse, contributing to the region's ecological richness.

7.4.1.1.1 Proposed Land Uses

The proposed Master Plan for Ghalanai presents a comprehensive land-use framework aimed at managing future urban growth while strengthening the town's role as the administrative and service center of District Mohmand. Under the plan, a total of 3,048.63 acres has been allocated for new land uses, which, when combined with existing developed areas, brings the total planned urban area to 10,644.63 acres. The proposals emphasize orderly expansion, provision of social and economic infrastructure, environmental protection, and improved urban livability.

Residential development constitutes the dominant land use in the Master Plan, reflecting current housing shortages and projected population growth. A total of 1,174.47 acres has been allocated for proposed residential zones, supplemented by an additional 51.00 acres reserved as long-term residential expansion. This brings the total proposed residential area to 1,225.47 acres, accounting for 40.20 percent of the total proposed land uses. When combined with existing residential areas, the overall residential footprint reaches 2,194.34 acres. These areas are intended to accommodate planned neighborhoods with supporting facilities, ensuring controlled growth and preventing informal sprawl.

Commercial development has been planned to reinforce Ghalanai's emerging role as a district-level economic hub. The plan proposes 27.62 acres for new commercial zones along with 8.21 acres for additional commercial expansion, complemented by a 37.40-acre Central Business District (CBD). Collectively, commercial land uses amount to 170.55 acres, representing 5.59 percent of the proposed land uses, and increase to 258.35 acres when existing areas are included. The CBD is envisioned as a high-intensity mixed-use core accommodating offices, retail, services, and public institutions, while peripheral commercial areas cater to local and neighborhood-level needs.

To support ***economic diversification*** and employment generation, the Master Plan designates areas for industrial and agro-based activities. A proposed ***industrial zone*** covering 58.66 acres is planned to accommodate light and service industries. In addition, 96.27 acres have been allocated for a Livestock and Dairy Development Zone, along with 1.06 acres for a slaughterhouse facility. These uses are strategically located to minimize environmental and social impacts on residential areas while supporting the district's agrarian economy. The total planned industrial and related economic area amounts to 146.08 acres.

The provision of ***social infrastructure*** forms a key component of the proposed land-use framework. ***Educational facilities*** are allocated 82.66 acres under the proposed educational zone, with an additional 2.33 acres reserved for future expansion, bringing the total proposed educational area to 104.89 acres. Including existing facilities, the total planned educational land reaches 220.60 acres, ensuring adequate provision for schools, colleges, and technical institutions in line with population growth. Similarly, ***healthcare infrastructure*** is supported through the allocation of 17.59 acres for proposed health care zones, along with 2.32 acres for additional health facilities, enabling the development of hospitals, clinics, and specialized medical services.

Recreational and open spaces have been incorporated to enhance urban livability and public well-being. The plan proposes 17.87 acres for neighborhood-level parks, an additional 1.43 acres for park expansion, and a major Central Park covering 45.21 acres. Together, these parks and recreational spaces total 64.52 acres under proposed land uses and increase to 84.14 acres when existing parks are included. These spaces are intended to serve as community gathering areas, promote healthy lifestyles, and improve the overall environmental quality of the urban area.

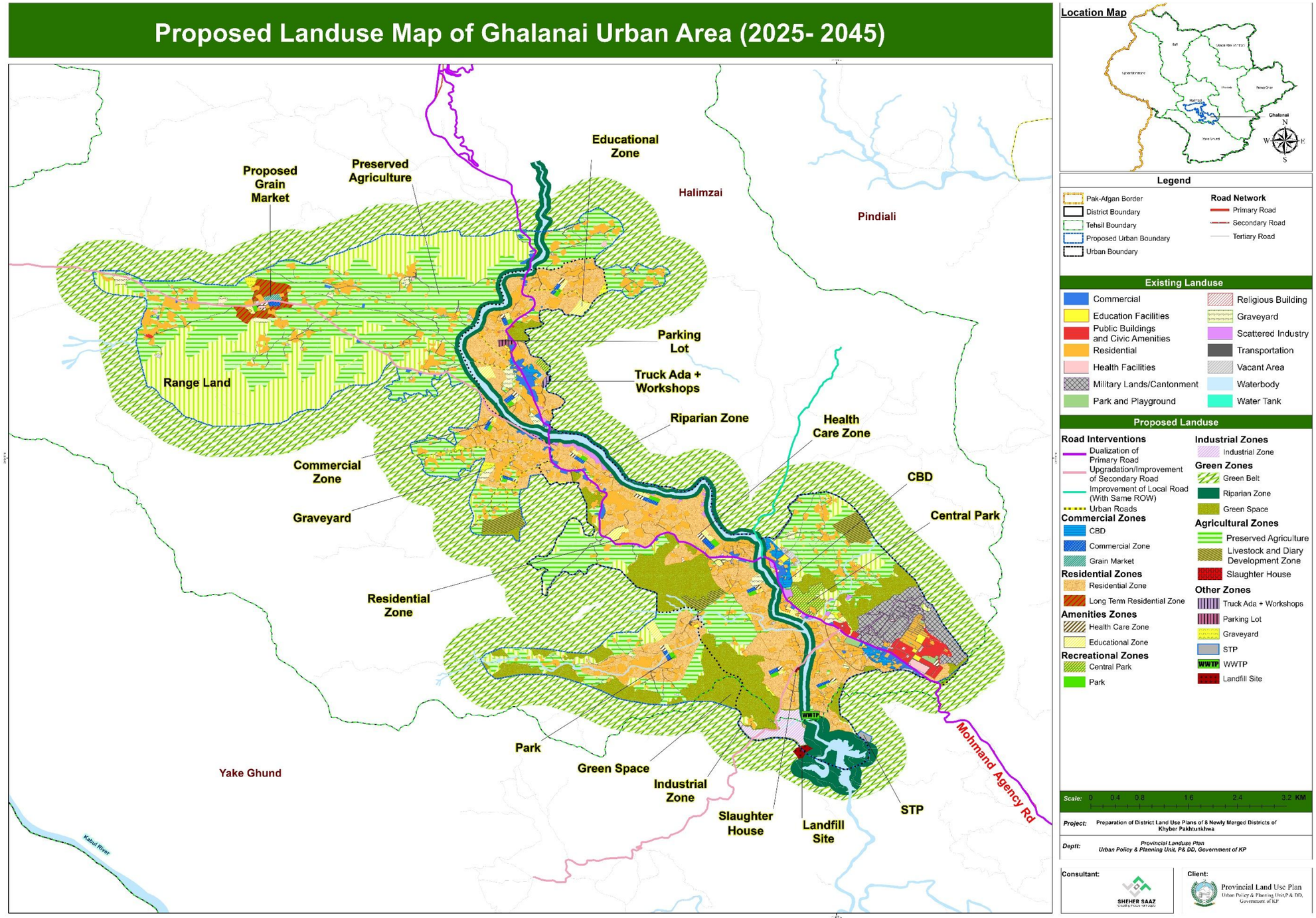
Environmental protection and green infrastructure form a significant part of the Master Plan. A large riparian zone covering 574.58 acres has been designated along natural drainage corridors to protect watercourses, reduce flood risk, and maintain ecological balance. In addition, 806.39 acres have been allocated as green spaces and environmental buffers. Combined, these environmentally sensitive areas account for a substantial share of the proposed land uses and demonstrate a strong commitment to climate resilience, landscape preservation, and sustainable urban development.

Essential ***civic and utility services*** have also been carefully planned. The Master Plan proposes 22.13 acres for ***graveyard facilities*** to meet long-term burial needs, 4.79 acres for organized parking lots to reduce congestion in commercial areas, and 3.31 acres for a truck adda and associated workshops to manage freight movement efficiently. Furthermore, 8.11 acres have been reserved for a ***landfill site*** and 5.22 acres for a sewage treatment plant, ensuring environmentally sound solid waste and wastewater management for the growing urban population.

Table 132: Existing and Proposed Land Uses – Ghalanai

Landuses	Existing Landuses	Existing Landuses	Total Existing Landuses	Total Existing Landuses %	Proposed (Master Plan)	Area (Acres)	Proposals	Area (Acres)	**Total Proposed Landuses**	Total Proposed Landuses %	Sum of Existing and Proposed Area
Residential/Housing	Residential	968.86	968.86	12.75%	Proposed Residential Zone	1174.47	Long Term Residential Zone	51.00	1225.47	40.20%	2194.34
Commercial	Commercial	87.80	87.80	1.16%	Proposed Commercial Zone	27.62	Proposed Commercial Zone	8.21	170.55	5.59%	258.35
					CBD	37.40					
					Livestock and Dairy Development Zone	96.27					
					Slaughter House	1.06					
Industrial	Scattered Industry	87.42	87.42	1.15%	Proposed Industrial Zone	58.66			58.66	1.92%	146.08
Institutional	Public Buildings and Civic Amenities	63.26	115.71	1.52%	Proposed Educational Zone	82.66	Proposed Educational Zone	2.33	104.89	3.44%	220.60
	Religious Building	15.11			Proposed Health Care Zone	17.59	Proposed Health Care Zone	2.32			
	Education Facilities	23.89									
	Health Facilities	13.46									
Recreational/Open Spaces	Park and Playground	19.62	19.62	0.26%	Proposed Park	17.87	Proposed Park	1.43	64.52	2.12%	84.14
					Proposed Central Park	45.21					
Graveyard	Graveyard	82.51	82.51	1.09%	Proposed Graveyard	17.08	Proposed Graveyard	5.05	22.13	0.73%	104.64
Transportation	Transportation	294.16	294.16	3.87%	Proposed Parking Lot	4.79			4.79	0.16%	302.27
					Proposed Truck Ada + Workshops	3.31			3.31	0.11%	
Others	Agriculture	3995.24	3995.24	52.60%	Riparian Zone	574.58			574.58	18.85%	574.58
	Range Land	1431.05	1431.05	18.84%	Green Space	806.39			806.39	26.45%	806.39
	Vacant Area	174.23	174.23	2.29%	Proposed Landfill Site	8.11			8.11	0.27%	8.11
	Military Lands/Cantonment	178.36	178.36	2.35%	Proposed STP	5.22			5.22	0.17%	5.22
	Waterbody	161.03	161.03	2.12%							
Total		**7596.01**	**7596.01**	**100.00%**	**Total**	**2978.29**		**70.33**	**3048.63**	100.00%	10644.63

Map 70: Proposed Land Use Map – Ghalanai Urban Center



7.4.2 Recommended Land Uses for Potential Urban Centers

7.4.2.1 Yake Ghund Potential Urban Centers

Yake Ghund is an important locality within Mohmand District, characterized by its expanding population, agricultural activity, and diverse natural environment. Covering a total area of 45.68 square kilometers, it represents one of the district's larger settled pockets with significant potential for future development and land-use planning.



Figure 37: Existing Mohmand Economic Zone in Yake Ghund



As of 2025, the population of Yake Ghund is estimated at 50,541, and projections indicate substantial growth over the next two decades, reaching 80,614 by 2045. This steady rise underscores the increasing demand for urban services, infrastructure expansion, and improved resource management to support the future population.

7.4.2.1.1 Proposed land Uses

The proposed land-use framework for Yake Ghund is designed to guide long-term, phased urban growth while preserving its predominantly rural and agrarian character. Under the landuse Plan, a total area of 7,617.59 acres has been proposed for planned land uses, which, when combined with existing developed areas, results in an overall planned area of 18,075.71 acres. The strategy emphasizes controlled residential expansion, protection of agricultural land, provision of essential civic facilities, and environmental conservation.

Residential development forms a significant component of the plan, accounting for 27.23 percent of the total proposed land uses. A total of 2,074.11 acres has been allocated for residential purposes, comprising 21.56 acres of infill residential development and phased expansion through short-term (215.71 acres), medium-term (552.60 acres), and long-term (1,284.24 acres) residential zones. This phased approach allows Yake Ghund to accommodate future population growth in an orderly manner while avoiding premature conversion of agricultural land. When combined with existing residential areas, the total residential footprint amounts to 3,482.96 acres.

The residential zone is further subdivided within each proposed zone. A central allied facilities zone (Markaz) is proposed in each zone, serving as a focal point for development. These Markaz areas will accommodate mixed-use development, commercial activities, and all essential civic and community facilities typically required at a central service hub. Urban roads have also been proposed to enhance accessibility; however, these serve as guidelines only. During implementation, ground realities and site-specific conditions will be taken into account, allowing flexibility for adjustments and modifications as required.

Commercial activities in Yake Ghund are planned at a modest scale, reflecting its supporting role to Ghalanai rather than a primary commercial hub. The Landuse Plan proposes 12.65 acres for commercial zones, along with a 14.90-acre Central Business District (CBD) and a 3.32-acre dedicated grain market. Together, these uses constitute 30.88 acres, representing 0.41 percent of the proposed land uses, and increase to 113.06 acres when existing commercial areas are included. The inclusion of a grain market highlights the area's strong linkage with agricultural trade and local economic activity.

Provision of civic and social infrastructure is addressed through the allocation of 30.35 acres for civic amenities, accounting for 0.40 percent of the proposed land uses. This includes 7.11 acres for health care facilities and 11.70 acres for educational institutions, along with supporting civic services. When combined with existing facilities, the total civic amenities area reaches 127.21 acres, ensuring access to basic health, education, and administrative services for the growing population.

Open spaces and community facilities are incorporated to improve livability and social well-being. The Master Plan proposes 35.17 acres for public parks, which increase to 54.14 acres when existing parks are included. Additionally, 11.43 acres have been allocated for graveyard facilities, bringing the total planned graveyard area to 53.66 acres. These allocations ensure adequate provision of recreational and burial spaces in line with population needs.

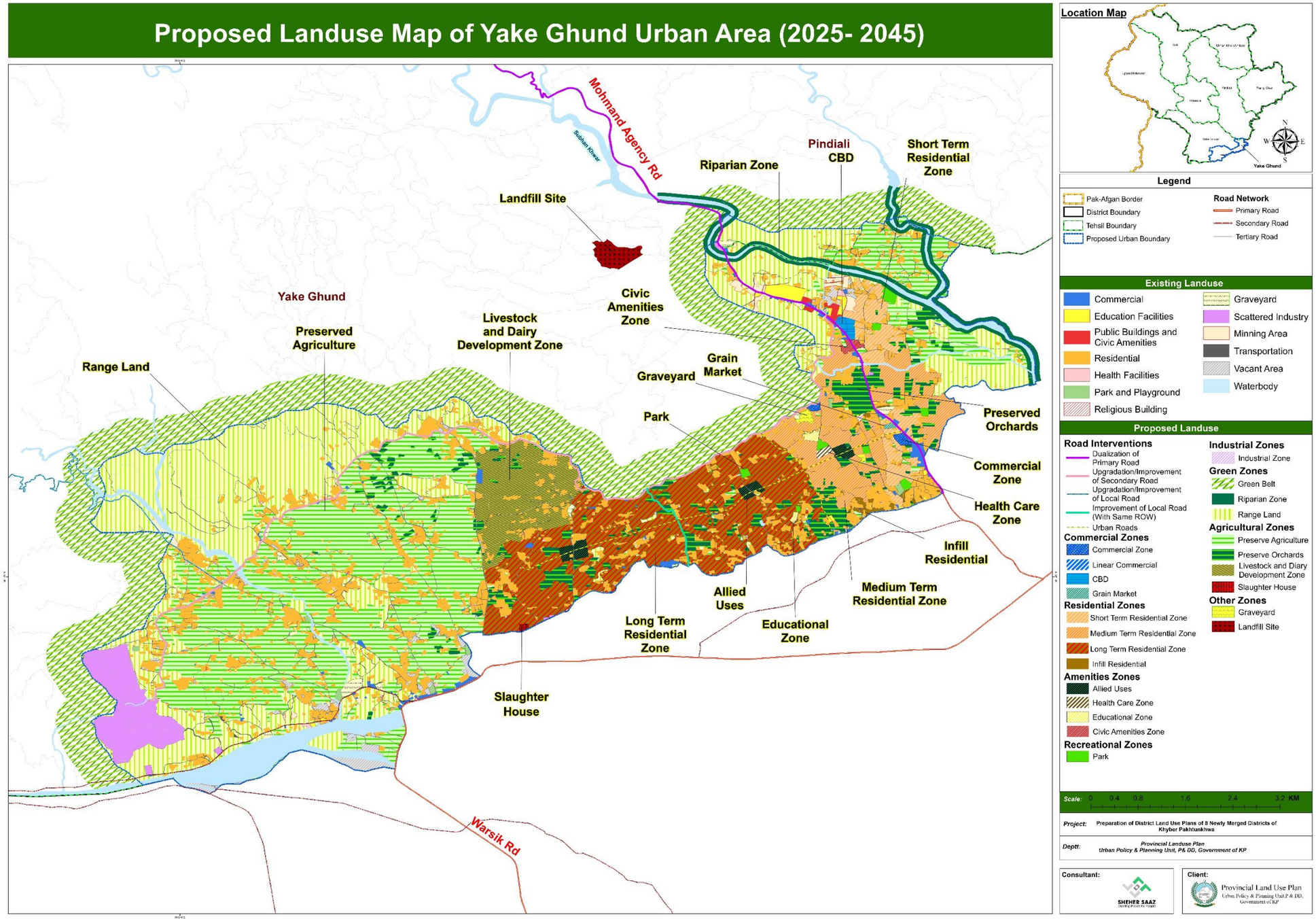
A defining feature of the Yake Ghund landuse Plan is the strong emphasis on agricultural preservation and rural economy. Preserved agricultural land covers 3,892.96 acres, representing 51.10 percent of the total proposed land uses and expanding to 8,253.87 acres when existing agricultural areas are included. This is complemented by a 434.92-acre Livestock and Dairy Development Zone and a 3.49-acre slaughterhouse, supporting agro-based livelihoods and value-added agricultural activities. In addition, 496.04 acres of preserved orchards and 1,230.18 acres of preserved rangeland have been designated to protect traditional land uses, ecological balance, and grazing resources.

Environmental protection and land management are further strengthened through the designation of 168.00 acres as riparian zones, accounting for 2.21 percent of the proposed land uses and totaling 602.02 acres when existing areas are included. These zones protect natural drainage corridors, reduce flood risk, and enhance environmental resilience. Vacant land amounting to 144.50 acres (1.90 percent) has also been identified to provide flexibility for future adjustments and unanticipated development needs, bringing the total vacant area to 331.19 acres.

Table 133: Proposed Land Uses in Yake Ghund Potential Urban Center

Existing Landuses		Existing Landuses	Existing Landuses %	Proposed	Area (Acres)	Total Proposed Landuses	Total Proposed Landuses %	Sum of Existing and Proposed Area
Residential/Housing	Residential/Housing	1408.85	13.47%	Infill Residential	21.56	2074.11	27.23%	3482.96
				Short Term Residential Zone	215.71			
				Medium Term Residential Zone	552.60			
				Long Term Residential Zone	1284.24			
Commercial	Commercial	82.19	0.79%	Proposed Commercial Zone	12.65	30.88	0.41%	113.06
				CBD	14.90			
				Proposed Grain Market	3.32			
Industrial	Scattered Industry	368.61	3.52%					368.61
Institutional	Public Buildings and Civic Amenities	14.31	0.14%	Civic Amenities Zone	11.54	30.35	0.40%	127.21
	Religious Building	9.82	0.09%	Proposed Health Care Zone	7.11			
	Education Facilities	65.54	0.63%	Proposed Educational Zone	11.70			
	Health Facilities	7.20	0.07%					
Recreational/Open Spaces	Park and Playground	18.97	0.18%	Proposed Park	35.17	35.17	0.46%	54.14
Graveyard	Graveyard	42.23	0.40%	Proposed Graveyard	11.43	11.43	0.15%	53.66
Transportation	Transportation	360.97	3.45%					360.97
Others	Agriculture	5295.36	50.63%	Preserved Agriculture	2958.51	3892.96	51.10%	8253.87
				Livestock and Dairy Development Zone	434.92			438.41
				Slaughter House	3.49			
	Orchards	497.82	4.76%	Preserved Orchards	496.04			993.86
	Range Land	1616.39	15.46%	Preserved Range Land	1230.18	1230.18	16.15%	2846.57
	Minning Area	49.16	0.47%					49.16
	Vacant Area	186.69	1.79%	Vacant Area	144.50	144.50	1.90%	331.19
	Waterbody	434.02	4.15%	Riparian Zone	168.00	168.00	2.21%	602.02
Total		10458.12	100.00%	Total	7617.59	7617.59	100.00%	18075.71

Map 71: Proposed Land Use Map – Yake Ghund Urban Center



7.4.2.2 Pindiali Potential Urban Center

Pindiali, located at 34°23'34.43"N and 71°27'2.95"E, is a compact tehsil within Mohmand District covering 18.72 sq. km. With a 2025 population of 40,364 projected to rise to 80,180 by 2045, the area is experiencing rapid demographic expansion. Situated in one of the more habitable valley zones of Mohmand, Pindiali benefits from pockets of cultivable land where maize, wheat, and seasonal vegetables are grown, although agriculture remains limited by the district's rugged terrain and scarce water resources.



The wider Mohmand region, to which Pindiali belongs, is characterized by arid mountains, shallow valleys, low literacy rates, and constrained livelihood opportunities, with many residents relying on small-scale farming, trade, or external labor. Despite these challenges, ongoing improvements in connectivity, water infrastructure, and basic services have gradually strengthened Pindiali's development potential.

7.4.2.2.1 Proposed Land Uses

The proposed land-use plan for Pindiali aims to balance residential growth, economic development, agricultural preservation, and environmental protection within the area. A total of 4,468.46 acres has been allocated for proposed land uses, which, when combined with existing areas, results in an overall planned area of 9,687.65 acres. The plan emphasizes phased residential expansion, provision of essential civic facilities, support for local economic activities, and the conservation of agricultural and ecologically sensitive lands.

Residential development constitutes the largest share of proposed land uses, accounting for 34.50 percent. A total of 1,541.72 acres has been allocated for residential purposes, including 30.11 acres for infill residential development, 443.21 acres for short-term, 282.57 acres for medium-term, and 785.83 acres for long-term residential expansion. When existing residential areas are included, the total residential footprint reaches 2,054.90 acres. This phased approach allows for orderly population growth while protecting productive agricultural lands and minimizing unplanned sprawl. The residential zone is further subdivided within each proposed zone. A central allied facilities zone (Markaz) is proposed in each zone, serving as a focal point for development. These Markaz areas will accommodate mixed-use development, commercial activities, and all essential civic and community facilities typically required at a central service hub. Urban roads have also been proposed to enhance

accessibility; however, these serve as guidelines only. During implementation, ground realities and site-specific conditions will be taken into account, allowing flexibility for adjustments and modifications as required.

Commercial and industrial development is designed to support local trade, services, and employment. Proposed commercial zones cover 65.58 acres, complemented by an 11.84-acre Central Business District, a 3.46-acre fish farm, and a 7.14-acre grain market, totaling 88.02 acres or 1.97 percent of proposed land uses. The industrial zone occupies 52.71 acres (1.18 percent) and provides small-scale and agro-based industrial opportunities, with the total industrial footprint remaining compatible with surrounding land uses.

Civic and social infrastructure has been planned to meet community needs, with 76.25 acres (1.71 percent) allocated for civic amenities, including 43.24 acres for educational facilities and 21.99 acres for healthcare services. Recreational and open spaces include 26.65 acres of parks, 45.60 acres of recreational zones, 33.79 acres of green space, and 25.46 acres for graveyard facilities, which increases to 46.60 acres when existing areas are considered. These provisions ensure quality of life and social well-being for the community.

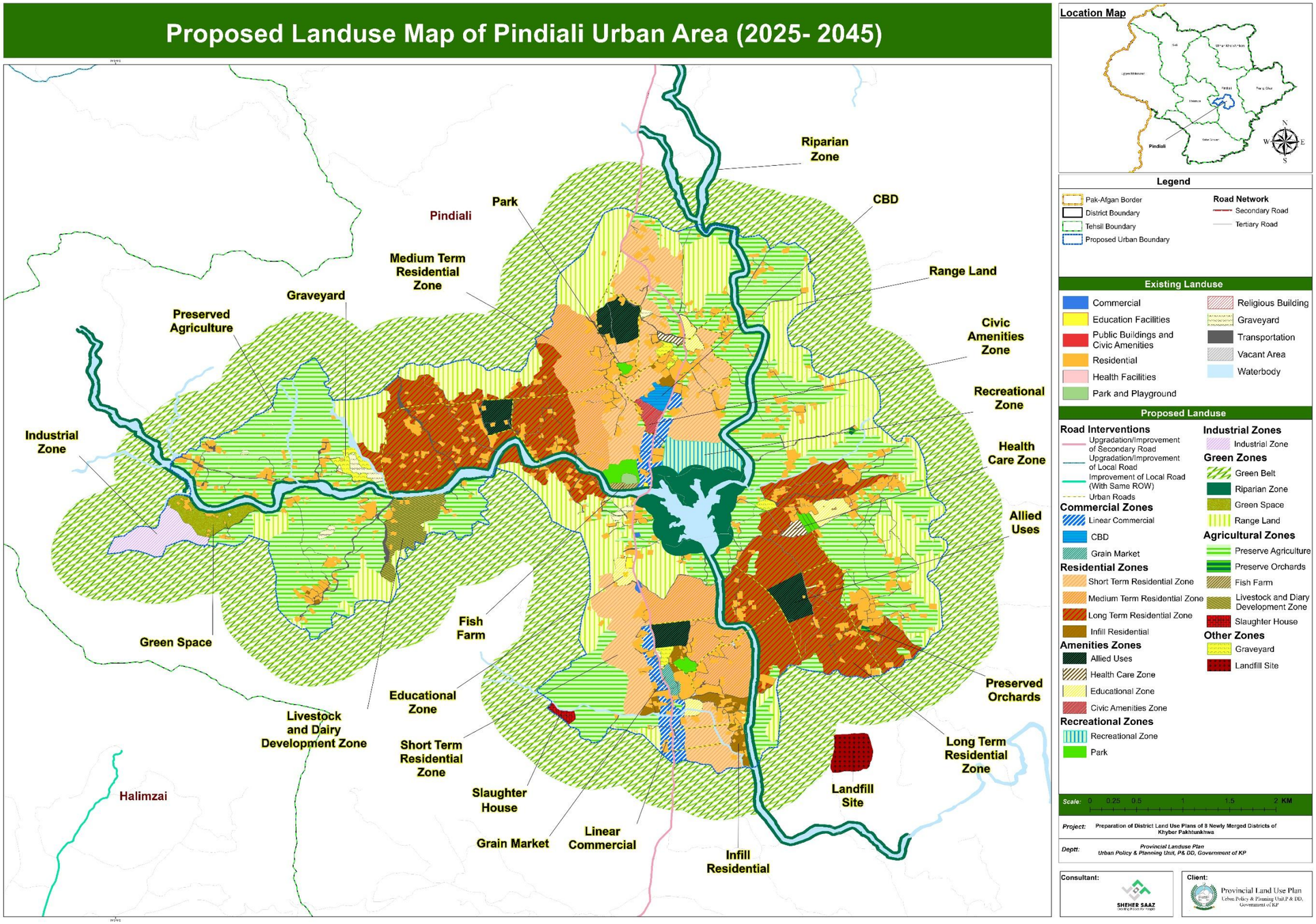
Agricultural preservation remains a priority, with 1,466.97 acres (32.83 percent) designated as preserved agricultural land, expanding to 4,727.23 acres when existing farmland is included. Livestock and Dairy Development Zones (55.98 acres), a 5.93-acre slaughterhouse, and 1.82 acres of preserved orchards further support local agro-based livelihoods. In addition, 816.06 acres of preserved rangeland have been designated to protect grazing areas, while 294.75 acres of riparian zones safeguard natural drainage corridors, control flood risks, and maintain ecological balance.

A small vacant area of 0.48 acres (0.01 percent) is reserved to accommodate future adjustments or unanticipated needs. Overall, the Pindiali land-use plan establishes a sustainable, phased development framework, balancing residential and civic growth with agricultural protection, environmental conservation, and local economic development, thereby maintaining the area's rural and productive character while planning for future population and service needs.

Table 134: Proposed Land uses in Pindiali

Existing Landuses			Existing Landuses	Proposed	Area (Acres)	Total Proposed Landuses	Total Landuse %	Sum of Existing and Proposed Area
Residential/Housing	Residential	513.18	9.83%	Infill Residential	30.11	1541.72	34.50%	2054.90
				Short Term Residential Zone	443.21			
				Medium Term Residential Zone	282.57			
				Long Term Residential Zone	785.83			
Commercial	Commercial	1.91	0.04%	Linear Commercial	65.58	88.02	1.97%	89.93
				CBD	11.84			
				Proposed Fish Farm	3.46			
				Proposed Grain Market	7.14			
Industrial				Proposed Industrial Zone	52.71	52.71	1.18%	52.71
Institutional	Public Buildings and Civic Amenities	0.13	0.00%	Civic Amenities Zone	11.02	76.25	1.71%	79.69
	Religious Building	0.51	0.01%	Proposed Educational Zone	43.24			
	Health Facilities	0.12	0.00%	Proposed Health Care Zone	21.99			
	Education Facilities	2.68	0.05%					
Recreational/Open Spaces	Park and Playground	4.16	0.08%	`	26.65	106.038924	2.37%	110.20
				Proposed Recreational Zone	45.60			
				Green Space	33.79			
Graveyard	Graveyard	21.14	0.40%	Proposed Graveyard	25.46	25.46	0.57%	46.60
Transportation	Transportation	152.61	2.92%					152.61
Others	Agriculture	3258.44	62.43%	Preserved Agriculture	1403.24	1466.97	32.83%	4727.23
	Orchards	1.82	0.03%	Preserved Orchards	1.82			
	Range Land	1108.93	21.25%	Livestock and Dairy Development Zone	55.98			
	Vacant Area	2.25	0.04%	Slaughter House	5.93			
	Waterbody	151.32	2.90%	Preserved Range Land	816.06	816.06	18.26%	1924.99
				Vacant Area	0.48	0.48	0.01%	2.73
				Riparian Zone	294.75	294.75	6.60%	446.07
Total		5219.20	100.00%	Total	4468.46	4468.46	100.00%	9687.65

Map 72: Proposed Land Use Map – Pindiali Urban Center



7.4.2.3 Utman Khel Vc-2&9 Potential Urban Center



Utman Khel (VC-2 & VC-9), located at 34°35'23.10"N and 71°26'32.23"E, spans an area of 25.84 sq. km within Mohmand District. With a population of 28,547 in 2025 projected to increase to 63,675 by 2045, the area is experiencing steady demographic growth. Set within the characteristic rugged landscape of Mohmand, Utman Khel comprises a mix of valleys and elevated terrain where small-scale agriculture primarily maize, wheat, and seasonal vegetables is practiced, supported by native shrubs and dryland tree species typical of the region.

Like much of Mohmand District, the locality faces challenges related to water scarcity, low literacy levels, and limited economic opportunities, though gradual improvements in connectivity, basic services, and administrative integration continue to enhance its development outlook.

7.4.2.3.1 Proposed Land Uses

The proposed land-use framework for Utman Khel VC-2 and VC-9 aims to manage future growth in a controlled manner while preserving the area's strong agricultural base and natural systems. The Landuse Plan proposes a total area of 3,808.23 acres under planned land uses, which, when combined with existing development, results in an overall planned area of 8,059.53 acres. The strategy focuses on phased residential expansion, limited commercial and industrial development, provision of essential civic facilities, and protection of environmentally sensitive areas.

Residential development represents the largest share of the proposed land uses, accounting for 34.56 percent of the total. A combined area of 1,316.00 acres has been allocated for residential purposes through short-term (496.91 acres), medium-term (521.44 acres), and long-term (297.65 acres) residential zones. This phased approach allows population growth to be accommodated progressively, ensuring infrastructure provision keeps pace with development. When existing residential areas are included, the total residential footprint reaches 1,597.22 acres. The residential zone is further subdivided within each proposed zone. A central allied facilities zone (Markaz) is proposed in each zone, serving as a focal point for development. These Markaz areas will accommodate mixed-use development, commercial activities, and all essential civic and community facilities typically required at a central service hub. Urban roads have also been proposed to enhance accessibility; however, these serve as

guidelines only. During implementation, ground realities and site-specific conditions will be taken into account, allowing flexibility for adjustments and modifications as required.

Commercial development has been planned at a localized and corridor-based scale to support daily needs and agricultural trade. The plan proposes 24.88 acres of linear commercial development along major movement corridors, supplemented by 16.80 acres of commercial zones, an 18.97-acre Central Business District (CBD), and a 5.98-acre grain market. Together, these commercial uses cover 66.63 acres, representing 1.75 percent of the total proposed land uses, and increase to 72.95 acres when existing areas are included. This structure ensures economic activity without encouraging excessive urban concentration.

To support employment generation and value-added economic activities, 122.57 acres have been allocated for a proposed industrial zone, accounting for 3.22 percent of the proposed land uses. This zone is intended for small-scale and agro-based industries and is strategically located to minimize conflicts with residential areas. When existing industrial uses are considered, the total industrial area reaches approximately 123.00 acres.

Social and civic infrastructure has been integrated through a dedicated civic amenities zone covering 52.50 acres, or 1.38 percent of the proposed land uses. This includes 33.81 acres for educational facilities and 9.51 acres for healthcare services, ensuring adequate access to schools, colleges, and health facilities for surrounding settlements. These allocations are designed to meet present needs while allowing capacity for future expansion.

Community facilities and open spaces have been provided to enhance livability and social cohesion. A total of 12.31 acres has been allocated for graveyard facilities, increasing to 40.15 acres when existing areas are included. Recreational and open space provision includes 26.49 acres of parks, 9.32 acres of recreational zones, and 32.25 acres of green spaces. Collectively, these uses account for 68.06 acres, or 1.79 percent of the proposed land uses, contributing to environmental quality and community well-being.

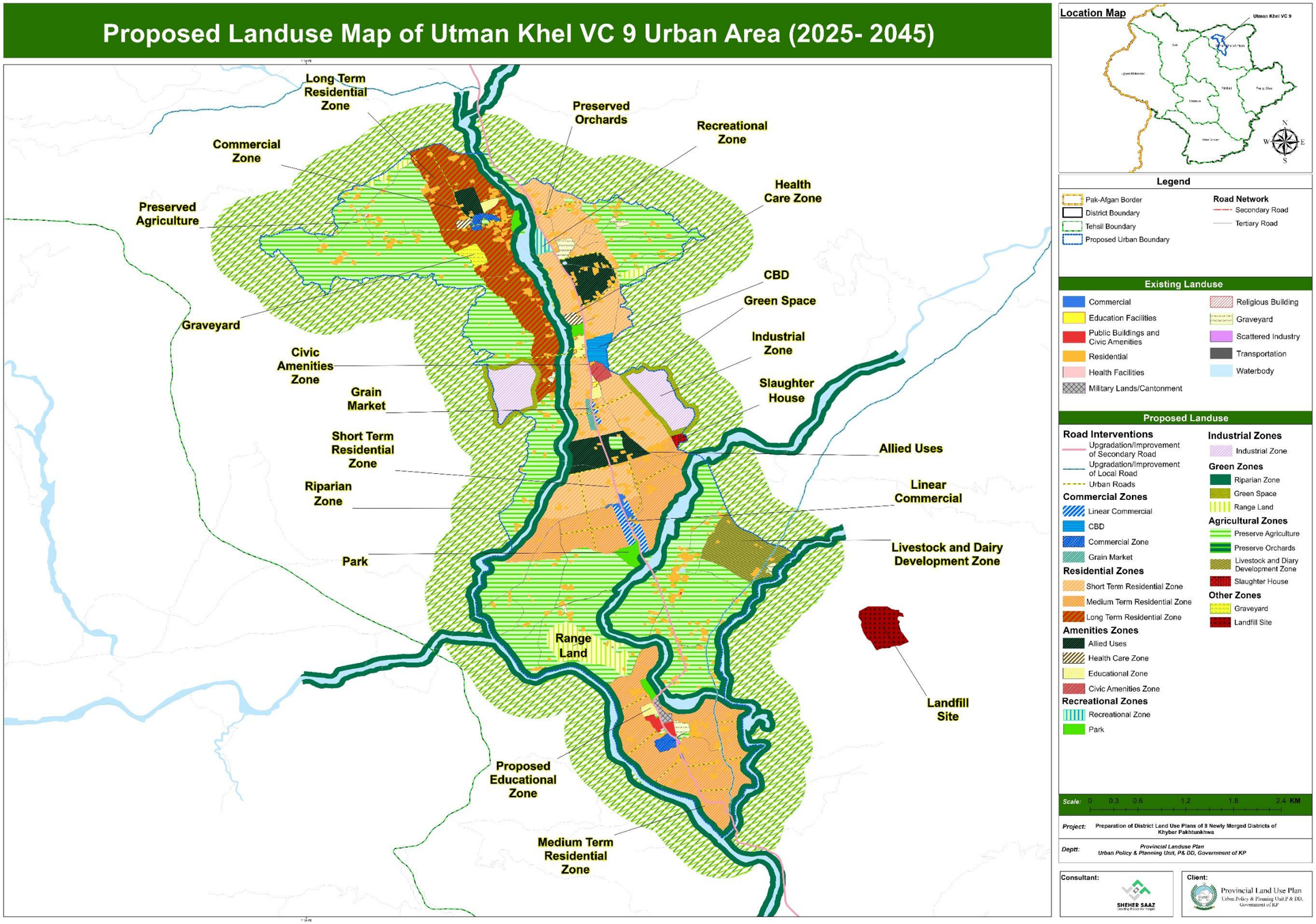
Agricultural preservation forms a central pillar of the Utman Khel VC-2 and VC-9 Landuse Plan. Preserved agricultural land covers 1,617.21 acres, representing 42.47 percent of the total proposed land uses and expanding to 5,286.49 acres when existing agricultural areas are included. This is supported by 95.43 acres allocated for a Livestock and Dairy Development Zone, a 4.19-acre slaughterhouse, and 0.28 acres of preserved orchards. In addition, 89.78 acres of preserved rangeland have been designated to safeguard grazing resources and maintain ecological balance.

Environmental protection is further strengthened through the designation of 463.15 acres as riparian zones, accounting for 12.16 percent of the proposed land uses and totaling 556.55 acres when existing areas are included. These zones protect natural drainage channels, reduce flood risks, and enhance climate resilience.

Table 135: Proposed Land uses in Utman Khel Vc-2&9 Potential Urban Center

Existing Landuses			Existing Landuses %	Proposed	Area (Acres)	Total Proposed Landuses	Total Landuse %	Sum of Existing and Proposed Area
Residential/Housing	Residential	281.221	6.61%	Short Term Residential Zone	496.91	1316.00	34.56%	1597.22
				Medium Term Residential Zone	521.44			
				Long Term Residential Zone	297.65			
Commercial	Commercial	6.318	0.15%	Linear Commercial	24.88	66.63	1.75%	72.95
				Proposed Commercial Zone	16.80			
				CBD	18.97			
				Proposed Grain Market	5.98			
Industrial	Scattered Industry	0.423	0.01%	Proposed Industrial Zone	122.57	122.57	3.22%	123.00
Institutional	Public Buildings and Civic Amenities	8.833	0.21%					65.36
	Religious Building	0.874	0.02%	Civic Amenities Zone	9.18	52.50	1.38%	
	Education Facilities	2.830	0.07%	Proposed Educational Zone	33.81			
	Health Facilities	0.324	0.01%	Proposed Health Care Zone	9.51			
Graveyard	Graveyard	27.840	0.65%	Proposed Graveyard	12.31	12.31	0.32%	40.15
Recreational/Open Spaces				Proposed Park	26.49	68.06	1.79%	68.06
				Proposed Recreational Zone	9.32			
				Green Space	32.25			
Transportation	Transportation	48.295	1.14%					48.30
Others	Agriculture	3668.997	86.30%	Preserved Agriculture	1517.31	1617.21	42.47%	5286.49
	Orchards	0.284	0.01%	Preserved Orchards	0.28			
				Livestock and Dairy Development Zone	95.43			
				Slaughter House	4.19			
	Range Land	105.248	2.48%	Preserved Range Land	89.78	89.78	2.36%	195.02
	Waterbody	93.400	2.20%	Riparian Zone	463.15	463.15	12.16%	556.55
	Military Lands/Cantonment	6.415	0.15%					6.41
Total		4251.30	100.00%	Total	3808.23	3808.23	100.00%	8059.53

Map 73: Proposed Land Use Map – Utman Khel Vc-2&9 Urban Center



7.4.2.4 Qandahari Vc-3&2 Potential Urban Center

Qandahari, located at 34°31'7.27"N and 71°16'45.47"E, covers an area of 32.81 sq. km within the rugged landscape of Mohmand District. Its population stands at 22,347 in 2025 and is projected to reach 31,714 by 2045, reflecting moderate demographic growth compared to other tehsils in the district. Positioned within the lower–central belt of Mohmand, Qandahari shares the region's characteristic topography of arid hills, narrow valleys, and scattered cultivable pockets where small-scale farming typically maize, wheat, and seasonal vegetables forms a core livelihood.

The wider Mohmand region continues to face persistent challenges related to water scarcity, limited irrigated land, and low literacy rates, with economic opportunities often tied to agriculture, daily-wage labor, and remittances from workers abroad. Despite these constraints, gradual improvements in road connectivity, social services, and administrative integration since the FATA–KP merger have enhanced accessibility and development prospects for settlements like Qandahari, positioning it for incremental socio-economic improvement in the coming decades.

7.4.2.4.1 Proposed Land Uses

The proposed land-use framework for Qandahari is centered on conserving its predominantly rural and agrarian character while accommodating limited and well-managed settlement growth. The Master Plan proposes a total of 6,710.98 acres under planned land uses, which, when combined with existing developed areas, results in an overall planned area of 14,311.34 acres. The strategy prioritizes agricultural preservation, controlled residential expansion, provision of essential civic facilities, and protection of traditional livelihoods.

Residential development in Qandahari is deliberately kept at a low scale, reflecting modest population growth and the area's rural setting. A total of 625.36 acres has been allocated for residential use, accounting for 9.32 percent of the total proposed land uses. This includes short-term residential development over 219.67 acres, medium-term expansion over 163.13 acres, and long-term residential reserves covering 242.56 acres. When existing residential areas are included, the total residential footprint reaches 1,271.95 acres. The phased approach ensures that housing growth remains demand-driven and does not encroach unnecessarily on productive agricultural land. The residential zone is further subdivided within each proposed zone. A central allied facilities zone (Markaz) is proposed in each zone, serving as a focal point for development. These Markaz areas will accommodate mixed-use development, commercial activities, and all essential civic and community facilities typically required at a central service hub. Urban roads have also been proposed to enhance accessibility; however, these serve as guidelines only. During implementation, ground realities and site-specific conditions will be taken into account, allowing flexibility for adjustments and modifications as required.

Commercial development is limited and primarily intended to support local needs and agricultural trade. The Master Plan proposes 19.02 acres for commercial use along with a 9.88-acre grain market, resulting in a total commercial allocation of 28.90 acres, or 0.43

percent of the proposed land uses. Including existing commercial areas, the total commercial footprint increases to 56.29 acres. This restrained commercial allocation reinforces Qandahari's role as a rural service area rather than a major economic center.

Civic and social infrastructure has been provided at a community scale to meet basic service requirements. A total of 34.57 acres, representing 0.52 percent of the proposed land uses, has been allocated for civic amenities. This includes 13.87 acres for educational facilities and 9.47 acres for healthcare services, along with supporting community functions. When combined with existing civic uses, the total area for civic amenities reaches 41.84 acres, ensuring access to essential public services without promoting excessive urbanization.

Open space and community facilities have been incorporated to support social well-being and environmental quality. The plan proposes 23.59 acres for public parks, bringing the total park area to 28.33 acres when existing parks are included. In addition, 7.21 acres have been allocated for graveyard facilities, increasing to 42.20 acres with existing graveyards. These allocations ensure adequate recreational and burial spaces aligned with local population needs.

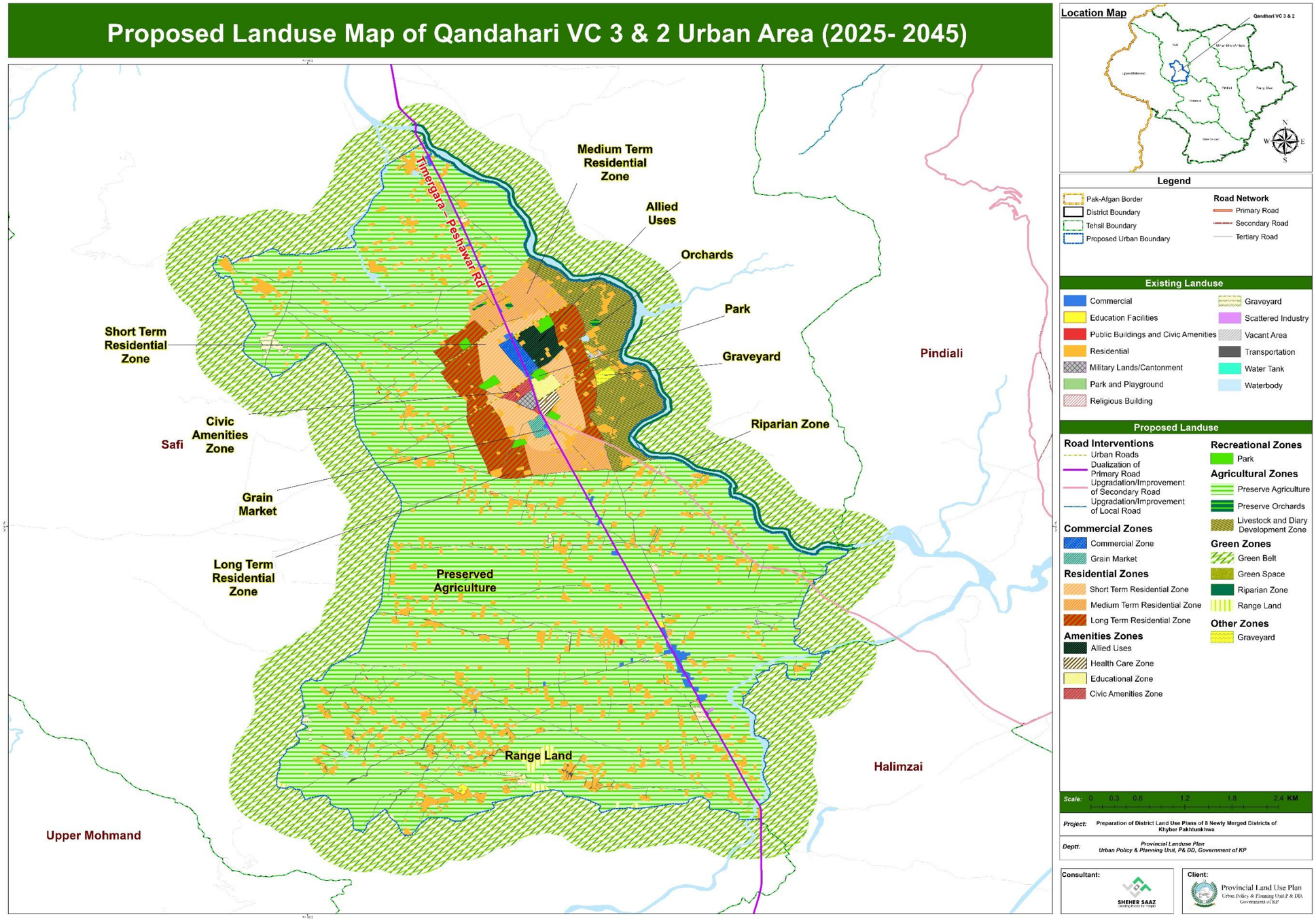
Agricultural preservation is the dominant land-use priority in Qandahari. Preserved agricultural land covers 5,953.52 acres, accounting for a substantial 88.71 percent of the total proposed land uses, and expands to 12,626.63 acres when existing agricultural areas are included. This is supported by 261.26 acres designated for a Livestock and Dairy Development Zone and 4.36 acres of preserved orchards, reinforcing agro-based livelihoods and food security. Additionally, 32.86 acres have been allocated as preserved rangeland to protect grazing areas and maintain ecological balance.

A small amount of land, totaling 4.97 acres or 0.07 percent of the proposed land uses, has been identified as vacant area to allow flexibility for future community needs. This increases to 9.95 acres when existing vacant land is considered.

Table 136: Proposed Land uses in Qandahari Vc-3&2

Existing Landuses			Existing Landuses %	Proposed Landuses	Area (Acres)	Total Proposed Landuses	Total Landuse %	Sum of Existing and Proposed Area
Residential/Housing	Residential	646.59	8.51%	Short Term Residential Zone	219.67	625.36	9.32%	1271.95
				Medium Term Residential Zone	163.13			
				Long Term Residential Zone	242.56			
Commercial	Commercial	27.39	0.36%	Proposed Commercial Zone	19.02	28.90	0.43%	56.29
				Proposed Grain Market	9.88			
Industrial	Scattered Industry	0.77	0.01%					0.77
Institutional	Public Buildings and Civic Amenities	0.48	0.01%	Civic Amenities Zone	11.22	34.57	0.52%	41.84
	Religious Building	0.70	0.01%	Proposed Educational Zone	13.87			
	Education Facilities	6.09	0.08%	Proposed Health Care Zone	9.47			
Recreational/Open Spaces	Park and Playground	4.73	0.06%	Proposed Park	23.59	23.59	0.35%	28.33
Graveyard	Graveyard	34.99	0.46%	Proposed Graveyard	7.21	7.21	0.11%	42.20
Transportation	Transportation	152.27	2.00%					152.27
Others	Agriculture	6668.75	87.74%	Preserved Agriculture	5687.89	5953.52	88.71%	12626.63
	Orchards	4.36	0.06%	Preserved Orchards	4.36			
				Livestock and Dairy Development Zone	261.26			
	Range Land	32.86	0.43%	Preserved Range Land	32.86	32.86	0.49%	65.72
	Vacant Area	4.97	0.07%	Vacant Area	4.97	4.97	0.07%	9.95
	Military Lands/Cantonment	7.67	0.10%					7.67
	Waterbody	7.73	0.10%					7.73
Total		7600.36	100.00%	Total	6710.98		100.00%	14311.34

Map 74: Proposed Land Use Map – Qandahari Vc-3&2Urban Center



7.4.3 Recommended Land Uses for Potential Urban Settlement/Areas

7.4.3.1 Baizai-4

Baizai-4, located at 34°38'55.91"N and 71°9'7.15"E, spans 13.29 sq. km in the northern part of Mohmand District. With a population of 7,158 in 2025, projected to reach 11,031 by 2045, it remains one of the smaller yet steadily growing settlements in the district. The area is characterized by rugged hills, narrow valleys, and scattered agricultural pockets typical of Mohmand's semi-arid terrain.

Adjacent to Baizai lies the Soran Valley, one of the most scenic natural landscapes in the district, known for its lush greenery, natural water channels, and mountainous backdrop. The valley holds significant potential for eco-tourism, community-based tourism, hiking, and nature-based recreational activities opportunities that could support local livelihoods if planned sustainably.

Figure 38: Soran Valley



7.4.3.1.1 Proposed Land Uses

The proposed land-use framework for Baizai VC-4 is designed to balance limited residential growth with the preservation of agricultural land, environmental protection, and promotion

of local economic and tourism activities. The Master Plan allocates a total of 1,712.24 acres for proposed land uses, which, combined with existing development, results in an overall planned area of 3,539.31 acres. The plan emphasizes phased residential development, agro-based livelihoods, environmental conservation, and support for civic and tourism infrastructure.

Residential development accounts for 13.79 percent of the proposed land uses, with a total of 236.04 acres allocated. This includes 73.27 acres for medium-term residential expansion and 162.77 acres reserved for long-term residential growth, providing a framework for orderly population accommodation while protecting surrounding agricultural and natural areas. When existing residential zones are included, the total residential footprint reaches 297.36 acres. The residential zone is further subdivided within each proposed zone. A central allied facilities zone (Markaz) is proposed in each zone, serving as a focal point for development. These Markaz areas will accommodate mixed-use development, commercial activities, and all essential civic and community facilities typically required at a central service hub. Urban roads have also been proposed to enhance accessibility; however, these serve as guidelines only. During implementation, ground realities and site-specific conditions will be taken into account, allowing flexibility for adjustments and modifications as required.

Commercial and industrial activities are planned at a modest scale to support local economic needs. Linear commercial development covers 12.96 acres, while an industrial zone of 22.22 acres has been designated for small-scale or agro-based industries. Together, these account for approximately 2.06 percent of proposed land uses, ensuring local employment opportunities without significant environmental or social impact.

Civic and social infrastructure has been integrated through a 14.46-acre civic amenities zone, including 5.20 acres for educational facilities and 3.27 acres for health care services. This ensures basic community services are accessible, while supporting future expansion as the population grows. Public open spaces and recreational areas are provided through a 6.53-acre park, 3.29 acres of green space, and a 4.80-acre graveyard, contributing to community well-being and environmental quality.

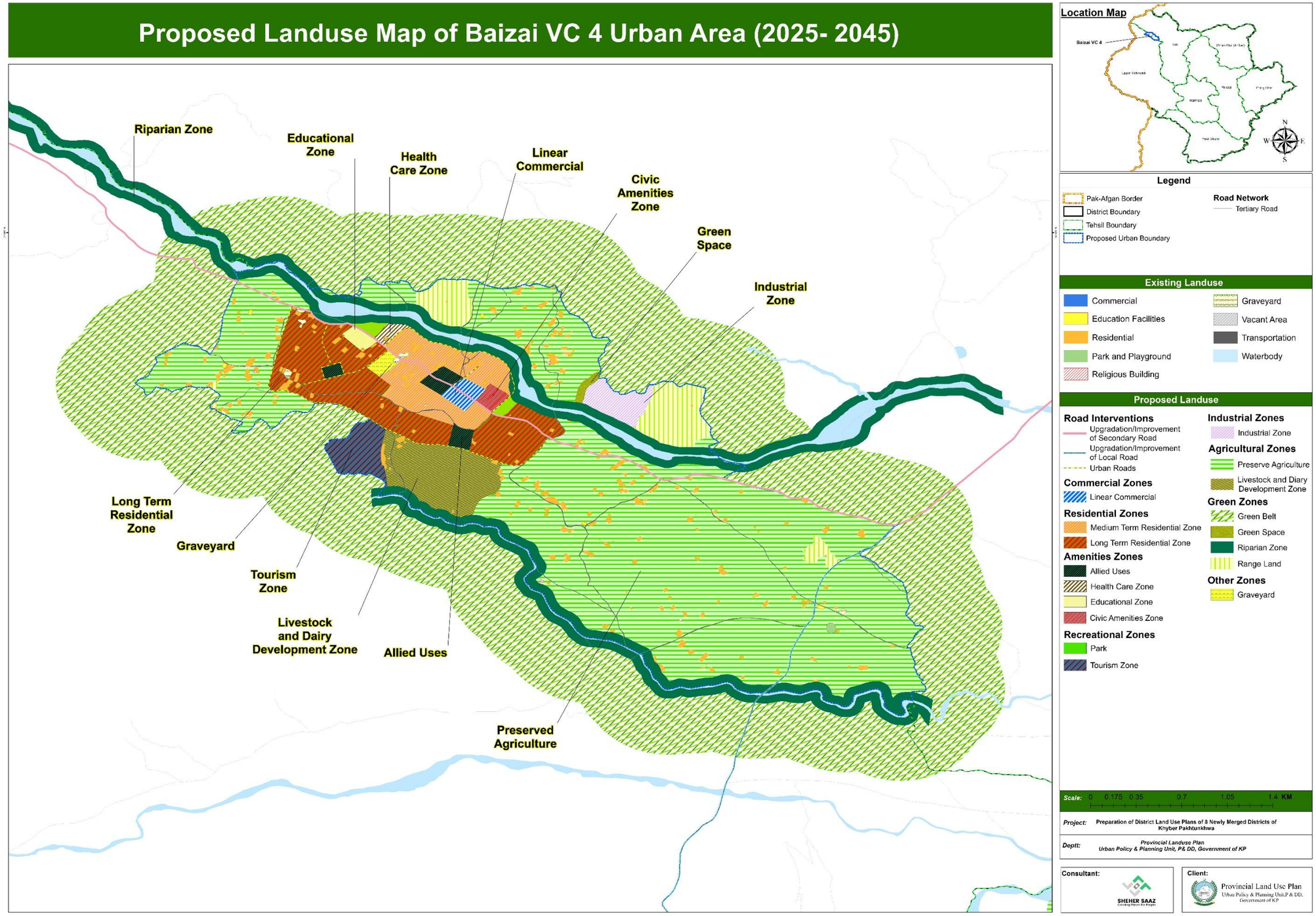
Agricultural preservation is a central feature of the Baizai VC-4 plan. Preserved agricultural land constitutes 66.15 percent of proposed land uses, covering 1,132.63 acres, and expands to 2,722.07 acres when existing farmland is included. A Livestock and Dairy Development Zone of 73.08 acres supports local agro-based livelihoods, while 74.45 acres of preserved rangeland safeguard grazing resources. Environmental protection is further reinforced through the designation of 175.75 acres as riparian zones, protecting natural drainage corridors and reducing flood risk.

In addition to agricultural and environmental priorities, Baizai VC-4 includes a 29.10-acre tourism zone, expanded to 38.92 acres with existing facilities, to promote eco-tourism and cultural heritage activities, enhancing local income sources.

Table 137: Proposed Land Uses in Baizai -4

Existing Landuses		Existing Landuses	Existing Landuses%	Proposed Landuses	Area (Acres)	Total Proposed Landuses	Total ProposedLanduse %	Sum of Existing and Proposed Area
Residential/Housing	Residential	61.31	3.36%	Medium Term Residential Zone	73.27	236.04	13.79%	297.36
				Long Term Residential Zone	162.77			
Commercial	Commercial	0.04	0.00%	Linear Commercial	12.96	12.96	0.76%	13.00
Industrial				Proposed Industrial Zone	22.22	22.22	1.30%	22.22
Institutional	Religious Building	0.51	0.03%	Civic Amenities Zone	5.99	14.46	0.84%	16.27
	Education Facilities	1.30	0.07%	Proposed Educational Zone	5.20			
				Proposed Health Care Zone	3.27			
Recreational/Open Spaces				Tourism Zone	29.10	38.92	2.27%	39.91
	Park and Playground	0.99	0.05%	Proposed Park	6.53			
				Green Space	3.29			
Graveyard	Graveyard	2.58	0.14%	Proposed Graveyard	4.80	4.80	0.28%	7.38
Transportation	Transportation	25.19	1.38%					25.19
Others	Range Land	114.13	6.25%	Preserved Range Land	74.45	74.45	4.35%	188.58
	Agriculture	1589.45	86.99%	Preserved Agriculture	1059.54	1132.63	66.15%	2722.07
				Livestock and Dairy Development Zone	73.08			
	Vacant Area	2.88	0.16%					2.88
	Waterbody	28.69	1.57%	Riparian Zone	175.75	175.75	10.26%	204.44
Total		1827.07	100.00%	Total	1712.24	1712.24	100.00%	3539.31

Map 75: Proposed Land Use Map of Potential Settlement - Baizai -4



7.4.3.2 Lakarai

Lakarai, located at 34°37'16.77"N and 71°16'59.50"E, covers an area of 15.20 sq. km and is identified as a potential growth settlement in Mohmand District. The population stands at 7,452 in 2025, projected to increase to 10,575 by 2045, indicating steady demographic growth. Lakarai is widely recognized as the "Marble City" of Mohmand due to its abundant high-quality marble reserves and the presence of numerous marble processing factories, which form the backbone of the local economy and provide significant employment while contributing to district-level mineral production.

Figure 39: Marble City and Marble Zone



Adjacent to the settlement is the Mohmand Cadet College (MCC), Mamad Gat, a prominent educational institution that strengthens the area's academic profile and attracts students from across the region. The combination of strong mineral-based industry, educational infrastructure, and available land positions Lakarai as a strategically important settlement with considerable potential for planned industrial and urban development.

7.4.3.2.1 Proposed Land Uses

The proposed land-use plan for Lakarai is designed to manage settlement growth while maintaining the area's strong agricultural base and natural landscape. A total of 3,036.76 acres has been designated for proposed land uses, which, when combined with existing areas, results in an overall land-use footprint of 6,801.20 acres. The plan emphasizes phased residential development, support for local economic activities, provision of civic facilities, and protection of agricultural and environmentally sensitive areas.

Residential development forms a moderate portion of the plan, accounting for 6.27 percent of proposed land uses. A total of 190.27 acres has been allocated for residential purposes, comprising 79.77 acres for medium-term residential expansion and 110.50 acres for long-term residential reserves. This phased approach allows for controlled settlement growth while ensuring that residential expansion does not encroach on productive agricultural land. Including existing residential areas, the total residential footprint reaches 411.09 acres. The residential zone is further subdivided within each proposed zone. A central allied facilities zone (Markaz) is proposed in each zone, serving as a focal point for development. These Markaz areas will accommodate mixed-use development, commercial activities, and all essential civic and community facilities typically required at a central service hub. Urban roads

have also been proposed to enhance accessibility; however, these serve as guidelines only. During implementation, ground realities and site-specific conditions will be taken into account, allowing flexibility for adjustments and modifications as required.

Commercial and industrial uses are limited but strategically planned to support local livelihoods and economic activity. Proposed commercial zones cover 14.39 acres, complemented by a 3.48-acre grain market, bringing the total commercial allocation to 17.86 acres, or 0.59 percent of proposed land uses. Industrial activities occupy 86.43 acres (2.85 percent), providing small-scale and agro-based industrial opportunities without significant environmental or social impact. When existing areas are included, the total industrial footprint reaches 145.46 acres.

Civic infrastructure is provided to meet the educational, healthcare, and community needs of the population. A total of 12.45 acres (0.41 percent) has been allocated for civic facilities, including 7.64 acres for educational institutions and 4.81 acres for healthcare services, increasing to 129.77 acres when existing areas are included. Recreational and open space provision includes a 20.88-acre park, expanded to 30.68 acres with additional green spaces, and a 5.87-acre graveyard, ensuring community well-being and supporting cultural needs.

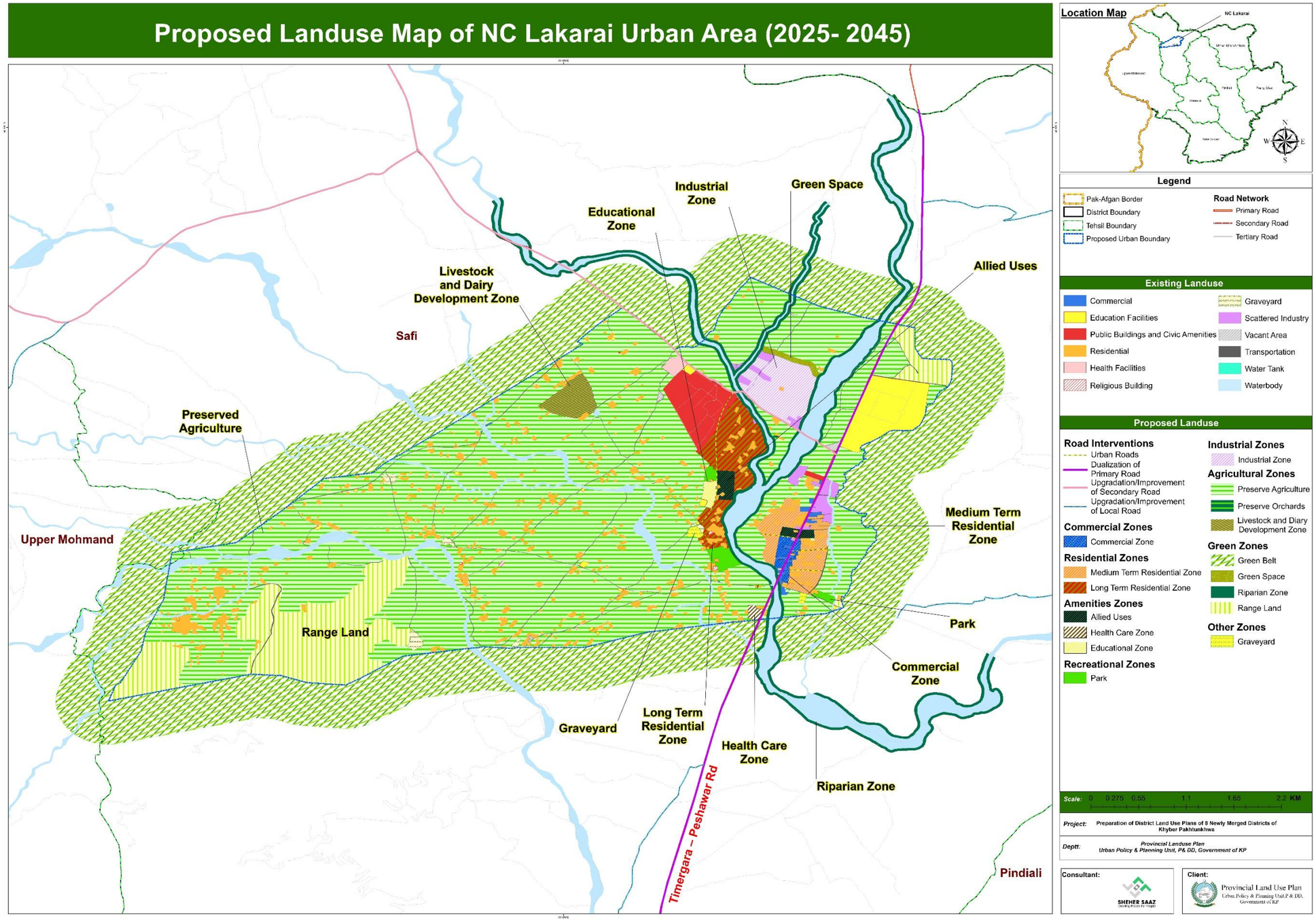
Agricultural preservation is a central feature of the Lakarai land-use plan. Preserved agricultural land covers 2,526.93 acres, accounting for 83.21 percent of the proposed land uses, and expands to 5,486.55 acres when existing farmland is included. This is complemented by 47.01 acres of preserved rangeland and 0.27 acres of preserved orchards. A 39.97-acre Livestock and Dairy Development Zone further support Agro-based livelihoods and local food security.

Environmental protection is addressed through the designation of 115.04 acres as riparian zones (3.79 percent of proposed land uses), safeguarding natural drainage corridors and contributing to flood control and ecological balance. A small vacant area of 4.22 acres (0.14 percent) is also reserved to accommodate unforeseen or future land needs.

Table 138: Proposed Land Uses in Lakarai

Existing Landuses			Existing Landuses	Proposed	Area (Acres)	Total Proposed Landuses	Total Landuse %	Sum of Existing and Proposed Area
Residential/Housing	Residential	220.82	5.87%	Medium Term Residential Zone	79.77	190.27	6.27%	411.09
				Long Term Residential Zone	110.50			
Commercial	Commercial	12.33	0.33%	Proposed Commercial Zone	14.39	17.86	0.59%	30.19
				Proposed Grain Market	3.48			
Industrial	Scattered Industry	59.02	1.57%	Proposed Industrial Zone	86.43	86.43	2.85%	145.46
Institutional	Public Buildings and Civic Amenities	84.70	2.25%					84.70
	Religious Building	2.01	0.05%					2.01
	Education Facilities	117.32	3.12%	Proposed Educational Zone	7.64	12.45	0.41%	129.77
	Health Facilities	8.34	0.22%	Proposed Health Care Zone	4.81			8.34
Recreational/Open Spaces	Park and Playground	3.51	0.09%	Proposed Park	20.88	30.68	1.01%	34.19
				Green Space	9.80			
Graveyard	Graveyard	9.57	0.25%	Proposed Graveyard	5.87	5.87	0.19%	15.44
Transportation	Transportation	47.88	1.27%					47.88
Others	Range Land	47.01	1.25%	Preserved Range Land	47.01	47.01	1.55%	94.01
	Agriculture	2959.63	78.62%	Preserved Agriculture	2486.68	2526.93	83.21%	5486.55
	Orchards	0.28	0.01%	Preserved Orchards	0.27			0.28
				Livestock and Dairy Development Zone	39.97			
	Vacant Area	4.27	0.11%	Vacant Area	4.22	4.22	0.14%	8.48
	Waterbody	187.75	4.99%	Riparian Zone	115.04	115.04	3.79%	302.79
Total		3764.44	100.00%	Total	3036.76	3036.76	100.00%	6801.20

Map 76: Proposed Land Use Map Potential Settlement - Lakarai



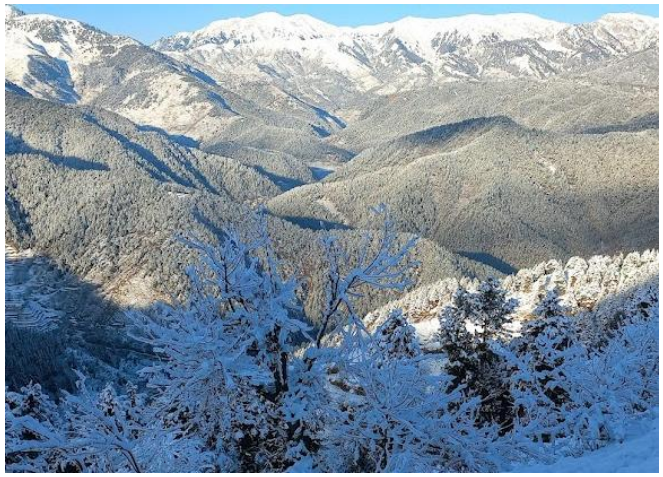
7.4.3.3 Prang Ghar

Parang Ghar, located at 34°25'34.55"N and 71°38'46.11"E, is a compact settlement covering 3.89 sq. km in Mohmand District. With a population of 11,092 in 2025 projected to reach 17,639 by 2045, it is a steadily expanding locality despite its small geographic footprint.

Around 4 km northeast lies the Palai Water Dam, a 104-ft-high structure on the Jindai Khwar (coordinates: 34°25'53.48"N, 71°40'56.62"E), positioned roughly 16 km from Tangi and 40 km north of Charsadda. The dam has emerged as a popular recreational spot, attracting visitors for its scenic waterbody, natural surroundings, and peaceful environment.

Figure 40: Palai Water Dam





Parang Ghar is particularly breathtaking in winter, when its hills and valleys take on a striking seasonal beauty that draws nature lovers and local tourists to the area. Combined with the recreational value of Palai Dam, the settlement possesses notable tourism potential, offering opportunities for eco-tourism, picnic areas, and nature-based activities that could support local livelihoods and future development.

7.4.3.3.1 Proposed Land Uses

The proposed land-use plan for Prang Ghar is designed to manage residential growth while preserving agricultural land, rangelands, and environmental features. A total of 936.23 acres has been allocated for proposed land uses, which, when combined with existing areas, results in an overall planned area of 2,000.07 acres. The plan emphasizes phased residential expansion, support for local economic activities, provision of civic and social infrastructure, and protection of agricultural and environmentally sensitive areas.

Residential development constitutes the largest share of proposed land uses, accounting for 24.22 percent, with a total of 226.80 acres allocated. This includes 43.00 acres for short-term residential expansion, 59.48 acres for medium-term, and 124.32 acres reserved for long-term residential growth. Including existing residential areas, the total residential footprint reaches 315.45 acres. This phased approach ensures orderly growth while protecting productive land and minimizing unplanned settlement. The residential zone is further subdivided within each proposed zone. A central allied facilities zone (Markaz) is proposed in each zone, serving as a focal point for development. These Markaz areas will accommodate mixed-use development, commercial activities, and all essential civic and community facilities typically required at a central service hub. Urban roads have also been proposed to enhance accessibility; however, these serve as guidelines only. During implementation, ground realities and site-specific conditions will be taken into account, allowing flexibility for adjustments and modifications as required.

Commercial and industrial development is planned at a modest scale to support local livelihoods. Proposed commercial zones cover 17.59 acres (1.88 percent), while industrial uses occupy 17.80 acres (1.90 percent). These uses are strategically located to provide employment and trade opportunities without compromising the rural and agricultural character of the area.

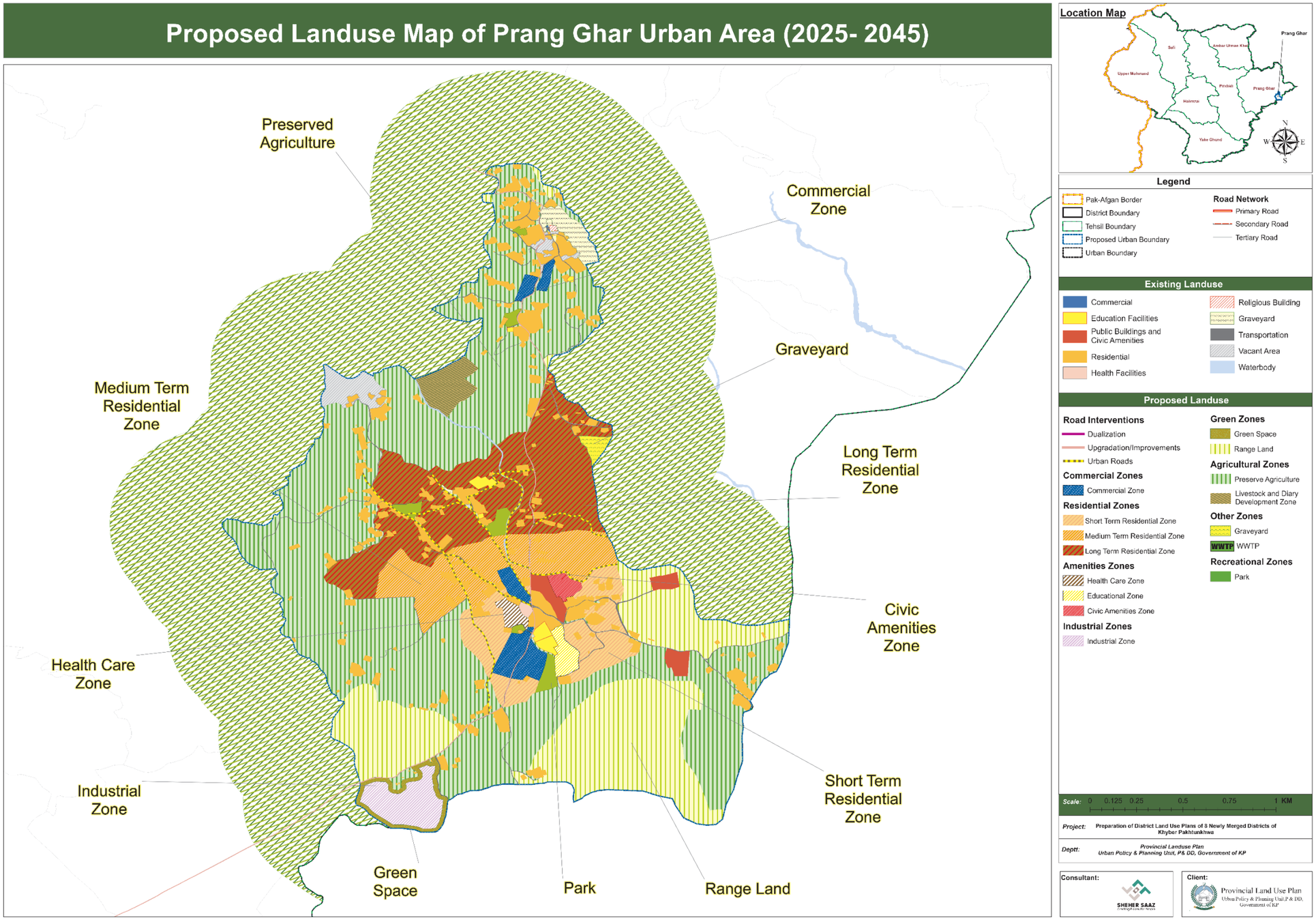
Civic and social infrastructure is integrated to meet community needs, with 11.66 acres (1.25 percent) designated for civic amenities, including 5.01 acres for educational facilities and 3.18 acres for healthcare services. Recreational spaces include a 9.10-acre park and 7.14 acres of green space, totaling 16.24 acres, while 2.91 acres are allocated for graveyard facilities, increasing to 11.34 acres when existing areas are included. These facilities support community well-being and maintain the quality of life for residents.

Agricultural preservation is a dominant feature of the plan. Preserved agricultural land covers 449.22 acres (47.98 percent) and expands to 1,111.96 acres when existing farmland is included. Livestock and Dairy Development Zones cover 12.37 acres to support local agro-based livelihoods. In addition, 182.38 acres of preserved rangeland have been designated to safeguard grazing areas, contributing to ecological stability and sustainable land use. Vacant land totaling 11.64 acres (1.24 percent) provides flexibility for future adjustments or additional community needs.

Table 139: Proposed Land Uses in Prang Ghar

Existing Landuses			Existing Landuses	Proposed	Area (Acres)	Total Proposed Landuses	Total Landuse %	Sum of Existing and Proposed Area (acres)
Residential/Housing	Residential/Housing	88.65	8.33%	Short Term Residential Zone	43.00	226.80	24.22%	315.45
				Medium Term Residential Zone	59.48			
				Long Term Residential Zone	124.32			
Commercial	Commercial	0.09	0.01%	Proposed Commercial Zone	17.59	17.59	1.88%	17.68
Industrial				Proposed Industrial Zone	17.80	17.80	1.90%	17.80
Institutional	Public Buildings and Civic Amenities	9.53	0.90%	Civic Amenities Zone	3.47	11.66	1.25%	26.95
	Religious Building	0.25	0.02%	Proposed Educational Zone	5.01			
	Education Facilities	4.71	0.44%	Proposed Health Care Zone	3.18			
	Health Facilities	0.81	0.08%					
Recreational/Open Spaces				Proposed Park	9.10	16.24	1.73%	16.24
				Green Space	7.14			
Graveyard	Graveyard	8.44	0.79%	Proposed Graveyard	2.91	2.91	0.31%	11.34
Transportation	Transportation	15.06	1.42%					15.06
Others	Agriculture	662.74	62.30%	Preserved Agriculture	436.85	449.22	47.98%	1111.96
				Livestock and Dairy Development Zone	12.37			
	Range Land	260.45	24.48%	Preserved Range Land	182.38	182.38	19.48%	442.83
	Vacant Area	11.64	1.09%	Vacant Area	11.64	11.64	1.24%	23.28
	Waterbody	1.49	0.14%					1.49
Total		1063.84	100.00%	Total	936.23	936.23	100.00%	2000.07

Map 77: Proposed Land Use Map Potential Settlement - Prang Ghar



8 CHAPTER VIII: REGIONAL CONTEXT OF PLANNING FOR DISTRICT MOHMAND

Mohmand District has a population of 553,933 as per population census for year 2023.The overall population of the district is divided into seven tehsils. The district has only one urban center, Ghalanai, located in Halim Zai Tehsil. Ghalanai also serves as the district headquarters of Mohmand. Total area of district Mohmand is 2,296 sq. km. as per population census 2023. The rural character is dominating with 74 % range land and 22% agricultural land of the entire area of the district. While keeping in view the predominant rural character, it is quite crucial to preserve the agricultural, range land, natural features and environmentally sensitive areas in the district.

The detailed narrative regarding hierarchy of settlements has already been elaborated in chapter 4 wherein the overall process and methodology for declaring existing settlements as urban, potential urban and potential settlements is explained. After going through multi-criteria analysis for delineating the status of settlements, the figures came out as 04 potential urban centers, 03 potential settlements which have the potential and possibility to transform into urban settlements in the near future. Hence, there are total 08 urban settlements including main urban center Ghalanai in District Mohmand. Although Ghalanai is the only core urban center, however, the whole district is divided into 07 Neighborhood Councils (NCs) and 55 Village Councils (VCs).

8.1 Rural Settlements in the District

In order to incorporate the integrated approach of regional planning into the project, it is very significant to align the urban and rural areas while proposing the future land use development strategy for the entire district Apart from identified 08 urban settlements mentioned above, rest of VCs form the rural area of the district. Excluding the NCs / VCs falling in the urban settlements, there are 37 VCs which are classified under the rural area of the district.

8.2 Clustering of the VCs in Rural Areas of District Mohmand

The assessment of existing conditions and future demand for public facilities in rural areas is as critical as that of urban settlements, particularly in districts such as Mohmand where a large proportion of the population resides in dispersed rural settlements. An individual analysis of each rural Village Council (VC) would neither support regional integration nor align effectively with national and local planning norms for the provision of public facilities. Therefore, a clustered planning approach was adopted to ensure efficiency, equity, and functional service delivery across the rural landscape.

8.2.1 Rationale for Clustering Approach

Keeping in view the multi-dimensional nature of rural development population distribution, accessibility, administrative coherence, and physical geography all rural VCs of Mohmand District were grouped into a defined number of planning clusters. The primary objective of clustering was to:

- Enable regional-scale planning instead of fragmented VC-level interventions
- Ensure provision of basic public facilities within reasonable service catchments;
- Reduce excessive dependency of rural populations on urban centers; and
- Align rural service provision with national and provincial planning standards and best practices.

Each cluster was designed to represent an average population threshold ranging between **30,000 and 40,000 persons**, reflecting a functional planning unit capable of supporting education, health, and administrative facilities at an appropriate scale.

8.2.2 GIS-Based Clustering Approach

A Geographic Information System (GIS)–based analytical framework was employed to form and validate rural clusters. The clustering process involved the following key steps:

- ***Population Threshold Analysis***

Population data at VC level were analyzed and aggregated to form clusters falling within the defined population range of 30,000–40,000. This ensured demographic viability for the provision of clustered public facilities.

- ***Road Network and Accessibility Analysis***

Network-based accessibility analysis was carried out using the existing road network to ensure physical connectivity within each cluster. Only those VCs and Neighborhood Councils (NCs) that demonstrated functional road access to one another were grouped together, ensuring realistic service delivery and mobility.

- ***Administrative Integration (NC and VC Merging)***

NCs and VCs were merged into clusters in a manner that respected existing administrative boundaries while minimizing fragmentation. The clustering ensured that administrative limits were rationalized, reducing boundary disparities, overlaps, and potential disputes, and enabling equitable access to public services within each cluster.

- ***Topographical and Physical Constraints Analysis***

Digital Elevation Model (DEM)–based analysis was conducted to assess terrain, slope, and physical barriers. Geographical features were carefully considered to avoid clustering areas

with severe topographic disconnections, ensuring practical accessibility and feasible infrastructure development.

8.2.3 Cluster-Based Facility Assessment and Proposals

Following the formation of rural clusters, a comprehensive assessment of the **existing stock of public facilities** and **future demand projections** was carried out at the cluster level. This included education, health, and other basic services, in line with planning standards and best practices.

Cluster-level proposals were then formulated to:

- Ensure that each cluster is functionally self-sufficient for basic services
- Distribute facilities equitably across rural areas;
- Strengthen rural service centers and reduce pressure on urban settlements and
- Align spatial proposals with sectoral recommendations discussed in the **Education and Health chapters** of the plan.

The clusters have been divided in respective tehsils for workable and unambiguous governance & implantation support framework. The detail regarding clusters of VCs is given in table below:

Table 140: Clusters of Rural VCs in District Mohmand

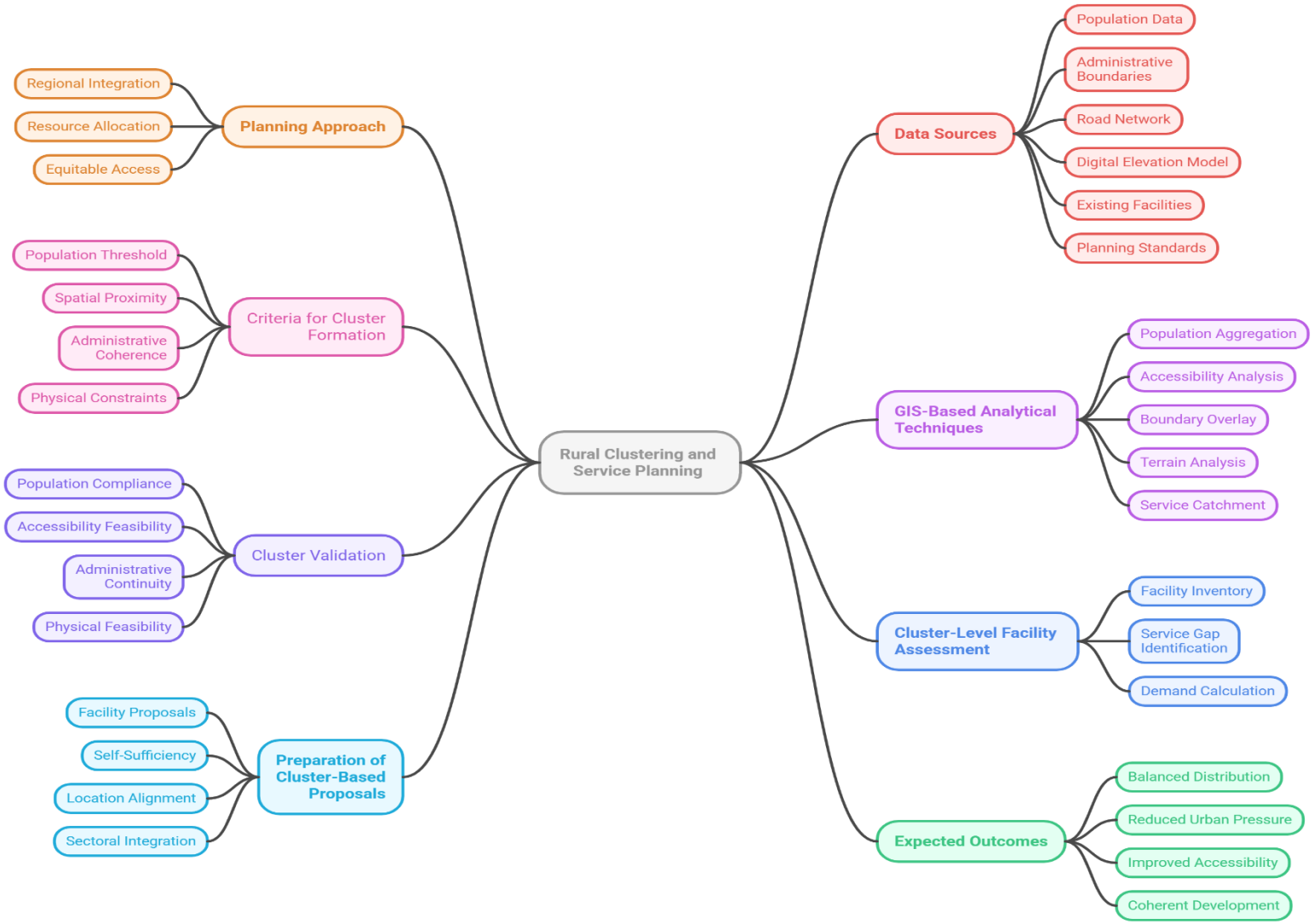
Tehsil	Cluster	VC/NC name	Total Population 2025	Total Population 2045
Yake Ghund Tehsil	Cluster 1	VC Tarakzai 6	5575	8778
Pindiali Tehsil	Cluster 2	Burhan Khel VC 1,Burhan Khel VC 2	15704	30997
Pindiali Tehsil	Cluster 3	Issa Khel VC 2, Issa Khel VC 4, Tamanzai VC 1	24766	48886
Pindiali Tehsil	Cluster 4	Dawezai VC 1, Tamanzai VC 2, Issa Khel VC 3	23354	46099
Pindiali Tehsil	Cluster 5	Dawezai VC 2, Dawezai VC 3	21412	42265
Amber Tehsil	Cluster 6	Utman Khel VC 5, Utman Khel VC 8	15227	33888
Amber Tehsil	Cluster 7	Utman Khel VC 1, Utman Khel VC 4	18963	42203
Paranghar Tehsil	Cluster 8	Laman Utman Khel VC 3	11049	15493
Halimzai Tehsil	Cluster 9	Kuz Kadi Khel VC-1, Kuza Kadi VC-2	13393	21429
Halimzai Tehsil	Cluster 10	Bar Kadi Khel VC-2, Kamali Haimzai VC-2	18281	29250

Halimzai Tehsil	Cluster 11	Bar Kadi Khel VC-1, Durba Khel VC-2, Kamali Halimzai VC-1	23719	37950
Upper Mohmand Tehsil	Cluster 12	Baizai-VC-1, Baizai-VC-2, Baizai-VC-3, Baizai-VC-4, Khewazai VC-1, Khewazai VC-2	36897	42442
Safi Tehsil	Cluster 13	Masood VC-3, VC Chamarkand, VC Sheikh Baba	25377	36012
Safi Tehsil	Cluster 14	Sagi VC-1, Sagi VC-2	20053	28456
Safi Tehsil	Cluster 15	Gurbaz VC, Masood VC-1, Masood VC-2	26195	37173

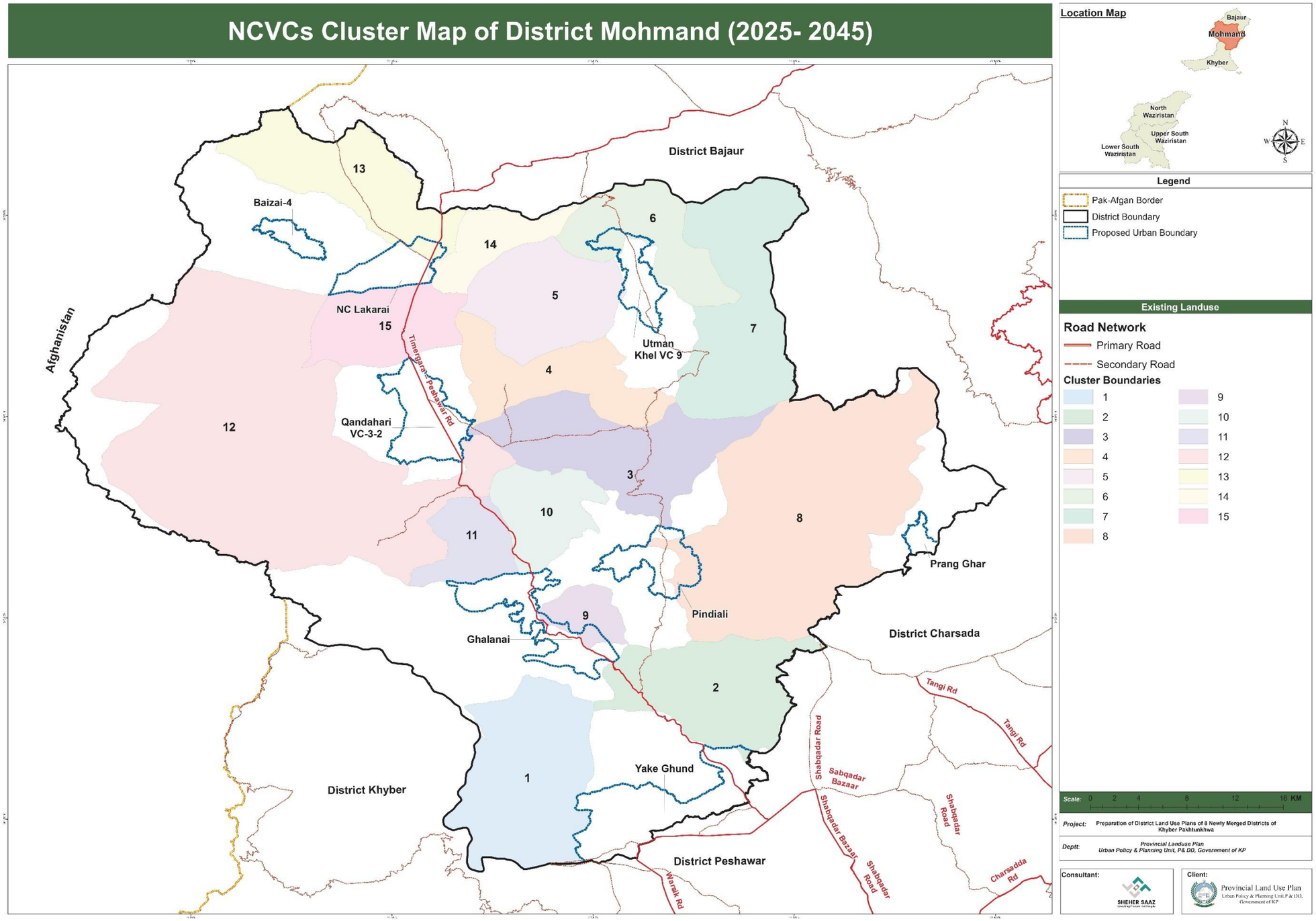
Source: Developed by Consultant

The above table shows that Halimzai tehsil has 03 clusters, Pindiali tehsil has 04 clusters, Paranghar tehsil has 01 cluster, Safi tehsil has 03 clusters, Yake Ghund tehsil has 01 cluster, Upper Mohmand tehsil has 01 cluster whereas Amber tehsil has 02 clusters based on average population range 30 – 40,000.

Figure 41: Cluster Formation and Planning approaches



Map 78: Clusters Map of Rural Areas in District Mohmand



8.3 Sustainable Rural Development

Environment friendly and sustainable development of the district in general and rural areas in particular is very significant. It has now become imperative to ensure the development pattern which respects the natural rural landscapes and predominant agricultural character which contributes a major share in the economic development of the region. The objective of sustainable developments in rural areas is to raise the quality of life and the environment in rural areas while promoting:

- An integrated, eco-friendly development that respects the natural rural landscapes and predominant agricultural land while keeping the unique rural character intact.
- Continued protection of the open countryside, with the maximum protection for the valuable landscapes and environmental resources.
- To promote eco-friendly development
- Preventing urban sprawl
- Introducing the compatible land uses which suit both rural and urban features to maximize the potential benefits of the countryside fringing urban areas and providing appropriate leisure opportunities to urban and rural residents to enjoy their countryside.
- To promote sustainable, diverse and adaptable agriculture sectors where farming achieves high environmental standards, minimizing impact on natural resources, and preserves valued landscapes and biodiversity; contributes both directly and indirectly to regional economic development.

8.4 Model Village

Rural development is a multidimensional process aimed at improving the quality of life and economic wellbeing of rural populations. It involves not only enhancing agriculture and basic infrastructure but also expanding non-farm economic opportunities, improving governance, and integrating innovative technologies. Effective rural planning supports productivity, reduces poverty, and balances growth with environmental sustainability.

District Mohmand is characterized by agrarian livelihoods, dispersed settlements, and limited access to modern services. These conditions present both challenges and opportunities:

- Challenges such as under-served infrastructure, limited digital access, and economic leakage to urban centers can prevent local potential from being realized.
- Opportunities lie in leveraging agriculture, communal resources, geography, and emerging technologies to create self-sustaining and resilient rural settlements.

A Model Village in this context is not merely upgraded infrastructure, it is a holistic, integrated development framework that combines spatial planning, economic diversification, modern services, community empowerment, and sustainability. The Model Village is conceptualized as an agriculture-based rural growth system, where planned development is structured to directly support agricultural production, Agro-based value addition, and sustainable rural

livelihoods. The planning approach deliberately reinforces the existing agrarian economy while introducing organized spatial development to accommodate future population growth.

A Model Village comprises an overarching development framework to guide the future rural growth and development pattern that aspires to transform a rural settlement into an exemplar of sustainable, inclusive, and technology-enabled development. Unlike traditional rural clusters that evolve organically with limited planning, a Model Village is conceptualized and envisaged while integrating the following components:

- Planned spatial & land use distribution supported by provision of diversified public amenities in the order of hierarchy.
- Economic systems based on indigenous agrarian and agro-based industry to improve livelihoods and overall economic situation of the village.
- Improvise the public awareness among farmers and general public through training centers
- Basic and advanced infrastructure tailored to community needs
- Digital and technological platforms that bridge the urban–rural divide
- Environmental management strategies that protect natural resources.

It is a context-responsive planning framework that harnesses local strengths while introducing innovations that enhance quality of life.

The Model Village framework is proposed for several reasons:

- Manageable population size: The cluster's **30,000 and 40,000** up to year 2045, population ensures that essential services are efficiently provided while remaining scalable for future growth.
- Rural character with development potential: Predominantly agricultural land use allows for structured interventions without compromising existing livelihoods.
- Availability of large land parcels: Facilitates integrated planning for residential zones, public services, green spaces and recreational areas, agro-industrial activities, well connected road and allied infrastructure.

Internationally, countries such as Indonesia (Cibodas Village, West Java) and India (Satnavri AI-Driven Village, Maharashtra) have successfully implemented rural development models that integrate agriculture, technology, and community governance. These examples demonstrate how digital tools, agro-industrial value chains, and participatory planning can transform rural settlements into resilient, productive, and livable communities.

8.4.1 Spatial Planning Concept and Settlement Hierarchy

The proposed Model Village in any identified clusters will be conceptualized as an agriculture-based rural growth system, where development will directly support agricultural production, agro-based value addition, and sustainable rural livelihoods. The suggested planning approach deliberately will reinforce the existing agrarian economy while introducing recommended

spatial organization to accommodate future population growth in a controlled and sustainable manner.

The recommended spatial structure will be derived from a multi-level growth centers model, ensuring functional efficiency, equitable access to services, and compatibility with the rural character of District Mohmand. Instead of imposing an artificial urban grid, the layout pattern needs to respond to natural topography, existing settlement typology, landscape features and other environmental considerations, available road network and allied services.

- ***Main Markaz and Sub Markaz Concept***

The model village will be organized around a functional service hierarchy comprising:

- High-Order Facilities: Central Main Growth Centre (Markaz)
- Low-Order Facilities: Secondary Sub-Centers (Sub-Markaz / Sub-Sector Clusters)

This recommended hierarchical arrangement will minimize unnecessary duplication of higher-order facilities, will rationalize land use distribution, and will ensure that essential services remain accessible within reasonable walking distances for surrounding residential clusters.

The High Order **Central Main Markaz** functions as the primary node of the model village, accommodating:

- Local administration and governance functions
- Major commercial services including grain, vegetable / fruit market etc.
- Storage facilities / Godowns
- Core public facilities like education and health services, central masjid etc.
- Communal farming areas accessible for the village dwellers
- Central Park and water front recreational zone
- Veterinary and Livestock Services
- Agricultural machinery repair workshops
- Post offices and banking services
- Revenue offices
- Agricultural support office & Farmers training center

The Low order facilities (**Sub-Centers)** serve as secondary service nodes catering to surrounding residential clusters. These areas are intended to host:

- Community-level social facilities (primary education, basic health units, mosques, community and recreational spaces)
- Neighborhood-scale commercial activities

- Local gathering and interaction spaces

This hierarchical arrangement ensures that daily needs are met locally, while higher-order services are centralized, thereby improving efficiency and reducing unnecessary travel.

8.4.2 Road Network and Connectivity

The internal circulation system will be based on a hierarchical road network to ensure efficient mobility, logical movement patterns, and seamless connectivity across the Model Village. The road hierarchy may comprise two to three categories of roads, generally ranging from 50 feet, 40 feet, and 30 feet in right-of-way, depending on local requirements and land availability.

A primary road corridor (approximately 50 feet wide) will function as the main circulation spine, providing linkage between the central activity node (Markaz), sub-centers, and the surrounding village road network. Secondary and tertiary roads (approximately 40 feet and 30 feet wide) will facilitate access to residential clusters, community facilities, and local activity areas. This hierarchical structure will support efficient circulation, improve accessibility, and encourage safe, walkable movement patterns suited to the rural village context.

This road hierarchy will ensure:

- Efficient vehicular and pedestrian movement
- Strong internal connectivity between residential areas and service centers
- Seamless integration with regional and village-level road networks

The alignment of roads respects existing paths and access routes, reinforcing continuity with current movement patterns while improving overall accessibility.

In accordance with rural development planning standards, the Model Village provides the following facilities across its hierarchy:

- Rural Health Centers and Community Hospital
- High / Higher Secondary School
- Community parks and playfields
- Police and emergency services

8.4.3 Proposed Concepts

The proposed land-use structure for the Model Village will be designed to support agriculture-led rural development, enhance livelihoods, and improve living standards while ensuring environmental protection and spatial efficiency. The framework integrates residential growth, Agro-economic activities, communal spaces, mobility infrastructure, and ecological conservation in a coherent and topography-responsive manner.

8.4.3.1 Residential

Residential development within the Model Village will be planned as a low-density settlement pattern, sensitively integrated with the surrounding rural and agricultural landscape. The intent is to maintain the village's rural character, visual openness, and productive land systems, while allowing for incremental residential growth in a controlled and sustainable manner. Residential areas will accommodate a range of plot sizes to respond to varying household needs and socio-economic groups, including extended families, middle-income households, and affordable housing options for lower-income and young households.

Housing development will be encouraged in compact clusters, allowing efficient service provision and minimizing land consumption. A phased development approach will be adopted to accommodate future population growth without disrupting existing settlements, while enabling infrastructure and services to be expanded gradually over time. Housing clusters will be developed in phased increments, enabling future population growth without displacing existing residents and allowing infrastructure provision to be scaled over time. In addition, the following supportive residential concepts are recommended for the Model Village:

- ***Rural Residential and Farmhouse Concept***

Keeping in view the topography and rural character of the area, low-density housing including farm houses may be proposed for the model village. Farmhouse options may include kitchen gardens, small orchards, poultry or livestock sheds, on-plot rainwater harvesting systems, thereby linking housing with household-level food production and potential source of income. The proposed planned settlement will align with the natural landscapes and ensure the maximum preservation of agricultural land while supporting sustainable livelihoods.

Figure 42: Rural Residential and Farmhouse Concept



- ***Incremental and Expandable Housing***

Residential units **will be designed** to allow **horizontal or vertical expansion**, enabling households to upgrade their homes gradually as income levels improve.

- ***Climate-Responsive Building Orientation***

Plot orientation and street layouts **will be recommended** to maximize natural ventilation, daylight access, and shading, reducing reliance on mechanical cooling in a hot-climate rural setting.

- ***Use of Local Materials and Construction Techniques***

The **recommended use of locally available materials** (stone, brick, mud composites, and timber) **will reduce construction costs**, support the local economy, and maintain architectural continuity with traditional rural housing.

- ***On-Plot and Community-Level Water Management:***

In addition to rainwater harvesting, **greywater reuse for irrigation** and **community-level recharge pits will be encouraged** to strengthen water resilience.

- ***Pedestrian Priority and Safe Internal Streets***

Internal streets within residential clusters **will be designed** as low-speed, pedestrian-friendly environments, prioritizing children, elderly residents, and daily social activity.

- ***Disaster-Resilient and Seismic-Safe Housing Practices***

Housing design **will incorporate** basic disaster-resilient measures, particularly relevant to the seismic sensitivity of the region.

8.4.3.2 Service Center/Commercial

The recommended Service Center will provide space for secondary health services, vocational and skills development facilities, and agro-support institutions, strengthening the linkage between settlement development and the local agrarian economy. This node is suggested to serve not only the immediate residential clusters but also surrounding villages, thereby enhancing regional service accessibility.

Commercial activities within the Service Center will be organized to support local livelihoods, including agro-input supply, produce collection and storage, small-scale processing, and rural markets. The recommended mixed-use character will allow compatible commercial, institutional, and service functions to co-exist, ensuring economic vitality while maintaining the rural scale and character.

The spatial placement of the Service Center will ensure direct connectivity with the primary spine road, facilitating efficient movement of goods and people, while minimizing conflicts with purely residential areas.

8.4.3.3 Agriculture and Integrated Rural Production Zones

Agriculture will remain a core land use within the Model Village. Rather than relying solely on large continuous tracts, small agricultural pockets are suggested along rangeland areas, enabling diversified and multi-functional rural activities. These pockets will support:

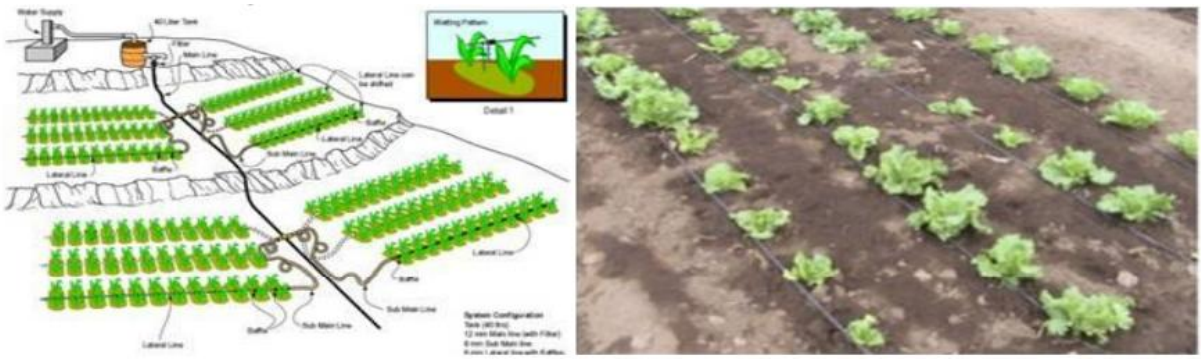
- Drip and sprinkler irrigation systems to optimize water use efficiency
- High-value crops, kitchen gardens, and horticultural plots for household and commercial purposes
- Fodder cultivation linked with livestock grazing in adjacent rangelands
- Demonstration farms showcasing modern, sustainable agricultural practices

Additional recommended interventions include:

- Agroforestry and mixed-cropping plots, combining timber, fruit, and fodder species for ecological and economic benefits
- Integrated pest management zones to reduce chemical inputs and improve crop resilience
- Soil and water conservation structures, such as contour bunding, check dams, and micro-catchments

This integrated approach will enhance productivity, optimize land use, and strengthen the linkage between agriculture and livestock-based livelihoods.

Figure 43: Low-Cost Drip Irrigation System for a Hilly Area



8.4.3.3.1 Communal Farming and Agro-Based Public Facilities

In addition to individual farming, communal farming zones are recommended as shared agricultural spaces linked to the main market and public amenities. These zones will promote cooperative farming models and collective economic activity. Proposed components within communal farming areas will include:

- Shared cultivation plots managed by local communities
- Seed banks, tool-sharing facilities, and equipment pools
- Training and extension centers for modern and climate-resilient farming techniques
- Collection points, cold storage, and processing facilities for agricultural produce
- Direct linkage with local markets to facilitate farm-to-market access

Further suggested interventions for communal areas:

- Community orchards and medicinal/herbal gardens to diversify income
- Agro-tourism plots demonstrating traditional and modern farming practices
- Cooperative livestock pens for dairy and poultry activities

These measures will enhance social cohesion, improve market access for small farmers, and support inclusive rural economic development.

8.4.3.3.2 Agro-Industry and Value Addition

A dedicated Agro-Industrial zone is recommended to support small-scale, non-polluting agro-based industries focused on value addition rather than heavy manufacturing. These facilities will include:

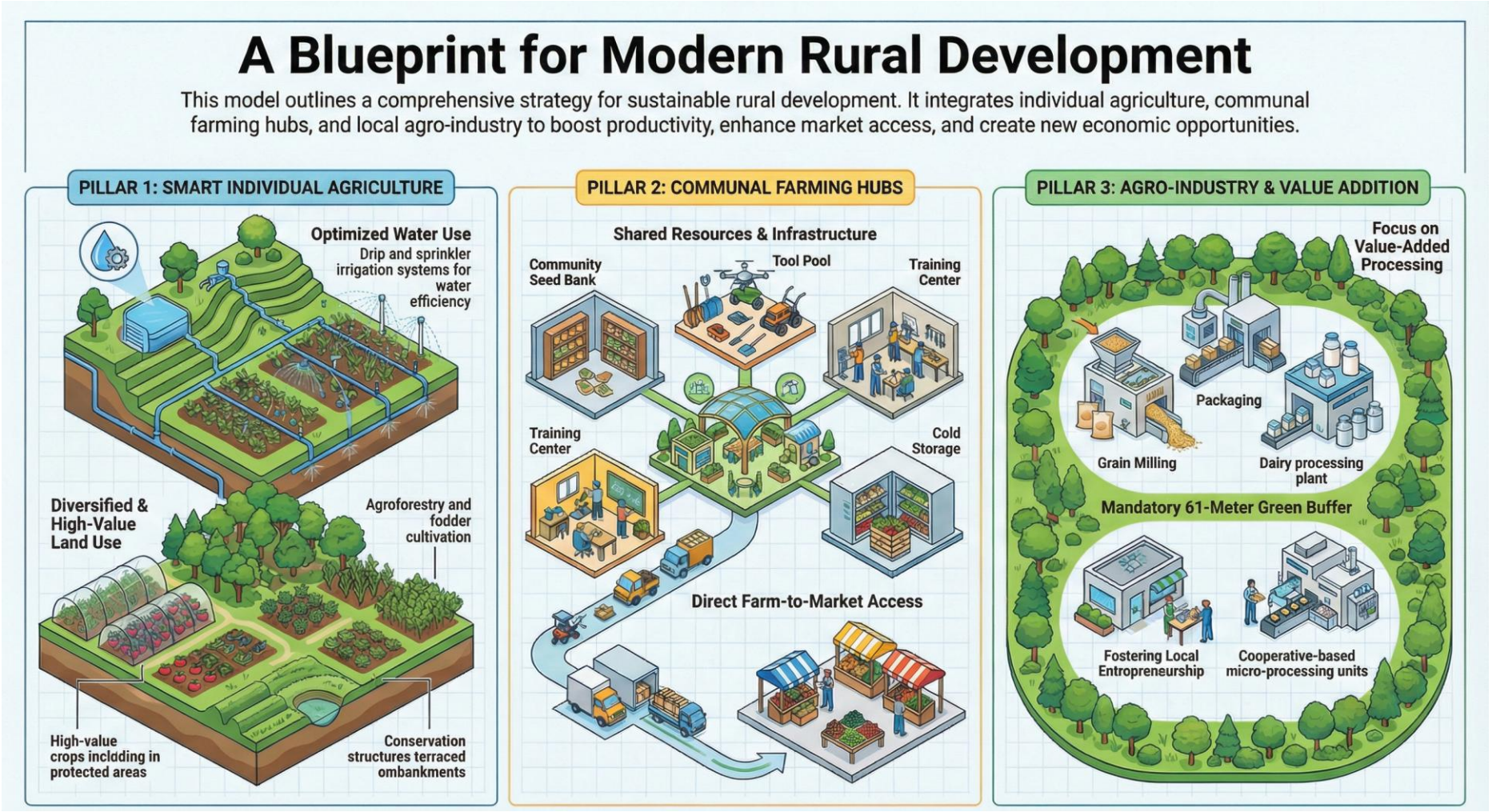
- Grain processing and milling units
- Fruit and vegetable grading, packaging, and cold storage units
- Dairy processing and meat chilling units
- Warehousing, logistics, and distribution facilities for agricultural products

Additional suggested interventions for enhancing the agro-industrial zone:

- Cooperative-based micro-processing units for community entrepreneurship
- Bioenergy and composting units utilizing agricultural residues
- Training and incubation centers for agro-entrepreneurs and youth employment

In compliance with Khyber Pakhtunkhwa Urban Policy, a mandatory green buffer of approximately 61 meters is recommended around the agro-industrial area to mitigate environmental impacts and ensure compatibility with surrounding residential and agricultural land uses.

Figure 44: Proposed Modern Agro-industrial Zone



Source: Design by Consultants

8.4.3.3.3 Traditionally Useful and Efficient Irrigation Systems for Slopy/Hill Agriculture

To enhance sustainable and context-sensitive water management, the Model Village will explore and recommend the adoption of traditional irrigation practices suitable for sloped or hilly terrain. These systems will support efficient water use, reduce dependency on external inputs, and strengthen resilience in agriculture. Examples include:

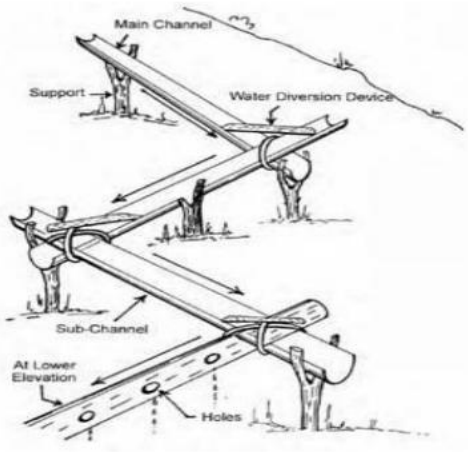
a) Zabo System of Irrigation (Nagaland, India):

- This traditional system will allow terrace farming in hilly regions while maintaining forested watersheds as sacred groves.
- Rainwater will successively irrigate terraces, with a pond or storage structure in the middle terraces to regulate flow.
- Water distribution will be enhanced through bamboo pipes to cover maximum agricultural area.
- The system will demonstrate integrated watershed management, combining forestry, irrigation, and sustainable farming.

b) Bamboo Drip Irrigation (Meghalaya, India):

- Tribes of Khasi and Jaintia use bamboo pipes to tap water from streams and springs for hilltop black pepper plantations.
- Water flow will be controlled through pipe diameter adjustments, with slow drip rates of 20–80 drops per minute.
- Bamboo internodes are removed and smoothed to reduce friction, providing a gravity-driven irrigation solution that is low-cost, locally sourced, and sustainable.

Figure 45: Bamboo drip irrigation system

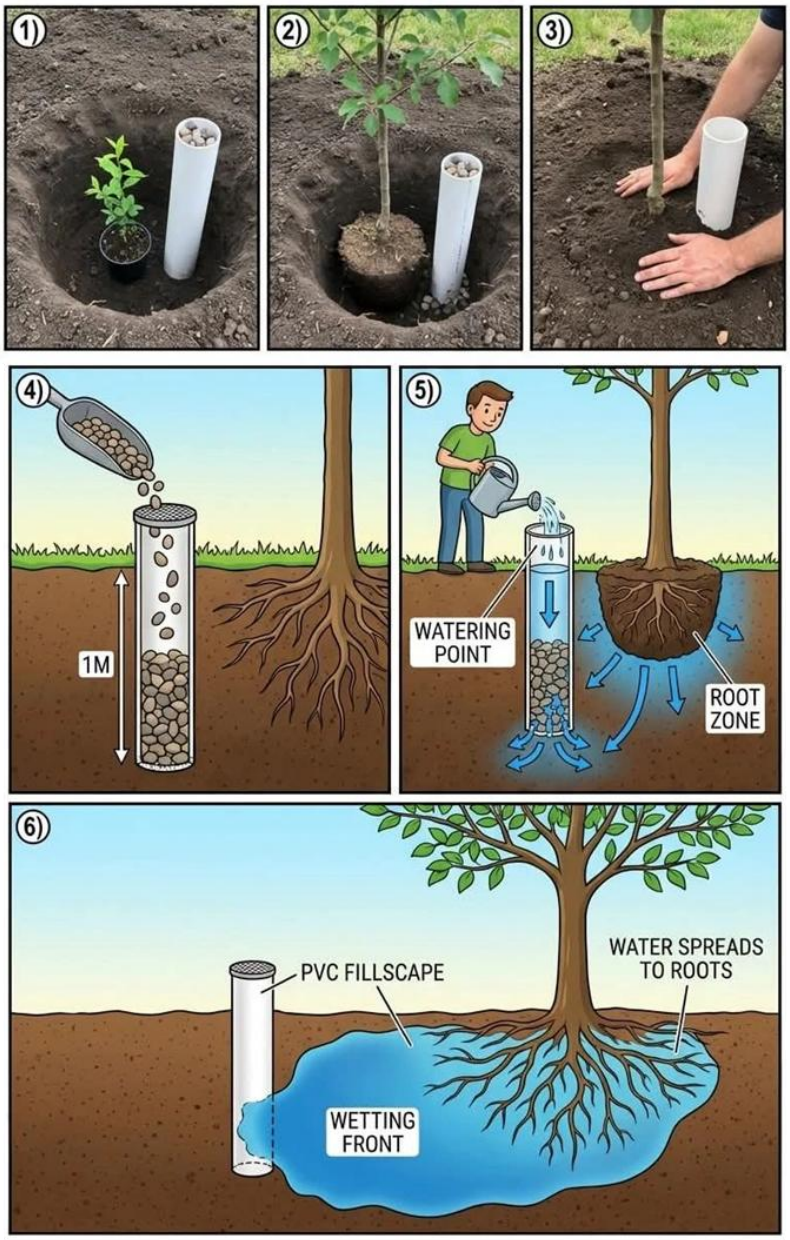




c) Deep Pipe Irrigation System:

- Pipes with a diameter of 2.5–5 cm are vertically installed 30–50 cm deep near tree seedlings, supplying water directly to the root zone.
- Openings will be covered with mesh to prevent animal intrusion, and small weep holes will distribute water evenly to roots.
- This system will support efficient water use, particularly for trees, orchards, and horticultural crops in areas with uneven rainfall.

Figure 46: Deep Pipe Irrigation System:



Source: Chowdhury, P., Meena, L. K., Ray, S. K., & Deka, B. (2016)[61]

4. **Kuhl System of Irrigation (Western Himalayas, India):**

- Diversion channels, known as Guhls or Kuhls, will direct water from streams to agricultural fields.
- Water user associations, led by a Kohli (water tender), will manage flow, maintain headwalls, and ensure equitable distribution.
- Flow control will be achieved by adjusting outlet widths between successive fields; temporary storage structures will store water for use during dry periods.

[61] Implication of feasible techniques for irrigation in hill agriculture. *ResearchGate*. https://www.researchgate.net/publication/341992310_Implication_of_Feasible_Techniques_for_Irrigation_in_Hill_Agriculture

- This system will encourage community participation, promote accountability, and strengthen traditional water governance.

Recommended Integration for the Model Village:

- Pilot implementation of bamboo drip irrigation for sloped orchards or horticulture zones
- Zabo- and Kuhl-inspired terracing and water-sharing systems for communal farms and rangeland areas
- Deep pipe irrigation for high-value crops, trees, and kitchen gardens
- Capacity-building programs and demonstration plots will educate farmers about the efficiency and maintenance of traditional irrigation methods

These practices will ensure that water is utilized efficiently, strengthen agricultural resilience, and maintain ecological balance, while respecting traditional knowledge and local cultural practices.

8.4.3.4 Riparian Zones and Water Resource Protection

In accordance with the Khyber Pakhtunkhwa Water Protection Act, a minimum 61-meter-wide riparian zone on both side will be established along both banks of all significant water bodies within the Model Village. These zones will be characterized by dense native vegetation and will serve multiple ecological, hydrological, and social functions, including:

- Protection of natural drainage systems and maintenance of water quality
- Flood risk reduction and stabilization of river or stream banks
- Preservation of biodiversity, wildlife habitats, and natural ecological corridors

Controlled and sustainable recreational uses are recommended within designated sections of the riparian buffer, including:

- Nature trails for walking and environmental education
- Camping sites and picnic areas
- Eco-tourism activities such as birdwatching, guided nature tours, and community-based experiences

These measures will promote tourism and community engagement while maintaining the ecological integrity of riparian areas and supporting long-term sustainability of water resources.

Additional recommendations for enhancing riparian functionality:

- Buffer vegetation zoning: Planting native species in layered strips to filter runoff, provide shade, and support habitat connectivity
- Community stewardship programs: Local participation in monitoring water quality and maintaining trails

- Low-impact infrastructure: Boardwalks, observation decks, and signage to minimize soil compaction and habitat disturbance

This integrated approach will ensure that riparian zones serve both environmental protection and community use objectives, aligning with regional water management and sustainable rural development goals.

8.4.3.5 Parks, Recreation, and Open Spaces

Parks and recreational areas are distributed across residential clusters and near community centers to ensure accessibility. These spaces accommodate:

- Playgrounds for children
- Sports facilities such as football and volleyball grounds
- Open-air gyms and jogging tracks
- Community event and cultural activity spaces

The availability of large open spaces within and along riparian buffers also allows for outdoor recreation, camping, seasonal festivals, and eco-tourism activities, further enhancing the socio-economic potential of the model village.

A Waterfront Park has been proposed along selected water bodies to enhance the visual quality of the settlement and provide recreational spaces for residents and visitors. The park integrates:

- Walking and cycling tracks
- Seating terraces and viewing decks
- Landscaped open lawns and shaded areas
- Informal gathering and cultural activity spaces

This waterfront development strengthens the blue-green infrastructure network and reinforces the relationship between the settlement and natural water systems.

8.4.4 Solid Waste Management Planning Model

Solid waste management remains a critical challenge in rural settlements due to the absence of organized collection systems, open dumping practices, and limited institutional capacity. The Model Village is therefore recommended to adopt a decentralized and integrated solid waste management system, aligned with rural socio-economic conditions and land availability.

The proposed model prioritizes waste reduction, resource recovery, and environmentally safe disposal, while encouraging community participation and local employment generation.Waste Segregation at Source

All residential, commercial, and institutional units within the Model Village should be encouraged to practice waste segregation at source, categorizing waste into:

- Biodegradable waste (kitchen waste, crop residues, animal waste)
- Recyclable waste (plastic, paper, metal, glass)

- Residual waste (non-recyclable materials)

Segregation at source is recommended to improve operational efficiency, reduce disposal volumes, and support downstream recycling and composting activities.

8.4.4.1 Community Composting and Organic Waste Management

Given the agrarian nature of rural settlements, biodegradable waste should be processed through community-level composting systems. These may include:

- Windrow composting units
- Enclosed compost pits
- Small-scale bio-gas digesters at cluster or neighborhood level

The resulting compost can be utilized for:

- Agricultural fields
- Kitchen gardens
- Public green spaces

Bio-gas production is recommended for communal cooking facilities or selected households, thereby contributing to renewable energy use and reducing reliance on conventional fuels.

8.4.4.2 Material Recovery and Recycling Facilities

A Material Recovery Facility (MRF) is recommended within or adjacent to the Service Center or Agro-Industrial Zone. This facility should function as a collection, sorting, and storage point for recyclable materials.

Key functions include:

- Manual sorting of recyclable waste
- Temporary storage and baling
- Linkage with regional recycling markets

This facility is expected to generate local employment and strengthen the circular economy within the village.

8.4.4.3 Final Disposal System

Residual waste that cannot be composted or recycled should be disposed of at a controlled rural disposal site, designed with:

- Lined disposal pits
- Periodic soil covering
- Vegetative buffers to reduce visual and environmental impact

This system is recommended to replace informal dumping practices and protect soil and groundwater quality.

8.4.5 Water Supply and Sanitation Networks

8.4.5.1 Model Village with Maximum Population (Pindiali Tehsil)

8.4.5.1.1 Rural Area Wise Existing and Proposed Water Demand of Model Village (Pindiali Tehsil) Issa Khel VC 2, Issa Khel VC 4, Tamanzai VC 1

Based on projected population growth, the combined rural population of the selected model villages comprising Issa Khel VC-2, Issa Khel VC-4, and Tamanzai VC-1 in Pindiali Tehsil is expected to increase substantially from 24,766 persons in 2025 to 48,886 persons by 2045. This growth reflects natural population increase as well as planned consolidation of dispersed settlements into a clustered model village framework.

In accordance with the adopted rural water supply design standards, the average daily water demand for the model village cluster is projected to rise from 0.371 MGPD in 2025 to 0.733 MGPD by 2045. Correspondingly, the maximum day demand is anticipated to increase from 0.557 MGPD to 1.100 MGPD, while the peak hour demand is expected to rise from 0.836 MGPD to 1.650 MGPD over the planning horizon.

Year	Rural Population	Water Demand (MGPD)	Maximum Day Demand (MGPD)	Peak Hour Demand (MGPD)
2025	24,766	0.371	0.557	0.836
2045	48,886	0.733	1.100	1.650

The significant increase in projected water demand underscores the necessity for a planned, phased, and scalable rural water supply system for the model village cluster. Priority interventions should include the development of deep tube wells, augmentation of ground and overhead storage capacities, and systematic expansion of the piped distribution network to ensure equitable and reliable service coverage across all settlements. Furthermore, emphasis should be placed on source sustainability, reduction of system losses, and strict compliance with drinking water quality standards to ensure a resilient and sustainable rural water supply system for the model villages of Pindiali Tehsil.

8.4.5.1.2 Proposed Water Supply System in Model Village (Pindiali Tehsil)

To address the projected water demand of Yake Tehsil covering both rural and semi-urban settlements up to the year 2045, a phased and sustainable water supply system is proposed. The design is based on 15 GPCD for rural areas following PHED and WASA standards.

The system design integrates maximum day and peak hour demand factors, ensuring operational flexibility, resilience, and capacity for future population growth. Key elements of the proposed scheme include sustainable groundwater abstraction, solar-powered pumping, and modular water storage reservoirs for reliable service delivery.

8.4.5.1.3 Proposed Source (New Tube-Well)

- ***Design Basis***

Groundwater abstraction will be the principal source for the proposed water supply network in Yake Tehsil. Wells will tap into productive aquifer zones identified through hydrogeological surveys, ensuring long-term sustainability without over-extraction.

To promote energy efficiency, solar-powered pumping systems are recommended, especially for off-grid and remote settlements, minimizing operational costs and improving service continuity.

- ***Unit Well Capacity:***

Each production well will be designed to yield a continuous discharge of 0.65 MGD (≈1 cusec). This capacity ensures efficient groundwater extraction, manageable maintenance, and operational redundancy to maintain continuous service during outages.

- ***Service Objective:***

The proposed system is designed to meet a maximum day demand of 1.1 MGD by 2045, including a 15% redundancy margin for operational downtime and emergencies. This configuration ensures reliable and sustainable water service across all settlements.

Stage	Implementation Period	Rural Demand to be Met (MGD)	New Production Wells*
Long-Term	2041 – 2045	up to 1.1	2 wells

8.4.5.1.4 Water Storage Model Village

- ***Urban Areas (VCs – 15GPCD)***

For rural settlements in Model Village (Pindiali Tehsil) Issa Khel VC 2, Issa Khel VC 4, Tamanzai VC 1, localized Overhead Reservoirs (OHRs) are proposed to provide consistent supply and operational reliability. Each OHR will provide a 12-hour service buffer, ensuring stable supply during power interruptions or maintenance shutdowns.

- ***Purpose:***

- Ensure consistent and reliable supply for rural communities.
- Provide a 12-hour operational buffer during outages or maintenance.
- Reduce stress on groundwater abstraction systems by regulating pumping cycles

Phased Capacities (based on projected demand):

Year	Maximum Day Demand (MGD)	12-Hour Buffer (MG)	Recommended OHR Capacity (MG)

2025	0.557	0.279	0.30
2045	1.100	0.550	0.60

8.4.5.1.5 Existing situation of the sanitation/drainage system in Model Village

Wastewater generation for the Model Village cluster comprising Issa Khel VC-2, Issa Khel VC-4, and Tamanzai VC-1 has been estimated based on 85% of the average daily water demand, with an additional 5% allowance for non-domestic uses, including small-scale commercial and institutional activities. This approach reflects prevailing rural and semi-urban water use patterns and aligns with standard sanitation planning practices.

For hydraulic design purposes, the peak sewage flow has been assumed as three times the average daily wastewater generation to account for diurnal variations and peak usage conditions. Stormwater inflow and infiltration (I&I) have been considered at 50% of the peak sewage flow to reflect combined inflows during monsoon rainfall events. Additionally, 10% infiltration losses have been incorporated to account for local soil permeability and hydrogeological conditions.

Based on a design per capita water demand of 15 GPCD, the corresponding per capita sewage generation is approximately 13.5 GPCD, which is typical for rural and semi-urban settlements.

- ***Rural Area Wise Existing and Proposed Wastewater Demand – Pindiali Tehsil (Issa Khel VC 2, Issa Khel VC 4, Tamanzai VC 1):***

Year	RURAL Population	Average Water Demand (MGD)	Wastewater Generation @ (85% + 5%) (MGD)	Peak Sewage Flow (MGD)	Stormwater Inflow (50% of Peak) (MGD)	Total Design Flow (MGD)
2025	24,766	0.37	0.33	1.00	0.50	1.50
2045	48,886	0.73	0.66	1.98	0.99	2.97

Based on population projections for the model village cluster, wastewater generation is expected to increase significantly over the planning horizon. The rural population is projected to rise from 24,766 in 2025 to 48,886 by 2045, resulting in an increase in average daily wastewater generation from 0.33 MGD to 0.66 MGD. The corresponding total design flow, including peak sewage flow and stormwater inflow, is projected to increase from 1.50 MGD in 2025 to 2.97 MGD by 2045.

These projections highlight the need for a phased and integrated rural sanitation strategy for the model village cluster. Key interventions should focus on upgrading on-site sanitation systems, introducing decentralized wastewater treatment solutions, safeguarding groundwater resources, and strengthening rural drainage infrastructure. Timely implementation of these measures will be critical to ensuring environmentally sound,

resilient, and sustainable wastewater management for Issa Khel VC-2, Issa Khel VC-4, and Tamanzai VC-1.

- ***Proposed Wastewater Treatment Plants (WWTP)***

To cater to the projected wastewater flows of the Model Village (Pindiali Tehsil), comprising Issa Khel VC-2, Issa Khel VC-4, and Tamanzai VC-1, it is proposed to develop two decentralized Wastewater Treatment Plants (WWTPs), each with a treatment capacity of 1.5 MGD. The combined treatment capacity of 3.0 MGD has been planned to adequately accommodate the ultimate design flow of 2.97 MGD by 2045, while also providing an operational buffer for peak flow variations, infiltration and inflow during storm events, and future uncertainties in population growth and water consumption patterns.

The proposed WWTPs shall be strategically located to serve their respective catchments, minimizing conveyance distances and pumping requirements and ensuring operational efficiency. Each facility is recommended to adopt cost-effective, low-energy, and low-maintenance treatment technologies suitable for rural and semi-rural contexts, such as waste stabilization ponds, constructed wetlands, or compact modular treatment units, in accordance with PHED Khyber Pakhtunkhwa guidelines and applicable National Environmental Quality Standards (NEQS).

Treated effluent may be safely discharged into natural drainage channels or reused for agricultural irrigation and landscape watering, subject to compliance with effluent quality standards. The phased development of these decentralized WWTPs will form the backbone of a sustainable and environmentally sound wastewater management system for the model village cluster, while ensuring long-term protection of both surface and groundwater resources.

8.4.5.1.6 Proposed Rainwater Harvesting System for Model Village

In order to enhance water security, reduce pressure on groundwater resources, and improve system resilience during peak demand periods, it is proposed to introduce a rainwater harvesting (RWH) system for the Model Village cluster comprising Issa Khel VC-2, Issa Khel VC-4, and Tamanzai VC-1. The system will serve as a supplementary water source, particularly during the monsoon season, and will contribute to sustainable water resource management.

Rainwater harvesting is particularly suitable for rural and semi-urban settlements where roof catchments, public buildings, and open spaces can be effectively utilized to capture and store rainfall for non-potable and limited potable uses following appropriate treatment.

Design Basis

The proposed rainwater harvesting system has been designed based on the following assumptions. Collection from rooftops of public buildings (schools, mosques, health units) and selected residential clusters. Average annual rainfall in the area is considered adequate for seasonal harvesting. Runoff coefficient of 0.75 for roof surfaces. Storage designed to

supplement 10–15% of average daily water demand. Provision of first-flush diversion and basic filtration prior to storage.

8.4.5.1.7 Proposed Rainwater Harvesting Storage Capacity

Based on the projected water demand and settlement pattern of the model village cluster, it is proposed to construct community-level rainwater harvesting tanks with phased storage capacities as summarized below.

Year	Average Water Demand (MGD)	Target Supplement (%)	Daily Supplement (MGD)	Recommended RWH Storage (MG)
2025	0.371	10%	0.037	0.4
2045	0.733	15%	0.11	0.8

The recommended storage volumes allow harvested rainwater to be utilized over several days following rainfall events, thereby reducing reliance on tube wells during peak demand periods.

Utilization Strategy & Operational Benefits

The proposed rainwater harvesting system for the Model Village (Pindiali Tehsil), comprising Issa Khel VC-2, Issa Khel VC-4, and Tamanzai VC-1, will consist of roof and paved surface catchments connected through a gutter and downpipe collection network, supported by first-flush diversion chambers and sand-and-gravel filtration units to ensure improved water quality prior to storage. Harvested rainwater will be stored in reinforced concrete underground or semi-underground tanks, with overflow arrangements linked to soak pits or recharge trenches to safely dispose of excess runoff and promote groundwater recharge. The collected rainwater will be utilized primarily for non-potable domestic purposes such as washing and cleaning, irrigation of public green spaces and landscaped areas, and controlled aquifer recharge, while limited emergency potable use may be permitted following basic treatment and disinfection. The rainwater harvesting tanks will remain hydraulically isolated from the main potable water supply system; however, controlled valving will be provided to allow emergency integration during extreme shortages. This system will complement the proposed tube-well-based supply and overhead reservoirs by providing an alternative water source during monsoon periods and operational downtime. Overall, the phased implementation of rainwater harvesting infrastructure will reduce pressure on groundwater acquirers, lower energy consumption associated with pumping, improve long-term sustainability of the rural water supply, and enhance resilience to droughts and climate variability, thereby contributing to a sustainable, resource-efficient, and climate-adaptive water supply system for the model village cluster.

8.4.5.2 Model Village With Manimun Population

8.4.5.2.1 Rural Area Wise Existing and Proposed Water Demand of (Halimzai Tehsil) Kuz Kadi Khel VC-1, Kuza Kadi VC-2

Based on projected population growth, the combined rural population of the selected model villages comprising Kuz Kadi Khel VC-1 and Kuza Kadi VC-2 in Halimzai Tehsil is expected to increase from 13,393 persons in 2025 to 21,429 persons by 2045. This increase reflects natural population growth over the planning horizon, along with gradual consolidation of rural settlements under the model village framework.

In accordance with the adopted rural water supply design standards, the average daily water demand for the model village cluster is projected to rise from 0.201 MGPD in 2025 to 0.321 MGPD by 2045. Correspondingly, the maximum day demand is expected to increase from 0.301 MGPD to 0.482 MGPD, while the peak hour demand is projected to rise from 0.452 MGPD to 0.723 MGPD over the planning period.

Year	Rural Population	Water Demand (MGPD)	Maximum Day Demand (MGPD)	Peak Hour Demand (MGPD)
2025	13,393	0.201	0.301	0.452
2045	21,429	0.321	0.482	0.723

The projected increase in water demand highlights the need for a planned, phased, and scalable rural water supply system for the model village cluster. Priority interventions should focus on the development of deep tube wells, augmentation of ground and overhead storage facilities, and systematic expansion of the piped distribution network to ensure equitable and reliable water supply coverage across both villages. In addition, emphasis should be placed on source sustainability, reduction of system losses, and compliance with drinking water quality standards to ensure a resilient and sustainable rural water supply system for the model villages of Halimzai Tehsil.

8.4.5.2.2 Proposed Water Supply System in Model Village

To address the projected water demand of Halimzai Tehsil covering both rural and semi-urban settlements up to the year 2045, a phased and sustainable water supply system is proposed. The design is based on 15 GPCD for rural areas following PHED and WASA standards.

The system design integrates maximum day and peak hour demand factors, ensuring operational flexibility, resilience, and capacity for future population growth. Key elements of the proposed scheme include sustainable groundwater abstraction, solar-powered pumping, and modular water storage reservoirs for reliable service delivery.

8.4.5.2.3 Proposed Source (New Tube-Well)

- ***Design Basis***

Groundwater abstraction will be the principal source for the proposed water supply network in Yake Tehsil. Wells will tap into productive aquifer zones identified through hydrogeological surveys, ensuring long-term sustainability without over-extraction.

To promote energy efficiency, solar-powered pumping systems are recommended, especially for off-grid and remote settlements, minimizing operational costs and improving service continuity.

- ***Unit Well Capacity:***

Each production well will be designed to yield a continuous discharge of 0.5 MGD (≈0.6 cusec). This capacity ensures efficient groundwater extraction, manageable maintenance, and operational redundancy to maintain continuous service during outages.

- ***Service Objective:***

The proposed system is designed to meet a maximum day demand of 0.48 MGD by 2045, including a 15% redundancy margin for operational downtime and emergencies. This configuration ensures reliable and sustainable water service across all settlements.

Stage	Implementation Period	Rural Demand to be Met (MGD)	New Production Wells*
Long-Term	2041 – 2045	up to 0.48	1 wells

8.4.5.2.4 Water Storage Model Village (Kuz Kadi Khel VC-1, Kuza Kadi VC-2)

Urban Areas (VCs – 15GPCD)

For rural settlements in Model Village (Halimzai Tehsil) Kuz Kadi Khel VC-1, Kuza Kadi VC-2, localized Overhead Reservoirs (OHRs) are proposed to provide consistent supply and operational reliability. Each OHR will provide a 12-hour service buffer, ensuring stable supply during power interruptions or maintenance shutdowns.

Purpose:

- Ensure consistent and reliable supply for rural communities.
- Provide a 12-hour operational buffer during outages or maintenance.
- Reduce stress on groundwater abstraction systems by regulating pumping cycles

Phased Capacities (based on projected demand):

Year	Maximum Day Demand (MGD)	12-Hour Buffer (MG)	Recommended OHR Capacity (MG)
2025	0.301	0.151	0.2
2045	0.482	0.241	0.3

8.4.5.2.5 Existing situation of the sanitation/drainage system

Wastewater generation for the model village cluster comprising Kuz Kadi Khel VC-1 and Kuza Kadi VC-2 has been estimated based on 85% of the average daily water demand, with an additional 5% allowance for non-domestic uses, including small-scale commercial and institutional activities. This methodology reflects prevailing rural and semi-urban water use patterns and is consistent with standard sanitation planning practices.

For hydraulic design purposes, the peak sewage flow has been assumed as three times the average daily wastewater generation to account for diurnal variations and peak usage conditions. Stormwater inflow and infiltration (I&I) have been considered at 50% of the peak sewage flow to represent combined inflows during monsoon rainfall events. In addition, 10% infiltration losses have been incorporated to reflect local soil characteristics and hydrogeological conditions.

Based on a design per capita water demand of 15 GPCD, the corresponding per capita sewage generation is approximately 13.5 GPCD, which is typical for rural settlements and low-density semi-urban area.

Rural Area Wise Existing and Proposed Wastewater Demand – (Halimzai Tehsil): Kuz Kadi Khel VC-1 and Kuza Kadi VC-2:

Year	RURAL Population	Average Water Demand (MGD)	Wastewater Generation @ (85% + 5%) (MGD)	Peak Sewage Flow (MGD)	Stormwater Inflow (50% of Peak) (MGD)	Total Design Flow (MGD)
2025	13,393	0.20	0.18	0.54	0.27	0.81
2045	21,429	0.32	0.29	0.87	0.43	1.30

Based on population projections, wastewater generation within the model village cluster is expected to increase in line with population growth and rising water demand. The rural population is projected to increase from 13,393 in 2025 to 21,429 by 2045, resulting in an increase in average daily wastewater generation from 0.18 MGD to 0.29 MGD. Accordingly, the total design flow, inclusive of peak sewage flow and stormwater inflow, is projected to increase from 0.81 MGD in 2025 to 1.30 MGD by 2045.

These projections underline the need for a phased and integrated rural sanitation strategy for Kuz Kadi Khel VC-1 and Kuza Kadi VC-2. Priority measures should focus on upgrading on-site

sanitation systems, introducing decentralized wastewater treatment solutions, protecting groundwater resources, and strengthening rural drainage infrastructure. Timely implementation of these interventions will be essential to ensure environmentally sound, resilient, and sustainable wastewater management over the planning horizon.

- ***Proposed Wastewater Treatment Plants (WWTP)***

To cater to the projected wastewater flows of the Model Village with Minimum Population (Halimzai Tehsil), comprising Kuz Kadi Khel VC-1 and Kuza Kadi VC-2, it is proposed to develop decentralized wastewater treatment facilities with a combined treatment capacity of approximately 1.5 MGD. This capacity has been planned to adequately accommodate the ultimate design flow of 1.30 MGD by 2045, while also providing a reasonable operational buffer for peak flow variations, infiltration and inflow during storm events, and uncertainties in future population growth and water consumption patterns.

The proposed WWTP(s) shall be strategically located to serve their respective catchments, minimizing conveyance distances and pumping requirements and ensuring operational efficiency. Each facility is recommended to adopt cost-effective, low-energy, and low-maintenance treatment technologies suitable for rural contexts, such as waste stabilization ponds, constructed wetlands, or compact modular treatment units, in accordance with PHED Khyber Pakhtunkhwa guidelines and applicable National Environmental Quality Standards (NEQS).

Treated effluent may be safely discharged into nearby natural drainage channels or reused for agricultural irrigation and landscaping, subject to compliance with effluent quality standards. The phased development of decentralized wastewater treatment infrastructure will form the backbone of a sustainable and environmentally sound wastewater management system for Kuz Kadi Khel VC-1 and Kuza Kadi VC-2, ensuring long-term protection of surface and groundwater resources.

8.4.5.2.6 Proposed Rainwater Harvesting System

To enhance water security, reduce pressure on groundwater resources, and improve system resilience during peak demand periods, it is proposed to introduce a rainwater harvesting (RWH) system for the Model Village cluster comprising Kuz Kadi Khel VC-1 and Kuza Kadi VC-2 in Halimzai Tehsil. The proposed system will serve as a supplementary water source, particularly during the monsoon season, and will contribute to sustainable and climate-resilient water resource management.

Rainwater harvesting is well suited to the rural settlement pattern of the model village cluster, where roof catchments of public buildings such as schools, mosques, and health facilities, along with selected residential clusters and paved areas, can be effectively utilized to capture and store rainfall for non-potable and limited potable uses following appropriate treatment.

➢ ***Design Basis***

The proposed rainwater harvesting system has been designed based on the following assumptions. Collection from rooftops of public buildings (schools, mosques, health units) and selected residential clusters. Average annual rainfall in the area is considered adequate for seasonal harvesting. Runoff coefficient of 0.75 for roof surfaces. Storage designed to supplement 10–15% of average daily water demand. Provision of first-flush diversion and basic filtration prior to storage.

8.4.5.2.7 Proposed Rainwater Harvesting Storage Capacity

Based on the projected water demand and settlement pattern of the model village cluster, it is proposed to construct community-level rainwater harvesting tanks with phased storage capacities as summarized below.

Year	Average Water Demand (MGD)	Target Supplement (%)	Daily Supplement (MGD)	Recommended RWH Storage (MG)
2025	0.201	10%	0.02	0.25
2045	0.321	15%	0.048	0.4

The recommended storage volumes allow harvested rainwater to be utilized over several days following rainfall events, thereby reducing reliance on tube wells during peak demand periods.

Utilization Strategy & Operational Benefits

The proposed rainwater harvesting system for the Model Village (Halimzai Tehsil), comprising Kuz Kadi Khel VC-1 and Kuza Kadi VC-2, will consist of roof and paved surface catchments connected through a gutter and downpipe collection network, supported by first-flush diversion chambers and sand-and-gravel filtration units to improve water quality prior to storage. Harvested rainwater will be stored in reinforced concrete underground or semi-underground tanks, with overflow arrangements linked to soak pits or recharge trenches to safely dispose of excess runoff and promote groundwater recharge.

The collected rainwater will primarily be utilized for non-potable domestic purposes, including washing and cleaning, irrigation of public green spaces and landscaped areas, and controlled aquifer recharge. Limited emergency potable use may be permitted following basic treatment and disinfection. The rainwater harvesting tanks will remain hydraulically isolated from the main potable water supply system; however, controlled valving will be provided to allow emergency integration during periods of extreme water shortage.

The proposed RWH system will complement the tube-well-based water supply and overhead storage reservoirs by providing an alternative seasonal water source during monsoon months and periods of operational downtime. Overall, the phased implementation of rainwater harvesting infrastructure will reduce pressure on groundwater aquifers, lower energy consumption associated with pumping, improve long-term sustainability of the rural water

supply system, and enhance resilience to droughts and climate variability, thereby contributing to a sustainable, resource-efficient, and climate-adaptive water supply system for the model village cluster of Halimzai Tehsil.

8.5 Regional Connectivity

The regional connectivity structure of Mohmand District has been conceived as an inclusive and hierarchical road network aimed at ensuring seamless mobility at regional, district and local levels. The network links major urban centers such as Yake Ghund, Ghalanai, Pindiali, Safi, Prang Ghar and Baizai with adjoining districts including Peshawar, Bajaur, Khyber and Charsadda, while also providing strategic access to the Mohmand Marble Industrial Zone and emerging trade nodes. The district's socio-economic development is closely tied to this system, as it supports the movement of agricultural produce, minerals, marble, construction materials and daily commuter traffic to markets, education facilities and healthcare services.

A key planning objective of the District Land Use Plan is to ensure universal accessibility by strengthening road linkages to all Village Councils (VCs), Neighbourhood Councils (NCs) and settlements across the district. The proposed road network has been rationalized and expanded in such a way that each and every settlement is connected through an all-weather road, eliminating isolated pockets and improving access to higher-order roads. This approach not only enhances mobility and service delivery but also promotes balanced territorial development and social integration across Mohmand District.

8.5.1 Primary Road Network

The primary road network forms the backbone of regional and inter-district connectivity in Mohmand District. The Mohmand Agency Primary Road serves as the principal mobility corridor, connecting major settlements, administrative centres, industrial zones and regional trade routes. Within urban limits, the corridor currently operates with an existing Right-of-Way (ROW) of approximately 40 ft. which constrains traffic capacity, limits safe manoeuvring and restricts orderly commercial development. In rural segments, the existing ROW of around 60 ft remains inadequate to accommodate increasing freight movement and future traffic demand.

To address these constraints, proposes targeted widening and dualization of the primary corridor. Within urban areas, the ROW is proposed to be enhanced from 40 ft. to 65 ft. over a length of 3.80 km, allowing for improved carriageway capacity, pedestrian movement and service infrastructure. In rural stretches, the ROW is proposed to be increased from 60 ft. to 80 ft. enabling full dualization over 64.91 km. These improvements will significantly enhance regional accessibility, reduce travel times, improve road safety and strengthen the linkage between Mohmand District and regional economic corridors leading to Peshawar and Bajaur.

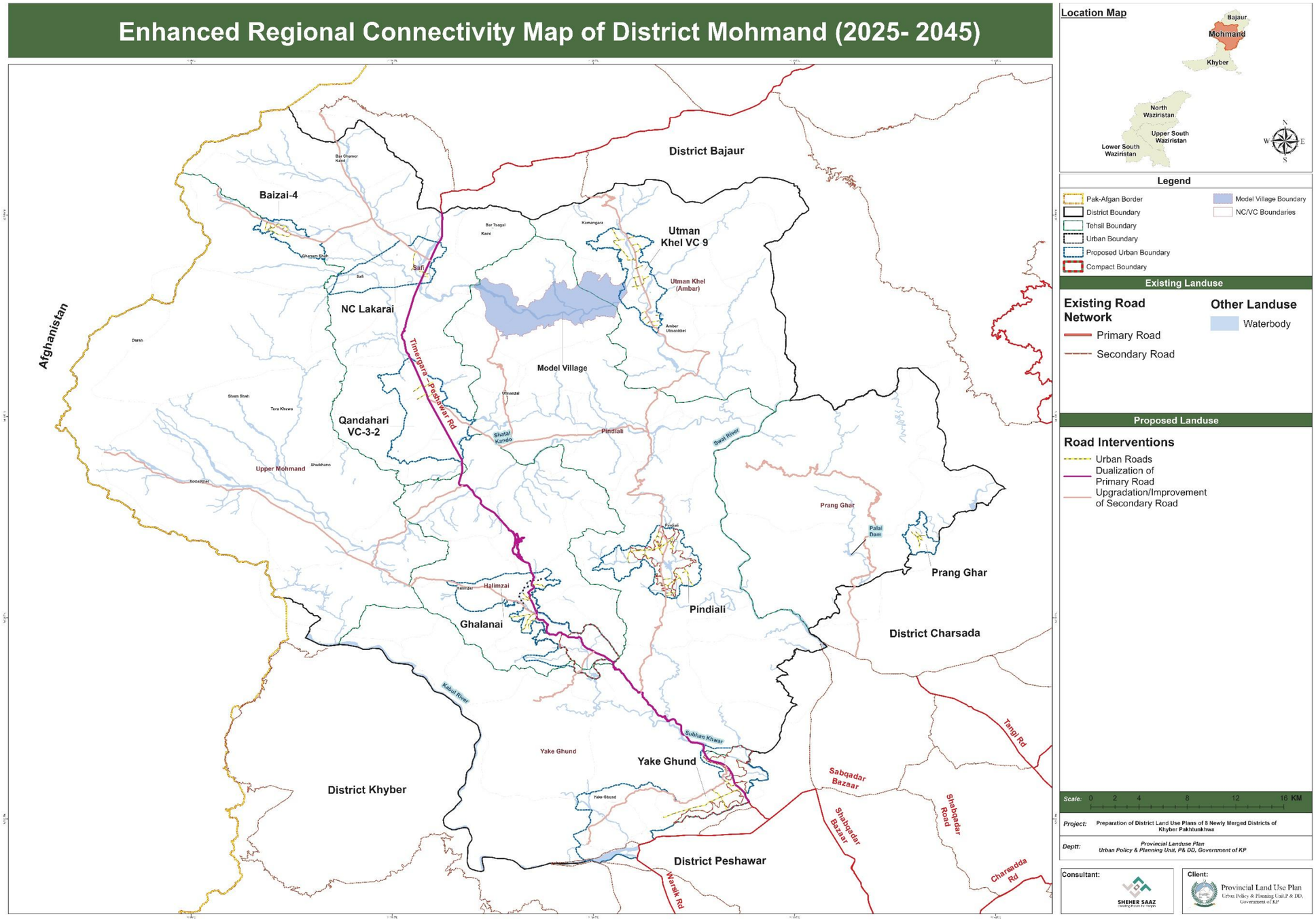
8.5.2 Secondary Road Network

The secondary road network plays a critical role in strengthening intra-district connectivity by linking Village Councils, Neighbourhood Councils, agricultural areas and industrial activity zones to the primary road spine. These roads function as key collectors, ensuring that traffic originating from rural settlements and production areas can efficiently access higher-order roads. At present, many secondary roads operate with limited carriageway widths of 20–30 ft. restricting two-way traffic flow and limiting the movement of freight vehicles, particularly during peak agricultural and market periods.

Under the proposed plan, secondary roads are to be upgraded to standardized widths ranging from 40 ft. to 50 ft., depending on their functional importance and surrounding land-use context. Major corridors such as Baizai Road, Mohmand Agency Road, Laman Utman Khel Road, Canal Road and Dawezai Tamanzai Road are proposed for systematic upgradation and geometric improvement over an extensive cumulative length. These interventions will enhance safety, improve service levels and ensure reliable access for all connected VCs, NCs and settlements.

Through the planned enhancement of primary and secondary roads establishes a cohesive and fully accessible road network, ensuring that no settlement remains disconnected. This integrated approach will facilitate efficient movement of people and goods, support rural and industrial economies and reinforce Mohmand District's integration with regional trade and transport corridors.

Map 79: Enhanced Regional Connectivity Map – District Mohmand



8.6 Regional Economic Development

8.6.1 Introduction

Regional Economic Development in Mohmand District aims to create a balanced, inclusive, and sustainable economy that integrates urban centres, rural clusters, agricultural and livestock zones, commercial hubs, and industrial estates. The strategy leverages the district's strategic location along the Peshawar–Torkham corridor, fertile agricultural land, rich mineral resources, and a growing population, while addressing disparities in economic opportunities across tehsils and settlements.

The approach is polycentric, distributing economic activity across primary urban centres, secondary towns, and 15 clusters and 1 Model Village, ensuring that growth is both spatially and economically balanced. This design aligns with international regional planning practices that emphasise cluster-based growth, connectivity, and value-chain integration.

8.6.2 Proposed Economic Components

8.6.2.1 Commercial Development

8.6.2.1.1 Hierarchy of Commercial Zones

- Central Business Districts (CBDs): Ghalanai, Utman Khel, Pindiali, and Ekka Ghund serve as primary commercial and administrative nodes.
- Linear Commercial Corridors: Pindiali, Baizai-4, and Utman Khel facilitate route-based trade and daily services.
- Grain Markets: Masood-3, Qandahari, and Utman Khel link rural producers to district markets.

Impact: These commercial zones reduce rural-urban disparities, stimulate local employment, and integrate agriculture and industry, promoting inclusive growth.

8.6.3 Industrial Development

Industrial zones are strategically allocated based on population clusters, transport connectivity, local mineral resources, and mining potential:

- SEZ at Ekka Ghund for high-value manufacturing and export-oriented industries.
- Industrial estates in Ghalanai, Pindiali, Utman Khel, Masood-3, and Baizai-4. Mohmand's mining resources, including marble and building stone, coal, limestone, and gypsum, support stone processing, tile manufacturing, cement production, brick-making, and small mineral-based industries.
- Clustered SME zones focus on handicrafts, agro-processing, and small-scale mineral-based industries, aligned with both population growth and resource availability.

Impact: These zones create employment for youth and returning migrants, add value to local resources, and promote district trade, while ensuring environmentally organized, location-specific industrial growth.

8.6.4 Agricultural and Horticultural Zones

- Preserve Agriculture Zones (127,369.33 acres) maintain staple and high-value crops, ensuring food security and rural livelihoods.
- Preserve Orchard Zones (620.57 acres) promote fruit cultivation (apples, peaches, apricots, grapes) with value-added facilities like cold storage and processing.

Impact: These zones strengthen food systems, sustain rural income, and integrate agriculture into commercial and industrial value chains.

8.6.5 Livestock and Dairy Development

- Livestock & Dairy Zones (1,069.28 acres) include fodder cultivation, dairy farms, veterinary services, and value-added processing.

Impact: These zones diversify rural incomes, enhance food security, and link producers to urban markets.

8.6.6 Transport Connectivity in Regional Economic Development – District Mohmand

Transport connectivity is a fundamental enabler of Regional Economic Development in Mohmand District, directly supporting the polycentric development framework by linking urban centres, industrial estates, agricultural zones, livestock areas, and Model Village clusters. The proposed upgradation of primary, secondary, arterial, local, and urban roads, together with phased development of bus terminals, ensures efficient movement of people, goods, and services across the district and towards regional markets.

Aligned with the district's strategic location along the Peshawar–Torkham corridor, the transport network strengthens Mohmand's role as a production, processing, and trade-supporting district within the Peshawar Division.

8.6.6.1 Key Economic Roles of Transport Infrastructure

➢ ***Supporting Commercial and Urban Economic Centres***

- Enhanced connectivity strengthens CBDs at Ghalanai, Ekka Ghund, Pindiali, and Utman Khel.
- Linear commercial corridors benefit from increased traffic flow, accessibility, and roadside economic activity.
- Grain markets gain reliable access for rural producers and traders.

Economic Contribution:

Stimulates trade, services, and employment while reducing rural–urban economic disparities.

➢ ***Enabling Industrial and Mineral-Based Growth***

- Improved road corridors facilitate the efficient transport of marble, building stone, limestone, gypsum, coal, and construction materials.

- Direct connectivity to industrial estates and the SEZ at Ekka Ghund reduces logistics costs and improves supply chain reliability.
- Supports clustering of mineral-based industries, SMEs, and export-oriented manufacturing sectors.

Economic Contribution:

Promotes value addition, attracts private investment, and generates employment for local youth and returning migrants.

➢ ***Strengthening Agricultural and Livestock Value Chains***

- Reliable road access links Preserve Agriculture Zones, Orchard Zones, and Livestock & Dairy Zones to markets, processing units, and storage facilities.
- Improves timely movement of perishable goods, reducing post-harvest losses.
- Encourages diversification into high-value crops and commercial dairy production.

Economic Contribution:

Enhances farm incomes, food security, and integration of agriculture with industry and commerce.

➢ ***Enhancing Model Village Clusters and Rural Connectivity***

- Secondary and local roads provide last-mile connectivity to the 15 Model Village clusters.
- Facilitates access to services, employment, and markets while supporting agro mini-industries.
- Reduces isolation of rural settlements and promotes balanced spatial development.

Economic Contribution:

Ensures inclusive growth and strengthens rural–urban economic integration.

➢ ***Improving Labour Mobility and Access to Services***

- Phased development of Class-B, C, and D bus terminals supports organised passenger movement.
- Enhances access to education, healthcare, and employment across tehsils.
- Reduces household transport costs and improves productivity.

Economic Contribution:

Expands labour markets and supports human capital development.

➢ ***Integrated Regional Impact***

- Reinforces the polycentric development approach by connecting multiple economic nodes.
- Enables value chain integration across agriculture, livestock, industry, and commerce.
- Improves regional competitiveness by linking local production with provincial and cross-border trade routes.
- Supports sustainable development through planned ROWs, safer roads, and climate-resilient infrastructure.

8.6.7 District-Level Impacts

1. Balanced Economic Development: Polycentric hubs distribute economic activity across tehsils and clusters.
2. Employment Generation: Across the commercial, industrial, agricultural, and livestock sectors.
3. Integrated Development Approach: Combines commercial, industrial, agricultural, livestock, and rural settlements to ensure coordinated growth.
4. Inclusive Growth: Model Villages and rural commercial zones offer opportunities close to residents.
5. Value Chain Integration: Agricultural and livestock production supplies industrial and commercial centres.
6. Sustainable Resource Management: Preservation zones, green buffers, and riparian areas maintain ecological balance.
7. Regional Competitiveness: Leveraging minerals, agriculture, and transport corridors enhances trade and investment.

Figure 47: Economic Growth in Mohmand District



9 CHAPTER IX: LAND USE REGULATIONS & GUIDELINES

Land use regulations constitute the legal and procedural backbone of spatial governance, enabling the orderly transformation of land while safeguarding public interest, environmental assets, and urban form.

As part of the zoning framework, these regulations establish the functional character of each land parcel by defining what activities are allowable, conditionally approvable, or strictly restricted within designated zones. Central to this framework are three key categories:

• Permitted Uses refer to those land use activities that are inherently aligned with the primary intent and planning objectives of a specific zone. These uses are allowed by right and do not require discretionary approval, provided they comply with applicable building codes, design guidelines, floor area ratios (FAR), setbacks, and height restrictions. Permitted uses facilitate predictable development outcomes and ensure efficient processing of building permits and planning approvals.

• Permissible Uses represent a secondary tier of land use activities that may be allowed within a zone subject to certain conditions. These uses are not automatically permitted but may be approved through a special review process—often involving impact assessment, stakeholder consultation, and compliance with supplementary criteria. The intent is to provide flexibility while maintaining compatibility with surrounding uses and minimizing potential land use conflicts.

• Prohibited Uses encompass activities that are fundamentally incompatible with the intended function of a zone due to their adverse environmental impacts, socio-spatial externalities, or infrastructure demands. These uses are categorically disallowed to preserve the integrity of zoning objectives, protect public health and safety, and maintain functional coherence in urban and rural areas.

These regulatory distinctions are essential to preserving urban form, promoting functional integration, managing growth, and facilitating context-sensitive development. They also empower local planning authorities to enforce zoning compliance, monitor land use change, and guide investment in alignment with strategic spatial frameworks.

The zoning regulations apply uniformly across the district and are tailored to the land use character and development intensity of each zone. The regulatory structure covers the following major land use categories:

• Residential Zones

• Commercial Zone (CBD)

• Industrial Zones

• Agricultural Zones

• Mining Zones

- Forest Zones
- Institutional Zones (including Education, Health, and Governmental uses)
- Mixed Land Use Zones
- Recreation Zone

Each of these zones is governed by a specific matrix of permitted, permissible, and prohibited uses, as detailed in the following subsections. This structured approach ensures the development of an inclusive, sustainable, and resilient urban-rural fabric while balancing socio-economic development with environmental stewardship.

9.1 Residential Zone

Permitted Uses	Permissible Uses	Prohibited Uses
• Detached/semi-detached dwellings, • place of worship or prayer, • Social/cultural institutions, • Parks and playgrounds, • Apartment buildings, • Graveyard or place of burial, horticultural nursery. • Urban farm, • Old age home or orphanage, • Urban forest,	• Commercial offices and service, • Shops of local character, • Raising of poultry for non-commercial purposes, • Private community centre or club • Day-care centre or Pre-schools, • primary school; • secondary school; • Rehabilitation centres, • Petrol pump, • Gas filling station, • Taxi/rickshaw stand. • Guest houses offices of TMAs/other tiers of local Govt. • Offices of professionals with adequate parking facilities, • Local shopping areas/retail shops,	• Heavy, large and extensive industries: noxious, obnoxious and hazardous industries, • Warehousing, storage go-downs of perishables, hazardous, inflammable goods, • Workshops for buses, • Slaughter-housing, • wholesale mandis, • treatment Sewage plant/disposal work, • Water treatment plant, • Solid waste dumping yards, • Outdoor games stadium, • Indoor games stadium, shooting range, • Zoological botanical garden, garden, • Bird sanctuary, • Picnic hut,

9.2 Commercial Zone (CBD)

Permitted Uses	Permissible Uses	Prohibited Uses
• Commercial buildings, • Markets, shopping mall departmental stores and Outlets, • Shops except dealing in hazardous dangerous substances • Taxi/rickshaw stand. • Public Squares and Parks • Bakery or confectionary, • Clinic or polyclinic, • place of worship or prayer, • Courier service or logistics office, • Private exchange operation telephone or cable JO • mobile franchise offices, • Memorial and monument, • Hotel or motel, • Hostel • Car showroom, • Police station, post office and fire station, • Boutique or garment outlets or beauty parlour, • Restaurant, • Social welfare institutions such as community centre,	• Pedestrian friendly streetscape, • Mixed-use buildings, • Technical vocational institution, and • Seasonal commercial fare site, • Stadium; amusement park /play land, • Bus terminal, • Fuel Stations, • Wholesale market, • Second hand goods market, • Coal, wood or Timber yard. • Education institution • Marriage or banquet hall, concert hall • petrol pump or gas or LPG or LNG station; • bus or truck terminal; • private hospital; • auto workshop; • athletic club, gymnasium, fitness centre or • indoor sport facility,	• Dwellings except those of service apartment, essential operational, watch and ward personnel, • Heavy, extensive, noxious, obnoxious, hazardous and extractive industrial units, • Hospitals/research laboratories treating contagious diseases, • Poultry farms/dairy farms, • Slaughter-houses, • Sewage sites, treatment/disposal • Agricultural uses, • Storage of perishable and inflammable commodities, • Quarrying of gravel, sand, clay and stone, • Zoological garden, botanical garden, • Bird sanctuary, • Forensic science laboratory and all other activities which may cause nuisance and are noxious and obnoxious in nature. • A local government shall not allow person to use land or building commercial area for any neither purpose which is

art gallery and museum, • Parking plaza or Parking site.		permitted nor permissible.

9.3 Industrial Zone

Permitted Use	Permissible Use	Prohibited Use
• Small and Medium Scale Industries • vertical green industry, • construction equipment, building material store; • Processing Units • Manufacturing Activities • Warehouses storage or Go-down; • Workshops • Cold storage and Ice factory • Petro chemicals, petroleum and gas products • Loading and unloading space; • Parking lot • Industrial park or estate • Police station, fire station and post office; • restaurant: • green area, park or forest • bank or automated teller machine (ATM); • Industrial research institute;	• Showrooms • Mixed-buildings used • Residence for workers • Fuel stations and Oil depot; • Restaurant; • Hospital; • Power plant • Grid Station • Place of Worship • Essential residential, • commercial, health and educational facility for workers or employees • Auto workshop, service and station; garage service	• Private residential housing schemes • Large health, commercial and educational institutions • The land use for storing, packing, pursing, cleaning, preparing, and manufacturing of blushing power, ammunition, fireworks, gun powder, Sutphin, mercury, gases, nitro-compounds, phosphorous, 'dynamite, explosives, bombs or any other obnoxious hazardous material shall not be permissible In a declared industrial area. • A local government shall not allow person to use land or property in an industrial area for any purpose which is neither permitted nor permissible.

• Treatment or recycling plant; • Grid station; • Vocational training institute		

9.4 Agriculture Zone

Permitted Use	Permissible Use	Prohibited Use
• Crop, • Orchard, • Pastureland • livestock such as dairy or poultry farm • Forest, • or a green house, Nursery horticulture, • Tube well, • Existing rural settlement or village, • place of worship or prayer. • Agro-based industry • Public slaughterhouse • Storage activities of agricultural goods which are non-hazardous in nature.	• Milk Chilling and Pasteurization • Animal husbandry clinic, veterinary dispensary or hospital. • Agricultural workshop machinery • Basic health unit • clinic or hospital; • Country club, • Zoological garden, • Farmhouse • Slaughterhouses, • Dairy production, • Botanical garden, • recreational club or resort or country club; • Bird sanctuary, • Zoo or wildlife park, • Grain market • Cattle farm • Poultry Farm, • Cattle market • Fruit and vegetable market, • Agriculture, Livestock research institute • monument, Park, playground, gymnasium or sports complex	• Other than permitted and permissible

	• public or private recreational or theme park; • Vegetable, fruit and grain market • water filtration plant; • wastewater treatment plant; • Power plant • petrol pump or gas station or LPG or LNG storage and filling station. • Base trans-receiver station • Or communication tower. • shooting range; • swimming pool; • library; • Detached/semi-detached dwellings.	

9.5 Mining Zone

Permitted Use	Permissible Use	Prohibited Use
• Extraction of minerals (e.g., coal, sand, gravel, stone), quarrying, and other resource mining activities.	• Housing or colony for workers (including schools and corner shops, health facility) • Processing plants for mined materials, • storage facilities for mined goods, • Industrial parks related to mining activities (Processing plants, Storage facilities • Workshops and manufacturing units, Logistics infrastructure),	• Housing or colony for workers (including schools and corner shops, health facility) • Processing plants for mined materials, • storage facilities for mined goods, • Industrial parks related to mining activities (Processing plants, Storage facilities • Workshops and manufacturing units, Logistics infrastructure),

	Transportation infrastructure. • Utilities for mining operations (water treatment plants, power plants for mining operations),	Transportation infrastructure. • Utilities for mining operations (water treatment plants, power plants for mining operations),

9.6 Forest Zone

Permitted Use	Permissible Use	Prohibited Use
• Forestry activities such as timber extraction (sustainable logging), reforestation, ecotourism (e.g., hiking, agroforestry, camping), conservation efforts. controlled • Wildlife conservation and habitat national parks, nature restoration, reserves	• Forestry research institutes, sustainable wood processing industries (e.g., paper mills), eco-tourism facilities (lodges, visitor centers), and community-based forest management activities. • Educational and training centers focused on environmental conservation sustainable and forestry practices	• Urban development (residential, commercial, industrial), large-scale agriculture (e.g., crop farming), mining activities, infrastructure projects (e.g., roads, buildings), land clearing for non-forest related uses. • Any activities that lead to deforestation, illegal logging, or degradation of forest ecosystems

9.7 Institutional Zone (Health, Education, and Civic Amenities)

Permitted Use	Permissible Use	Prohibited Use
• Permitted Uses • Large Scale education zone • General education universities • Scientific research institutes • IT and Media institutes	• Staff residences (teaching and non-teaching, health workers, employees) • Separate hostels for Boys and Girls • Auditoriums, seminar halls, workshop spaces, • Community facilities	

• City Level libraries, book banks, data information centers and • Large Scale Health Institutions; Hospitals, • Scientific research institutes, • Clinics, • Clinical Laboratory, • BHUs and RHCS, • Maternity Care Centres • Government government or semi-offices (District Secretariat, Town Hall etc. • Social welfare institution such as a community centre, art gallery, • museum and auditorium • • Local and zonal municipal • office • • Police station, fire station • or post office • • Shelter home, • • Pannahgahh, • • Convention Centre	(Parks, Playgrounds, neighbourhood commercial) • Athletic club, gymnasium, Sports facilities, fitness center or indoor sport facility, • Banks or Automated Teller • Machine (ATM), • Departmental Store, • Taxi or bus stand. • Hotel or Motel, • Guest house,	

9.8 Recreational Zone

Permitted Use	Permissible Use	Prohibited Use
• Public parks, • playgrounds, green • spaces	• Commercial amenities (e.g., cafés) • Event venues (festivals, concerts) • Campgrounds/RV parks	Industrial activities (factories) • Heavy commercial (malls) • Residential housing (high

• Sports facilities (fields, courts, pools) • Community/recreation • centers • Nature preserves • Accessory uses (parking, restrooms) • Educational facilities • (nature centres	• Private recreational facilities (marinas) • Small-scale lodging (eco-lodges) • Temporary uses (farmers' markets	density • High-impact infrastructure (highways) • Polluting uses (landfills) • Intensive agriculture (livestock farming) • Waste disposal facilities • Transport depots/terminals

9.9 Mixed Land Uses Zone

Permitted Use	Permissible Use	Prohibited Use
• Detached/semi-detached homes • Residential apartments • Social institutions (schools, places of worship) • Retail shops, cafes, local businesses, offices for professionals (doctors, lawyers) • Schools, • Clinics, • Community centers, • Public parks, • Transportation hubs (bus stations and public transport terminals) • Small workshops, • Artisan businesses, •	• Additional developments, Schemes, housing societies and residential apartments • Hotels, motels, restaurants, specialized retail outlets. • Day-care centers, health centers, cultural centers. • Cottage industries, home-based businesses, small-scale production units. • Public sports complexes, recreation centers.	• Large-scale housing projects incompatible with zoning. • Hazardous goods stores, large malls, or heavy industry shops. • Large hospitals, forensic labs, military facilities. • Large factories producing hazardous materials, heavy industrial operations. • Sewage plants, waste disposal sites, power plants

10 CHAPTER X: IMPLEMENTATION AND PHASING PLAN

10.1 Introduction and Purpose of the Implementation Framework

The Implementation and Phasing Framework constitutes a critical component of the District Land Use Plan (DLUP) for District Mohmand, translating the strategic vision, land use proposals, and policy directions into an actionable and time-bound development program. While the land use plan establishes the desired spatial structure and functional hierarchy of settlements, the implementation framework provides the institutional, regulatory, financial, and operational mechanisms required to realize these proposals on the ground.

Given the post-merger development context of District Mohmand, characterized by evolving governance systems, customary land tenure practices, infrastructure deficits, and increasing development pressures, a structured and phased implementation approach is essential. This framework ensures that land use interventions are undertaken in a coordinated, realistic, and resource-efficient manner, while maintaining flexibility to respond to emerging socio-economic and environmental dynamics.

10.1.1. Objective of the Implementation and Phasing Plan

The primary objective of the Implementation and Phasing Plan is to operationalize the District Land Use Plan by defining clear roles, responsibilities, priorities, and timelines for development interventions. It seeks to guide public and private sector actions in a manner that ensures orderly development, optimal utilization of land resources, and equitable provision of infrastructure and services across the district.

Specifically, the Implementation and Phasing Plan aims to:

- Translate land use proposals into implementable projects and sectoral action plans.
- Prioritize development interventions based on urgency, resource availability, and spatial development needs.
- Establish a phased development strategy that aligns short-, medium-, and long-term investments with the district's growth trajectory.
- Strengthen institutional coordination and development control mechanisms to support effective plan execution.

10.1.2. Linkage with District Land Use Vision and Policy Framework

The Implementation and Phasing Framework is directly derived from and aligned with the District Land Use Vision and Policy Framework. It serves as the operational extension of the vision, ensuring that the spatial development goals—such as compact settlement growth, protection of agricultural and environmentally sensitive areas, development of service centers, and balanced rural–urban integration—are systematically implemented.

All proposed actions, projects, and phasing priorities are anchored in the land use zoning plan, settlement hierarchy, and sectoral policies articulated in the DLUP. The framework ensures policy coherence by aligning implementation tools, development controls, and investment sequencing with the approved land use designations and regulatory provisions. This linkage safeguards the plan from ad-hoc development and reinforces its role as a guiding statutory document for decision-making by district and provincial authorities.

10.1.3. Alignment with Provincial and Federal Development Priorities

The Implementation and Phasing Plan is formulated in conformity with broader provincial and federal development agendas to ensure institutional compatibility, funding eligibility, and policy coherence. It aligns with the Khyber Pakhtunkhwa Urban Policy, Provincial Spatial Strategy, and sectoral policies related to housing, infrastructure, environment, and local governance. Additionally, it supports the objectives of post-merger district development, focusing on service delivery enhancement, economic integration, and spatial equity.

At the federal level, the framework complements national priorities outlined in development planning instruments, including sustainable development goals, climate resilience strategies, and infrastructure connectivity initiatives. By aligning district-level land use implementation with provincial and federal priorities, the framework enhances prospects for resource mobilization through Annual Development Programs (ADP), Public Sector Development Program (PSDP), and donor-supported initiatives, thereby ensuring the long-term viability and effectiveness of the District Land Use Plan for Mohmand.

10.2 Institutional and Governance Framework

Effective implementation of the District Land Use Plan (DLUP) for District Mohmand is contingent upon a clearly defined institutional and governance framework that delineates roles, responsibilities, and coordination mechanisms among relevant stakeholders. Given the multi-sectoral nature of land use planning and the post-merger administrative context of the district, strong institutional alignment and collaborative governance are essential to ensure coherent decision-making, regulatory compliance, and timely execution of planned interventions.

This framework establishes an integrated approach whereby district and tehsil-level institutions, provincial line departments, development authorities, the private sector, and local communities collectively contribute to the implementation of the land use plan within their respective mandates.

10.2.1 Roles and Responsibilities of Key Institutions

The implementation of the District Land Use Plan (DLUP) for Mohmand District is anchored in a clearly defined institutional framework that integrates provincial oversight, statutory land use regulation, district-level coordination, and local execution. At the provincial level, the Planning and Development Department, through the Urban Policy and Planning Unit (UPU), acts as the

custodian of the DLUP, responsible for policy guidance, technical support, monitoring, and periodic review of the plan.

Statutory land use control and development regulation are exercised by the Land Use and Building Control Authority (LUBCA), operating under the Local Government Department. LUBCA is the most significant authority for enforcing zoning regulations, approving building plans, and ensuring compliance with the land use proposals of the DLUP.

At the district level, the Deputy Commissioner and District Administration play a central coordinating role through the District Planning and Coordination Committee (DPCC), ensuring alignment between sectoral departments and facilitating effective plan implementation. Assistant Commissioners and district offices provide tehsil-level oversight and administrative support.

Local Governments, including Tehsil Municipal Administrations and Village/Neighbourhood Councils, function as the primary executing agencies responsible for municipal infrastructure, service delivery, and community-level development in accordance with the approved land use framework. Sectoral line departments support implementation through provision of infrastructure, utilities, and services, ensuring integrated and sustainable spatial development across the district.

Figure 48: Hierarchy of all Relevant Departments

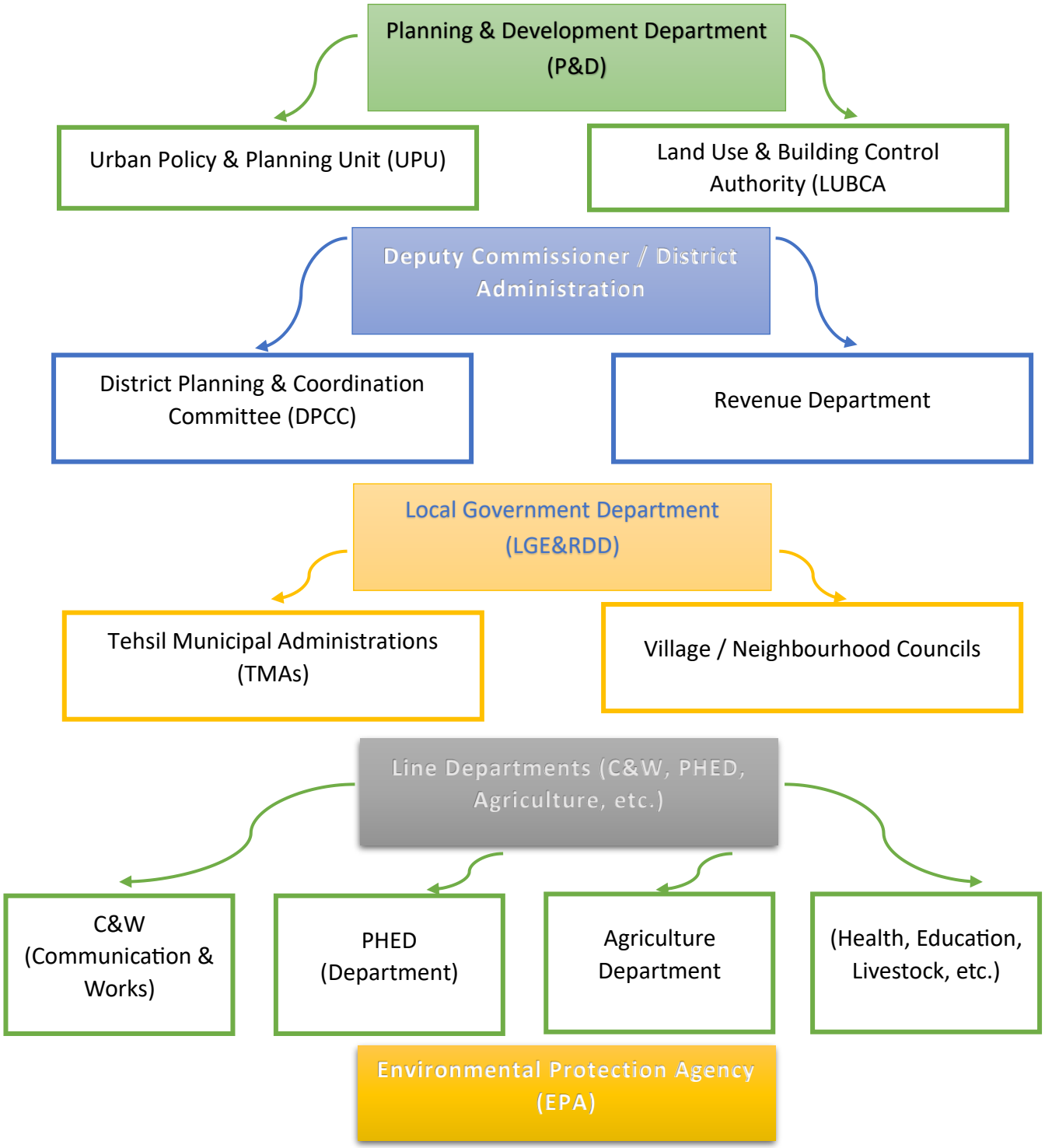


Table 141: Hierarchy of all Relevant Departments

Authority / Department	Primary Role in DLUP	Legal / Policy Basis
Planning & Development Department (P&D)	Provincial oversight & policy direction	KP Planning & Development framework
Urban Policy & Planning Unit (UPU)	Custodian of DLUP, monitoring, review, technical guidance	KP Urban Policy, DLUP Guidelines
Local Government Department (LGE&RDD)	Administrative control of local governance & LUBCA	KP Local Government Act
Land Use & Building Control Authority (LUBCA)	Zoning enforcement, land use regulation, building control, approvals	KP LUBCA Act (Statutory Authority)
Deputy Commissioner / District Administration	District-level coordination & implementation oversight	KP Land Revenue Act, Rules of Business
District Planning & Coordination Committee (DPCC)	Inter-departmental coordination & prioritization	Administrative orders / DC powers
Revenue Department	Land record management, acquisition, mutation	KP Land Revenue Act
Tehsil Municipal Administrations (TMAs)	Municipal services & infrastructure development	KP Local Government Act
Village / Neighbourhood Councils	Community-level development facilitation	KP Local Government Act
Line Departments (C&W, PHED, Agriculture, etc.)	Sectoral infrastructure & service provision	Relevant sectoral laws & policies
Environmental Protection Agency (EPA)	Environmental compliance & safeguards	KP Environmental Protection Act

10.3 District land use plan implementation strategy / Framework

The Infrastructure and Services Implementation Framework provide the operational basis for translating the spatial proposals of the District Land Use Plan (DLUP) for District Mohmand into coordinated, phased, and service-oriented investments. Infrastructure development is treated as both an enabler and regulator of land use, ensuring that growth is directed toward designated settlements, economic zones, and service centers in accordance with the approved land use hierarchy.

Given Mohmand's strategic location within the Peshawar Division, its emerging industrial base, cross-border trade potential, and predominantly rural settlement structure, infrastructure planning under the DLUP prioritizes regional connectivity, intra-district accessibility, and equitable service provision. The framework aligns infrastructure investments with projected land use demand, population growth, and economic activity, while ensuring resilience to terrain-related and environmental constraints.

10.3.1 Short Term

Table 142: Short-Term Key Actions (2025–2030)

Sector / Theme	Priority Areas / Locations	Short-Term Key Actions (2025–2030)	Lead / Supporting Agencies
Residential Development	Ghalanai, Yake Ghund, Pindiali, Utman Khel VC-2 & 9, Prang Ghar	Infill housing within existing built-up areas; regulation of informal expansion through zoning enforcement; upgrading of basic services; enforcement of building controls	TMAs, LG&RDD, District Administration
Industry & Mining	Ghalanai, Pindiali, Utman Khel VC-2 & 9, Baizai-4, Masood-3	Development of small-scale industrial clusters (marble, construction materials); provision of access roads, power and water; regulation of quarrying and mining through zoning and buffers	Industries Dept., Mines & Minerals, EPA
Trade & Commerce	Ghalanai, Yake Ghund, Pindiali	Enforcement of CBD zoning; regulation of ribbon commercial development; development of linear commercial corridors and grain markets	TMAs, Trade Dept., District Administration
Tourism & Recreation	Ghalanai, Palai Dam, Soran Valley, Prang Ghar	Development of urban parks; basic recreational facilities; initiation of eco-tourism and local cultural activities	Tourism Dept., TMAs
Agriculture & Livestock	Qandahari, Masood-3, Rural Tehsils	Protection of prime agricultural land through zoning; establishment of grain markets; livestock support zones; improvement of farm-to-market access	Agriculture Dept., Local Governments
Employment & Skills Development	Ghalanai, Pindiali, Utman Khel, Yake Ghund; Mining areas (Baizai-4, Prang Ghar)	Rapid skills needs assessment; short-duration vocational training (construction trades); on-site labor absorption in public works; youth & women skills programs; basic safety and technical training for mining workers	TEVTA, Industries Dept., District Administration
Environment & Natural Resources	Forests, rivers, slopes (Utman Khel, Baizai)	Demarcation of ecologically sensitive zones; establishment of green buffers and riparian zones; community-based forest protection; plantation programs	Forest Dept., EPA
Watershed & Natural Resource Management	Upper catchments & valleys	Construction of small check dams and recharge pits; soil conservation works; plantation in erosion-prone areas	Irrigation Dept., Forest Dept.
Climate Change (Adaptation & Mitigation)	All tehsils; urban centers	Climate training for DDMA and line departments; installation of weather monitoring stations; pilot urban forestry and Miyawaki plantations	DDMA, EPA, Line Departments
Disaster Risk Reduction (DRR)	Ghalanai, Yake Ghund, Pindiali; Tirah Valley & upper Mohmand	Establishment of functional DDMA cell; community-level early warning systems; pre-positioning of emergency stocks; first-responder training and preparedness drills	PDMA, DDMA, District Administration
Infrastructure & Utilities	Urban centers	Road rehabilitation; water supply, sanitation and drainage upgrades; stabilization of existing utility networks	C&W, PHED, Utilities
Solid Waste Management	All tehsil bazaars & dense settlements	Weekly door-to-door waste collection; two-stream source segregation; installation of community bins; site identification for storage, composting and disposal; capacity building of TMAs	TMAs, LG&RDD
Transport & Roads	Ghalanai, Pindiali, Yake Ghund, Baizai, Safi	Upgradation of priority primary and secondary roads; access road improvements to service centers; safety and drainage works	C&W, District Administration
Social Infrastructure (Education & Health)	Urban & semi-urban settlements	Upgrading of existing education and health facilities; service coverage improvement in priority settlements	Education Dept., Health Dept.
Governance & Capacity Building	District-wide	Institutional strengthening; zoning enforcement initiation; inter-departmental coordination; community participation mechanisms	District Administration, Local Governments

10.3.2 Medium Term

Table 143: Medium-Term Key Actions (2030–2035)

Sector / Theme	Priority Areas / Locations	Medium-Term Key Actions (2030–2035)	Lead / Supporting Agencies
Residential Development	Ghalanai, Yake Ghund, Pindiali, Utman Khel	Development of planned residential neighborhoods; upgrading of housing density with infrastructure support; expansion of municipal services to new growth areas	TMAs, LG&RDD, LUBCA
Industry & Mining	Pindiali, Utman Khel, Baizai, Safi	Establishment of organized industrial estates and marble processing zones; shared facilities (power, water, waste management); stricter environmental compliance	Industries Dept., Mines & Minerals, EPA
Trade & Commerce	Ghalanai, Yake Ghund, Pindiali	Development of structured wholesale markets; strengthening of CBDs; relocation and regulation of incompatible commercial uses	TMAs, District Administration
Tourism & Recreation	Palai Dam, Soran Valley, Tirah fringe	Development of tourism facilities (lodges, viewpoints); promotion of eco-tourism circuits; private sector participation	Tourism Dept., Private Sector
Agriculture & Livestock	Rural clusters & valleys	Establishment of agro-processing units; cold storage and value-addition facilities; expansion of livestock markets and veterinary services	Agriculture Dept., Livestock Dept.
Employment & Skills Development	District-wide	Establishment of permanent vocational training institutes; sector-linked skill programs (mining, construction, tourism); SME support	TEVTA, Industries Dept.
Environment & Natural Resources	Forest & watershed zones	Expansion of protected forest areas; biodiversity conservation programs; rehabilitation of degraded landscapes	Forest Dept., EPA
Watershed & Natural Resource Management	Upper catchments	Medium-scale water harvesting structures; integrated watershed management plans	Irrigation Dept., Forest Dept.
Climate Change	Urban & rural areas	Mainstreaming climate-resilient infrastructure; renewable energy pilots (solar, micro-hydel)	EPA, Energy Dept.
Disaster Risk Reduction (DRR)	Flood & landslide-prone areas	Construction of protective structures; strengthening early warning systems; district-level disaster preparedness planning	PDMA, DDMA
Infrastructure & Utilities	Growth corridors	Expansion of water supply, sewerage and drainage systems; upgrading of power distribution networks	PHED, Utilities
Solid Waste Management	Major urban centers	Development of transfer stations; controlled landfill sites; composting and recycling facilities	TMAs
Transport & Roads	Inter-tehsil corridors	Capacity enhancement of major roads; development of bypasses and freight movement corridors	C&W
Social Infrastructure	Urban expansion areas	Development of new education and health facilities in growing settlements	Education & Health Depts.
Governance & Institutions	District-wide	Full operationalization of zoning regulations; digital land and building approval systems	LUBCA, District Administration

10.3.3 Long Term

Table 144: Long-Term Key Actions (2035–2045)

Sector / Theme	Priority Areas / Locations	Long-Term Key Actions (2035–2045)	Lead / Supporting Agencies
Residential Development	Planned urban extensions	Development of compact, self-sustaining urban extensions; mixed-use and higher-density development	TMAs, LUBCA
Industry & Mining	Designated industrial zones	Transition to value-added and export-oriented industries; full environmental compliance and rehabilitation of mined areas	Industries Dept., EPA
Trade & Commerce	District commercial hubs	Regional-level wholesale and logistics hubs; integration with provincial and cross-border trade networks	Trade Dept., Private Sector
Tourism & Recreation	District-wide tourism circuits	Establishment of major tourism destinations; integration into provincial tourism economy	Tourism Dept.
Agriculture & Livestock	Agricultural belts	Modernization of agriculture; mechanization; climate-smart farming; large-scale agro-industry	Agriculture Dept.
Employment & Skills Development	District-wide	High-skill workforce development; linkage with regional markets; entrepreneurship ecosystems	TEVTA, Private Sector
Environment & Natural Resources	Ecological networks	Long-term ecological restoration; sustainable forest and rangeland management	Forest Dept., EPA
Water Resources	District-wide	Integrated water resource management; long-term water security infrastructure	Irrigation Dept.
Climate Change	All sectors	District-wide climate resilience mainstreamed into all planning and infrastructure	EPA, P&D
Disaster Risk Reduction (DRR)	High-risk zones	Fully climate-resilient settlements; disaster-proof infrastructure	PDMA, DDMA
Infrastructure & Utilities	Urban-rural systems	Smart infrastructure systems; sustainable energy and waste solutions	Utilities, TMAs
Solid Waste Management	District-wide	Zero-waste systems; circular economy approaches	TMAs
Transport & Mobility	Regional corridors	Integration with regional transport networks; logistics and freight hubs	C&W
Social Infrastructure	District-wide	Equitable access to advanced education, health, and social services	Line Departments
Governance & Planning	District-wide	Periodic DLUP review and updating; adaptive planning mechanisms	UPU, P&D, District Administration

10.4 Donor and Development Partner Funding

Development partners will be engaged to support capital-intensive, reform-oriented, and environmentally sensitive components of the land use plan.

10.4.1 Multilateral and Bilateral Development Partners

Potential areas for donor support include:

- Climate adaptation and mitigation (green infrastructure, urban forestry, watershed management)
- Disaster risk reduction and resilience-building
- Institutional strengthening of planning, land management, and environmental regulation
- Sustainable tourism and community-based livelihood programs
- Skills development and employment generation linked to industrial and agro-based sectors

Funding may be mobilized through grants, concessional loans, and technical assistance programs from institutions such as the **World Bank, ADB, UNDP, GIZ**, and bilateral donors.

11 CHAPTER XI: MONITORING, EVALUATION, AND REVIEW MECHANISM

The Monitoring, Evaluation, and Review (MER) Mechanism for the District Land Use Plan of Mohmand provides a comprehensive, results-oriented framework to track implementation progress, ensure institutional accountability, and support evidence-based decision-making. The mechanism is designed to monitor spatial development, sectoral investments, infrastructure delivery, environmental protection, and socio-economic outcomes in line with the phased land use strategy.

The MER framework integrates land use implementation with sectoral performance monitoring, enabling the District Administration and line departments to assess whether development is occurring in accordance with approved zoning, phasing priorities, environmental safeguards, and economic objectives. It emphasizes continuous monitoring, periodic evaluation, and adaptive review to respond to emerging challenges, population pressures, and climate and disaster risks.

11.1 Objectives of the Monitoring and Evaluation Framework

The key objectives of the MER framework are to:

- Track physical, financial, and institutional progress of land use plan implementation
- Ensure compliance with approved zoning, development controls, and environmental regulations
- Measure sectoral performance against defined targets and timelines
- Strengthen transparency, accountability, and inter-agency coordination
- Enable mid-course corrections through evidence-based reviews
- Support alignment with provincial and federal development priorities

11.2 Key Performance Indicators (KPIs)

KPIs are structured to reflect land use outcomes, service delivery improvements, economic performance, environmental sustainability, and governance effectiveness. Indicators are both quantitative and qualitative, disaggregated spatially where required, and aligned with short-, medium-, and long-term implementation phases.

➢ *Education Sector*

Monitoring focuses on spatial access, quality enhancement, and infrastructure adequacy.

Key KPIs include:

- Number of schools constructed, upgraded, or relocated in designated land use zones

- Teacher–student ratios and classroom adequacy
- Enrollment and dropout rates (gender-disaggregated)
- Availability of water, sanitation, electricity, and boundary walls

Verification sources include Education Department reports, field inspections, and household surveys. Monitoring will be conducted bi-annually, with annual evaluations.

➢ ***Residential Development***

Residential monitoring ensures orderly growth, service provision, and regulatory compliance.

Key KPIs include:

- Number of housing units developed or regularized in approved residential zones
- Percentage of population with access to water supply, sanitation, and solid waste services
- Compliance with building bylaws and density regulations
- Proportion of residential growth occurring within planned phases

Data will be verified through municipal records, building permits, and field surveys. Annual reviews will assess growth trends and infrastructure alignment.

➢ ***Commercial Development***

Monitoring focuses on economic vitality, spatial efficiency, and formalization.

Key KPIs include:

- Number of commercial units established within CBDs and designated corridors
- Growth in business registrations and licenses
- Market utilization rates and commercial land absorption
- Traffic, parking, and service load indicators in commercial zones

Quarterly monitoring and annual evaluations will be led by Trade and Commerce Departments and TMAs.

➢ ***Health Sector***

Health monitoring emphasizes spatial accessibility and service quality.

Key KPIs include:

- Number of health facilities constructed or upgraded as per land use plan
- Doctor–patient and bed–population ratios

- Immunization coverage and maternal/child health indicators
- Emergency response coverage in disaster-prone areas

Verification will rely on DHIS, departmental records, and surveys. Quarterly monitoring and annual evaluations are proposed.

➢ ***Forests, Environment, and Ecological Protection***

Environmental monitoring safeguards sensitive zones and natural assets.

Key KPIs include:

- Net change in forest cover and plantation survival rates
- Area under protected ecological zones and buffers
- Incidence of illegal logging or encroachments
- Implementation of watershed and riparian protection measures

Satellite imagery, Forest Department reports, and community monitoring will support bi-annual monitoring and annual reviews.

➢ ***Industrial and Mining Development***

Monitoring ensures economic benefits while enforcing environmental compliance.

Key KPIs include:

- Number of industrial and mineral processing units operational
- Employment generation within industrial zones
- Compliance with environmental and zoning regulations
- Infrastructure readiness within industrial estates

Quarterly monitoring and annual reporting will be conducted by the Industries Department and District Administration.

➢ ***Tourism and Recreation***

Tourism monitoring focuses on economic impact and environmental sustainability.

Key KPIs include:

- Annual tourist arrivals and tourism-generated revenue
- Number of recreational and eco-tourism facilities developed
- Waste management and environmental compliance at tourist sites
- Community participation in tourism-related livelihoods

Quarterly monitoring and five-year impact evaluations will be undertaken.

- ***Infrastructure and Utilities***

Infrastructure monitoring supports spatial connectivity and service equity.

Key KPIs include:

- Kilometers of roads constructed or rehabilitated
- Coverage of water supply, sanitation, electricity, and digital connectivity
- Service reliability and maintenance indicators

Quarterly progress updates and annual reviews will be undertaken by relevant departments.

- ***Disaster Risk Reduction and Emergency Management***

DRR monitoring ensures preparedness and resilience.

Key KPIs include:

- Number of disaster management plans prepared or updated
- Functionality of early warning systems
- Frequency of drills and community trainings
- Coverage of risk-informed land use controls

Bi-annual reporting and annual drills will support readiness.

- ***Cross-Sectoral Governance and Accountability***

Governance monitoring strengthens transparency and participation.

Key KPIs include:

- Development budget utilization rates
- Number of public consultations and stakeholder forums
- Citizen satisfaction survey results
- Compliance with approved land use plans

Annual reviews and mid-term and end-term evaluations will be undertaken.

11.3 Monitoring and Reporting Structure

The monitoring system is structured across three tiers:

11.3.1 District Level

- District Administration (DC Office) as overall coordinator

- District Planning and Development Unit as technical focal point
- Consolidated annual Land Use Implementation Progress Report

11.3.2 Departmental Level

- Line departments responsible for sector-specific monitoring
- Quarterly progress reports linked to ADP and sectoral targets

11.3.3 Community and Third-Party Oversight

- Community monitoring committees in urban and rural settlements
- Independent audits and evaluations for major projects

11.3.4 Review and Adaptive Management

- ***Annual Reviews:*** Performance assessment and corrective actions
- ***Mid-Term Review (Every 5 Years):*** Phasing adjustments and policy refinements
- ***End-Term Review (20 Years):*** Plan effectiveness and future planning inputs

11.4 Consolidated Monitoring, Evaluation, and Review Matrix

Sector	Key Indicators	Monitoring Tools	Responsible Agency	Frequency
Residential Development	Housing units, service coverage, zoning compliance	Building permits, field surveys	TMAs, District Admin	Annual
Industry & Mining	Units established, employment, compliance	Dept. records, inspections	Industries Dept., EPA	Quarterly / Annual
Tourism	Tourist arrivals, facilities, revenue	Surveys, tourism data	Tourism Dept., TMAs	Quarterly / 5-year
Infrastructure	Roads, utilities coverage	Dept. records, surveys	C&W, PHE, Utilities	Quarterly
Education	Enrollment, facilities, ratios	School inspections	Education Dept.	Bi-annual
Health	Facilities, coverage, outcomes	DHIS, surveys	Health Dept.	Quarterly
Environment & Forests	Forest cover, protected zones	Satellite data, reports	Forest Dept., EPA	Bi-annual
DRR	Plans, drills, early warning	PDMA reports	PDMA, DDMA	Bi-annual
Governance	Budget use, participation	Admin records, audits	DC Office	Annual

The Monitoring, Evaluation, and Review Mechanism establishes a robust institutional and technical framework to ensure that the District Land Use Plan of Mohmand is implemented effectively, transparently, and sustainably. By integrating spatial planning with sectoral performance monitoring, the framework enables continuous learning, accountability, and adaptive management—ensuring that land use decisions translate into tangible social, economic, and environmental benefits for the district.

11.5 Implementation Roadmap and Conclusion

The Implementation Roadmap translates the District Land Use Plan of Mohmand into a clear, time-bound, and action-oriented program. It consolidates sectoral proposals, spatial priorities, and institutional responsibilities into an integrated framework that guides phased development, investment sequencing, and governance oversight. The roadmap ensures alignment between land use zoning, infrastructure provision, environmental safeguards, and economic development objectives, while allowing flexibility for adaptive management over the plan period.

11.5.1 Consolidated Implementation Schedule

Table 145: District Mohmand – Consolidated Land Use Implementation Roadmap (2025–2045)

Sector / Theme	Phase	Timeframe	Priority Areas / Locations	Key Implementation Actions	Lead / Supporting Agencies
Residential Development	Short Term	2025–2030	Ghalanai, Yake Ghund, Pindiali, Utman Khel VC-2 & 9	Infill housing, short-term residential zones, service upgrading, enforcement of building controls	TMAs, LG&RDD, District Admin
	Medium Term	2030–2035	Ghalanai Expansion, Pindiali, Utman Khel, Masood-3	Planned residential expansion, neighborhood facilities, utilities extension	TMAs, PHE, Energy Dept.
	Long Term	2035–2045	All Urban Centers	Long-term residential reserves, density optimization, climate-resilient housing	TMAs, Housing Dept.
Industry & Mining	Short Term	2025–2030	Ghalanai, Pindiali, Utman Khel, Masood-3	Small industrial clusters, mineral yards, basic infrastructure, environmental zoning	Industries Dept., Mines & Minerals
	Medium Term	2030–2035	Utman Khel VC-2 & 9, Baizai-4, Prang Ghar	Expansion of stone-processing and SME estates, PPP-based industrial parks	Industries Dept., BOI, PPP Cell

	Long Term	2035–2045	Yake Ghund (MSEZ), District-wide	SEZ integration, value-added mineral industries, cleaner production systems	Industries Dept., SEZ Authority
Trade & Commerce	Short Term	2025–2030	Ghalanai, Yake Ghund, Pindiali	CBD enforcement, linear commercial corridors, grain markets	TMAs, Trade Dept.
	Medium Term	2030–2035	Pindiali, Utman Khel	Secondary commercial hubs, route-based trade	TMAs, District Admin
	Long Term	2035–2045	All Urban Centers	Integrated commercial network, mixed-use development	TMAs
Tourism & Recreation	Short Term	2025–2030	Ghalanai, Palai Dam, Soran Valley	Urban parks, basic recreational facilities, eco-tourism initiation	Tourism Dept., TMAs
	Medium Term	2030–2035	Pindiali, Baizai-4, River Corridors	Eco-trails, picnic areas, community tourism	Tourism Dept., Forest Dept.
	Long Term	2035–2045	Dams, Hills, Riverfronts	Adventure tourism hubs, water sports, destination branding	Tourism Dept., Private Sector
Agriculture & Livestock	Short Term	2025–2030	Qandahari, Masood-3	Grain markets, livestock support zones	Agriculture Dept., LG
	Medium Term	2030–2035	District-wide	Agro-processing, cold storage, value chains	Agriculture Dept., Private Sector
	Long Term	2035–2045	Rural & Peri-Urban Areas	Climate-smart agriculture, agroforestry	Agriculture Dept., NGOs
Environment & Natural Resources	Short Term	2025–2030	Forests, Rivers, Slopes	Green buffers, riparian zones, plantation	Forest Dept., EPA
	Medium Term	2030–2035	Catchments, Degraded Areas	Habitat restoration, watershed management	Forest Dept., Irrigation
	Long Term	2035–2045	District-wide	Ecological corridor network, monitoring systems	Forest Dept., EPA
Disaster Risk Reduction	Short Term	2025–2030	Tirah Valley, Flood-prone Areas	Early warning systems, emergency stocks, training	PDMA, DDMA
	Medium Term	2030–2035	Hilly & Southern Tehsils	Retrofitting, shelters, access routes	PDMA, C&W

	Long Term	2035–2045	All Settlements	Multi-hazard GIS mapping, risk-based zoning	PDMA, District Admin
Infrastructure & Utilities	Short Term	2025–2030	Urban Centers	Road rehabilitation, water & sanitation upgrades	C&W, PHE
	Medium Term	2030–2035	Expansion Areas	Network expansion, energy and ICT	Utilities, PTA
	Long Term	2035–2045	District-wide	Integrated infrastructure systems	Provincial Depts.
Governance & Capacity Building	Continuous	2025–2045	District-wide	Institutional strengthening, M&E, community participation	District Admin, LG

11.5.2 Key Milestones and Decision Points

Time Horizon	Key Milestones	Strategic Decision Points
2025–2030	Establishment of zoning enforcement, DDMA strengthening, initiation of priority residential and industrial projects	Approval of sectoral action plans, budget alignment with ADP
2030–2035	Expansion of secondary urban centers, operational industrial estates, agro-processing facilities	Mid-term review of land use phasing and density controls
2035–2045	SEZ maturity, integrated transport and tourism networks, ecological corridor completion	Revision of land use plan and preparation of next planning cycle

The Implementation Roadmap provides a coherent and actionable framework for translating the District Land Use Plan of Mohmand into phased, on-ground development. By integrating residential growth, economic development, infrastructure provision, environmental protection, and disaster resilience within a unified spatial and temporal structure, the roadmap ensures that development is orderly, inclusive, and sustainable.

Successful implementation will depend on strong institutional coordination, consistent financing, regulatory enforcement, and active community participation. The phased approach allows flexibility to respond to emerging challenges while maintaining long-term strategic direction. Through this roadmap, District Mohmand is positioned to achieve balanced urbanization, economic resilience, and environmental stewardship over the next two decad